



# FEED <sup>THE</sup> FUTURE

The U.S. Government's Global Hunger & Food Security Initiative



## Feed the Future NEPAL

Zone of Influence Survey 2019—Phase Two Baseline

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**USAID**  
FROM THE AMERICAN PEOPLE

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USAID Bureau for Resilience and Food Security Contact:

[rfs.ald@usaid.gov](mailto:rfs.ald@usaid.gov)

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## LIST OF ABBREVIATIONS

|        |                                                                  |
|--------|------------------------------------------------------------------|
| 5DE    | Five Domains of Empowerment                                      |
| A-WEAI | Abbreviated Women's Empowerment in Agriculture Index             |
| ARSSI  | Ability to Recover from Shocks and Stresses Index                |
| ATR    | Ability-to-Recover                                               |
| BRFS   | Bureau for Resilience and Food Security                          |
| BMI    | Body Mass Index                                                  |
| CI     | Confidence Interval                                              |
| CNA    | Children, No Adult                                               |
| CPI    | Consumer Price Index                                             |
| CSO    | Civil Society Organization                                       |
| CWI    | Comparative Wealth Index                                         |
| DEFF   | Design Effect                                                    |
| DHS    | Demographic and Health Survey                                    |
| EA     | Enumeration Area                                                 |
| FIES   | Food Insecurity Experience Scale                                 |
| FNM    | Female, No Male                                                  |
| GDP    | Gross Domestic Product                                           |
| GoN    | Government of Nepal                                              |
| GPI    | Gender Parity Index                                              |
| HH     | Household                                                        |
| KISAN  | Knowledge-based Integrated Sustainable Agriculture and Nutrition |
| LCC    | Land Capability Classification                                   |
| M&F    | Male and Female                                                  |
| MAD    | Minimum Acceptable Diet                                          |
| MNF    | Male, No Female                                                  |
| MPI    | Multidimensional Poverty Index                                   |
| NDVI   | Normalized Difference Vegetation Index                           |
| NGO    | Non-Governmental Organization                                    |
| NSAF   | Nepal Seed and Fertilizer                                        |
| PPP    | Purchasing Power                                                 |
| PPS    | Parity Probability Proportional to Size                          |
| SD     | Standard Deviation                                               |
| SDG    | Sustainable Development Goals                                    |
| SEI    | Shock Exposure Index                                             |
| SPI    | Standardized Precipitation Index                                 |
| ToT    | Training of Trainers                                             |
| UNICEF | United Nations Children's Fund                                   |
| USAID  | United States Agency for International Development               |
| USD    | United States Dollar                                             |
| VCC    | Value Chain Commodity                                            |
| WEAI   | Women's Empowerment in Agriculture Index                         |
| WHO    | World Health Organization                                        |
| ZOI    | Zone of Influence                                                |

## EXECUTIVE SUMMARY

### Background

Feed the Future is a United States (U.S.) Government initiative that addresses global food insecurity by supporting agriculture sector growth, improving household income and resilience, and improving nutritional status in 12 target countries. Program efforts are designed to impact the population in Zones of Influence (ZOIs) in Feed the Future target countries. The ZOI are the targeted sub-national regions and districts where the program intends to achieve the greatest household- and individual-level impacts on poverty, hunger, and malnutrition. Progress in achieving Feed the Future's objectives is tracked using population-based performance indicators collected at baseline and then periodically thereafter.

The purpose of the Feed the Future Nepal ZOI Survey is to provide the United States Agency for International Development (USAID) Mission Nepal, its U.S. Government interagency partners, the USAID Bureau for Resilience and Food Security (RFS), the Government of Nepal (GoN), and development partners with information on the current status of the Feed the Future population-based ZOI-level indicators. The survey was designed to (1) determine whether there has been statistically significant change over time in the Feed the Future Phase 1 ZOI key outcome and impact indicators within the Phase 1 ZOI and (2) establish the baseline status of Feed the Future Phase 2 ZOI indicators within the Phase 2 ZOI. Therefore, the 2019 Nepal ZOI Survey is intended to serve both as an endline for Feed the Future Phase 1 and a baseline for Feed the Future Phase 2 in Nepal. This report addresses the latter objective.

Feed the Future Phase 2 ZOI in Nepal includes the 21 districts included in the Phase 1 ZOI, containing both hill and plain (terai) agro-ecological zones. Following the devastating April 2015 earthquake in Nepal, four districts in Bagmati Province were added: Kavrepalanchok, Makwanpur, Nuwakot, and Sindhupalchowk. The Phase 2 baseline sample was collected from all 25 of these districts. The ZOI is both urban and rural. The sample frame was stratified into rural and urban enumeration areas (EAs), with 75 rural EAs and 90 urban EAs.

### Feed the Future Nepal ZOI Survey 2019 indicators

The Feed the Future ZOI indicators, which correspond to the Global Food Security Strategy Results Framework (**Figure ESI**), calculated for this survey are as follows:

1. Prevalence of poverty: Percent of people living on less than \$1.90/day, 2011 Purchasing Power Parity (PPP) (84.76 Rs), [EG-c]<sup>1</sup>
2. Depth of poverty of the poor: Mean percent shortfall of the poor relative to the \$1.90/day 2011 PPP poverty line (84.76 Rs), [EG-h]
3. Percent of people who are “near-poor,” living on 100 percent to less than 125 percent of the \$1.90 2011 PPP poverty line (84.76 to <105.95 Rs) [FTF Context-9]
4. Percent of households below the comparative threshold for the poorest quintile of the asset-based comparative wealth index (CWI) [EG-g]
5. Prevalence of moderate and severe food insecurity in the population, based on the Food

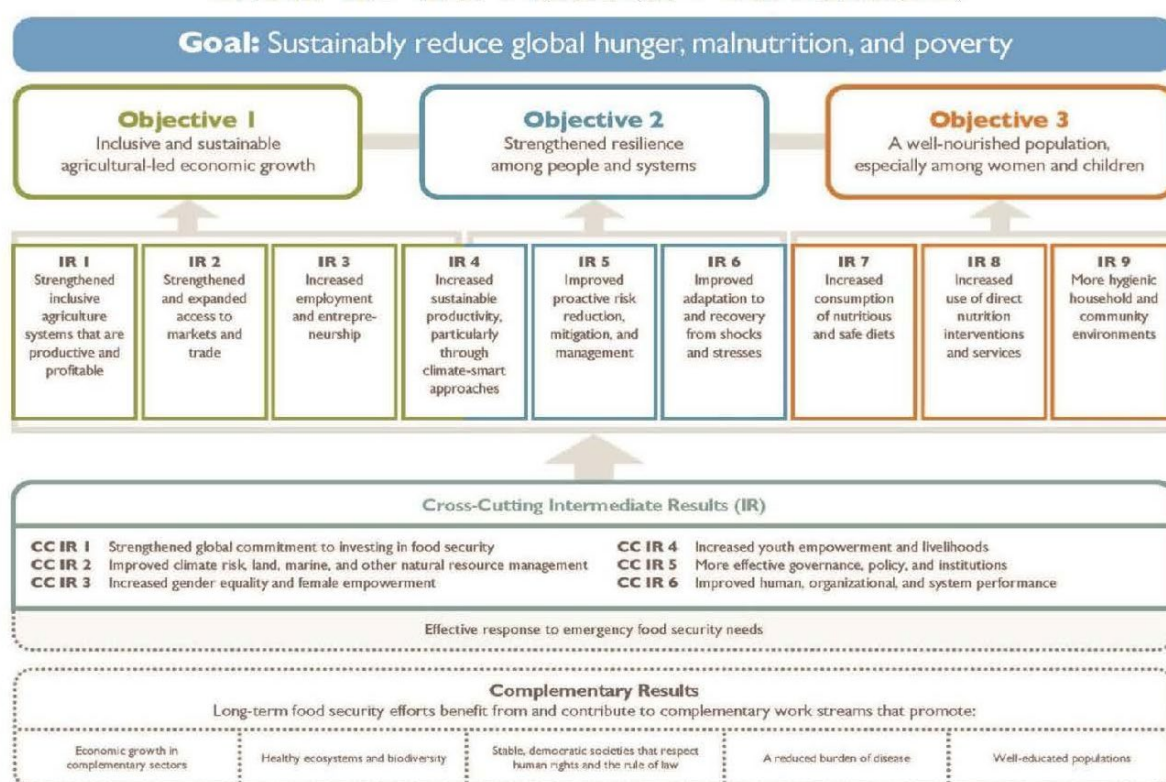
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<sup>1</sup> Text in brackets indicates the Feed the Future indicator number. See the [Feed the Future Indicator Handbook](#).



- Insecurity Experience Scale (FIES) [EG-e]
6. Ability to recover from shocks and stresses index (ARSSI) [RESIL-a]
  7. Index of social capital at the household level [RESIL-b]
  8. Proportion of households that believe local government will respond effectively to future shocks and stresses [RESIL-c]
  9. Percent of households participating in group-based savings, micro-finance, or lending programs [EG.4.2-a]
  10. Abbreviated Women's Empowerment in Agriculture Index (A-WEAI) [EG.3-f]
  11. Average percent of women achieving adequacy across the six indicators of the A-WEAI [FTF Context-25]
  12. Yield of targeted agricultural commodities within target areas (metric ton/hectare [mt/ha]) [EG.3-h]
  13. Percent of producers who have applied targeted improved management practices or technologies [EG.3.2-a]
  14. Prevalence of stunted ( $HAZ < -2$ ) children under five (0-59 months) [HL.9-a]
  15. Prevalence of wasted ( $WHZ < -2$ ) children under five (0-59 months) [HL.9-b]
  16. Prevalence of healthy weight ( $WHZ \leq 2$  and  $\geq -2$ ) children under five (0-59 months) [HL.9-i]
  17. Percent of children 6-23 months receiving a minimum acceptable diet (MAD) [HL.9.1-a]
  18. Prevalence of exclusive breastfeeding of children under six months of age [HL.9.1-b]
  19. Percent of women of reproductive age consuming a diet of minimum diversity [HL.9.1-d]
  20. Percent of households with access to a basic sanitation service [HL.8.2-a]
  21. Percent of households with soap and water at a handwashing station on premises [HL.8.2-b]

**Figure ESI: U.S. Government Global Food Security Strategy Results Framework**



These 19 performance and two context indicators measure hunger, malnutrition, and poverty and their determinants among the population in the Nepal Feed the Future ZOI. Roughly half of the indicators measure impact and outcomes at the goal or strategic objective levels, while the other indicators are at the intermediate result level and are relevant to programming in Nepal. Indicator estimates—in total and by key disaggregates—are presented in **Table ESI**.

**Table ESI: Feed the Future Indicator Estimates, by Key Disaggregates, Nepal 2019**

| Feed the Future indicator                                                                                                                                         | Estimate | 95% CI      | Sig. <sup>a</sup> | Number <sup>b</sup> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-------------|-------------------|---------------------|
| <b>Prevalence of poverty: Percent of people living on less than \$1.90 per day (2011 PPP) (84.76 Rs)</b>                                                          |          |             |                   |                     |
| <b>All households</b>                                                                                                                                             | 9.2      | 7.6 – 11.0  |                   | 2,407               |
| <b>Gendered household type</b>                                                                                                                                    | -        | -           | n/s               | -                   |
| Male and female adults                                                                                                                                            | 9.0      | 7.3 – 11.0  |                   | 1,891               |
| Female adults only                                                                                                                                                | 11.0     | 7.8 – 15.3  |                   | 459                 |
| Male adults only                                                                                                                                                  | 2.0      | 0.3 – 13.6  |                   | 53                  |
| Children only, no adults                                                                                                                                          | ^        | ^           |                   | 4                   |
| <b>Depth of poverty of the poor: Mean percent shortfall of the poor relative to \$1.90 per day 2011 PPP poverty line (84.76 Rs)</b>                               |          |             |                   |                     |
| <b>All households</b>                                                                                                                                             | 19.9     | 17.5 – 22.3 |                   | 205                 |
| <b>Gendered household type</b>                                                                                                                                    | -        | -           | **                | -                   |
| Male and female adults                                                                                                                                            | 20.1     | 17.5 – 22.7 |                   | 160                 |
| Female adults only                                                                                                                                                | 19.1     | 14.4 – 23.9 |                   | 44                  |
| Male adults only                                                                                                                                                  | ^        | ^           |                   | 1                   |
| Children only, no adults                                                                                                                                          | ^        | ^           |                   | 0                   |
| <b>Percent of people who are “near-poor,” living on 100 percent to less than 125 percent of the \$1.90 per day 2011 PPP poverty line (84.76 to &lt;105.95 Rs)</b> |          |             |                   |                     |
| <b>All households</b>                                                                                                                                             | 10.9     | 9.5 – 12.6  |                   | 2,407               |
| <b>Gendered household type</b>                                                                                                                                    | -        | -           | n/s               | -                   |
| Male and female adults                                                                                                                                            | 10.6     | 9.1 – 12.4  |                   | 1,891               |
| Female adults only                                                                                                                                                | 13.6     | 10.3 – 17.8 |                   | 459                 |
| Male adults only                                                                                                                                                  | 3.8      | 0.9 – 14.6  |                   | 53                  |
| Children only, no adults                                                                                                                                          | ^        | ^           |                   | 4                   |
| <b>Percent of households below the comparative threshold for the poorest quintile of the asset-based comparative wealth index</b>                                 |          |             |                   |                     |
| <b>All households</b>                                                                                                                                             | 7.9      | 6.3 – 9.8   |                   | 2,481               |
| <b>Gendered household type</b>                                                                                                                                    | -        | -           | n/s               | -                   |
| Male and female adults                                                                                                                                            | 8.0      | 6.4 – 10.1  |                   | 1,944               |
| Female adults only                                                                                                                                                | 7.7      | 5.5 – 10.8  |                   | 473                 |
| Male adults only                                                                                                                                                  | 6.4      | 2.6 – 14.6  |                   | 54                  |
| Children only, no adults                                                                                                                                          | ^        | ^           |                   | 10                  |
| <b>Ability to recover from shocks and stresses index</b>                                                                                                          |          |             |                   |                     |
| <b>All households</b>                                                                                                                                             | 5.2      | 5.1 – 5.3   |                   | 1,566               |
| <b>Gendered household type</b>                                                                                                                                    | -        | -           | ***               | -                   |
| Male and female adults                                                                                                                                            | 5.3      | 5.2 – 5.3   |                   | 1,247               |
| Female adults only                                                                                                                                                | 5.0      | 4.9 – 5.2   |                   | 290                 |
| Male adults only                                                                                                                                                  | ^        | ^           |                   | 25                  |
| Children only, no adults                                                                                                                                          | ^        | ^           |                   | 4                   |
| <b>Index of social capital at the household level (%)</b>                                                                                                         |          |             |                   |                     |
| <b>Overall index</b>                                                                                                                                              | -        | -           |                   | -                   |
| <b>All households</b>                                                                                                                                             | 0.71     | 0.68 – 0.73 |                   | 2,439               |
| <b>Gendered household type</b>                                                                                                                                    | -        | -           | n/s               | -                   |
| Male and female adults                                                                                                                                            | 0.71     | 0.68 – 0.73 |                   | 1,910               |
| Female adults only                                                                                                                                                | 0.70     | 0.66 – 0.73 |                   | 467                 |
| Male adults only                                                                                                                                                  | 0.75     | 0.68 – 0.81 |                   | 52                  |
| Children only, no adults                                                                                                                                          | ^        | ^           |                   | 10                  |

| Feed the Future indicator                                                                                             | Estimate | 95% CI       | Sig. <sup>a</sup> | Number <sup>b</sup> |
|-----------------------------------------------------------------------------------------------------------------------|----------|--------------|-------------------|---------------------|
| <b>Bonding sub-index</b>                                                                                              | -        | -            |                   | -                   |
| <b>All households</b>                                                                                                 | 0.81     | 0.79 – 0.84  |                   | 2,439               |
| <b>Gendered household type</b>                                                                                        | -        | -            |                   | -                   |
| Male and female adults                                                                                                | 0.81     | 0.79 – 0.84  | n/s               | 1,910               |
| Female adults only                                                                                                    | 0.81     | 0.78 – 0.85  |                   | 467                 |
| Male adults only                                                                                                      | 0.84     | 0.76 – 0.92  |                   | 52                  |
| Children only, no adults                                                                                              | ^        | ^            |                   | 10                  |
| <b>Bridging sub-index</b>                                                                                             | -        | -            |                   | -                   |
| <b>All households</b>                                                                                                 | 0.60     | 0.57 – 0.62  |                   | 2,439               |
| <b>Gendered household type</b>                                                                                        | -        | -            | n/s               | -                   |
| Male and female adults                                                                                                | 0.60     | 0.57 – 0.63  |                   | 1,910               |
| Female adults only                                                                                                    | 0.58     | 0.54 – 0.62  |                   | 467                 |
| Male adults only                                                                                                      | 0.65     | 0.56 – 0.74  |                   | 52                  |
| Children only, no adults                                                                                              | ^        | ^            |                   | 10                  |
| <b>Percent of households that believe local government will respond effectively to future shocks and stresses</b>     |          |              |                   |                     |
| <b>All households</b>                                                                                                 | 84.3     | 81.4 – 87.1  |                   | 2,332               |
| <b>Gendered household type</b>                                                                                        | -        | -            | n/s               | -                   |
| Male and female adults                                                                                                | 83.7     | 80.6 – 86.7  |                   | 1,825               |
| Female adults only                                                                                                    | 85.3     | 81.0 – 89.6  |                   | 446                 |
| Male adults only                                                                                                      | 93.3     | 85.0 – 100.0 |                   | 52                  |
| Children only, no adults                                                                                              | ^        | ^            |                   | 9                   |
| <b>Percent of households participating in group-based savings, micro-finance, or lending programs</b>                 |          |              |                   |                     |
| <b>All households</b>                                                                                                 | 41.7     | 37.0 – 46.5  |                   | 2,449               |
| <b>Gendered household type</b>                                                                                        | -        | -            | ***               | -                   |
| Male and female adults                                                                                                | 44.5     | 39.6 – 49.4  |                   | 1,932               |
| Female adults only                                                                                                    | 34.3     | 27.8 – 40.9  |                   | 462                 |
| Male adults only                                                                                                      | 11.0     | 2.2 – 19.8   |                   | 51                  |
| Children only, no adults                                                                                              | ^        | ^            |                   | 4                   |
| <b>Abbreviated Women's Empowerment in Agriculture Index (A-WEAI)</b>                                                  |          |              |                   |                     |
| <b>All women</b>                                                                                                      | 0.86     | 0.84 – 0.88  |                   | 918                 |
| <b>Women's age</b>                                                                                                    | -        | -            | n/s               | -                   |
| 18–29 years                                                                                                           | 0.84     | 0.81 – 0.88  |                   | 805                 |
| 30 years and older                                                                                                    | 0.86     | 0.85 – 0.88  |                   | 113                 |
| <b>Percent of women achieving adequacy across the six indicators of the A-WEAI</b>                                    |          |              |                   |                     |
| <b>All women</b>                                                                                                      | 25.4     | 22.9 – 27.9  |                   | 1,358               |
| <b>Women's age</b>                                                                                                    | -        | -            | n/s               | -                   |
| 18–29 years                                                                                                           | 26.3     | 21.6 – 31.0  |                   | 220                 |
| 30 years and older                                                                                                    | 25.2     | 22.6 – 27.9  |                   | 1,138               |
| <b>Percent of producers who have applied targeted improved management practices or technologies in targeted areas</b> |          |              |                   |                     |
| <b>All producers</b>                                                                                                  | 77.7     | 74.1 – 81.2  |                   | 1,874               |
| <b>Farmers' sex</b>                                                                                                   | -        | -            | ***               | -                   |
| Male                                                                                                                  | 83.8     | 80.8 – 86.8  |                   | 985                 |
| Female                                                                                                                | 71.0     | 65.7 – 76.2  |                   | 889                 |
| <b>Farmers' age</b>                                                                                                   | -        | -            | **                | -                   |
| 15–29 years                                                                                                           | 69.2     | 61.7 – 76.7  |                   | 256                 |
| 30 years and older                                                                                                    | 79.1     | 75.6 – 82.5  |                   | 1,618               |

| Feed the Future indicator                                             | Estimate | 95% CI      | Sig. <sup>a</sup> | Number <sup>b</sup> |
|-----------------------------------------------------------------------|----------|-------------|-------------------|---------------------|
| <b>Commodity</b>                                                      | -        | -           | -                 | -                   |
| Maize                                                                 | 38.9     | 33.8 – 44.2 |                   | 1,276               |
| Paddy Rice                                                            | 92.0     | 88.0 – 94.7 |                   | 1,347               |
| Cauliflower                                                           | 93.3     | 84.4 – 97.3 |                   | 67                  |
| Tomatoes                                                              | 95.6     | 83.4 – 98.9 |                   | 46                  |
| <b>Management practice or technology type</b>                         | -        | -           | -                 | -                   |
| Climate adaptation, climate risk management                           | 56.1     | 51.7 – 60.6 |                   | 1,874               |
| Crop genetics                                                         | 51.9     | 47.5 – 56.3 |                   | 1,874               |
| Cultural practices                                                    | 90.9     | 87.5 – 94.2 |                   | 1,380               |
| Irrigation                                                            | 0.0      | 0.0 – 0.1   |                   | 1,295               |
| Pest and disease management                                           | 13.0     | 10.3 – 15.8 |                   | 1,874               |
| Post-harvest handling and storage                                     | 0.1      | 0.1 – 0.3   |                   | 1,276               |
| <b>Yield of targeted agricultural commodities within target areas</b> |          |             |                   |                     |
| <b>Maize (mt/ha)</b>                                                  |          |             |                   |                     |
| <b>Farm size</b>                                                      | -        | -           |                   | -                   |
| <b>Smallholder</b>                                                    | 2.7      | 2.4 – 3.1   |                   | 830                 |
| <b>Farmers' sex</b>                                                   | -        | -           | **                | -                   |
| Male                                                                  | 3.0      | 2.5 – 3.5   |                   | 439                 |
| Female                                                                | 2.4      | 2.1 – 2.7   |                   | 391                 |
| <b>Farmers' age</b>                                                   | -        | -           | **                | -                   |
| 15–29 years                                                           | 2.1      | 1.7 – 2.4   |                   | 106                 |
| 30 years and older                                                    | 2.8      | 2.4 – 3.2   |                   | 724                 |
| <b>Non-smallholder</b>                                                | ^        | ^           |                   | 8                   |
| <b>Farmers' sex</b>                                                   | -        | -           | -                 | -                   |
| Male                                                                  | ^        | ^           |                   | 3                   |
| Female                                                                | ^        | ^           |                   | 5                   |
| <b>Farmers' age</b>                                                   | -        | -           | -                 | -                   |
| 15–29 years                                                           | ^        | ^           |                   | 2                   |
| 30 years and older                                                    | ^        | ^           |                   | 6                   |
| <b>Paddy rice (mt/ha)</b>                                             |          |             |                   |                     |
| <b>Farm size</b>                                                      | -        | -           |                   | -                   |
| <b>Smallholder</b>                                                    | 4.5      | 4.0 – 4.9   |                   | 662                 |
| <b>Farmers' sex</b>                                                   | -        | -           | **                | -                   |
| Male                                                                  | 4.9      | 4.4 – 5.5   |                   | 349                 |
| Female                                                                | 4.0      | 3.5 – 4.6   |                   | 313                 |
| <b>Farmers' age</b>                                                   | -        | -           | **                | -                   |
| 15–29 years                                                           | 3.5      | 2.8 – 4.2   |                   | 92                  |
| 30 years and older                                                    | 4.7      | 4.2 – 5.2   |                   | 570                 |
| <b>Non-smallholder</b>                                                | ^        | ^           |                   | 2                   |
| <b>Farmers' sex</b>                                                   | -        | -           | -                 | -                   |
| Male                                                                  | ^        | ^           |                   | 2                   |
| Female                                                                | ^        | ^           |                   | 0                   |
| <b>Farmers' age</b>                                                   | -        | -           | -                 | -                   |
| 15–29 years                                                           | ^        | ^           |                   | 0                   |
| 30 years and older                                                    | ^        | ^           |                   | 2                   |
| <b>Cauliflower (mt/ha)</b>                                            |          |             |                   |                     |
| <b>Farm size</b>                                                      | -        | -           |                   | -                   |

| Feed the Future indicator                                                                                                                 | Estimate | 95% CI      | Sig. <sup>a</sup> | Number <sup>b</sup> |
|-------------------------------------------------------------------------------------------------------------------------------------------|----------|-------------|-------------------|---------------------|
| <b>Smallholder</b>                                                                                                                        | ^        | ^           |                   | 21                  |
| <b>Farmers' sex</b>                                                                                                                       | -        | -           | -                 | -                   |
| Male                                                                                                                                      | ^        | ^           |                   | 13                  |
| Female                                                                                                                                    | ^        | ^           |                   | 8                   |
| <b>Farmers' age</b>                                                                                                                       | -        | -           | -                 | -                   |
| 15–29 years                                                                                                                               | ^        | ^           |                   | 2                   |
| 30 years and older                                                                                                                        | ^        | ^           |                   | 19                  |
| <b>Non-smallholder</b>                                                                                                                    | ^        | ^           |                   | 0                   |
| <b>Farmers' sex</b>                                                                                                                       | -        | -           | -                 | -                   |
| Male                                                                                                                                      | ^        | ^           |                   | 0                   |
| Female                                                                                                                                    | ^        | ^           |                   | 0                   |
| <b>Farmers' age</b>                                                                                                                       | -        | -           | -                 | -                   |
| 15–29 years                                                                                                                               | ^        | ^           |                   | 0                   |
| 30 years and older                                                                                                                        | ^        | ^           |                   | 0                   |
| <b>Tomato (mt/ha)</b>                                                                                                                     |          |             |                   |                     |
| <b>Farm size</b>                                                                                                                          | -        | -           |                   | -                   |
| <b>Smallholder</b>                                                                                                                        | ^        | ^           |                   | 5                   |
| <b>Farmers' sex</b>                                                                                                                       | -        | -           | -                 | -                   |
| Male                                                                                                                                      | ^        | ^           |                   | 2                   |
| Female                                                                                                                                    | ^        | ^           |                   | 3                   |
| <b>Farmers' age</b>                                                                                                                       | -        | -           | -                 | -                   |
| 15–29 years                                                                                                                               | ^        | ^           |                   | 0                   |
| 30 years and older                                                                                                                        | ^        | ^           |                   | 5                   |
| <b>Non-smallholder</b>                                                                                                                    | ^        | ^           |                   | 0                   |
| <b>Farmers' sex</b>                                                                                                                       | -        | -           | -                 | -                   |
| Male                                                                                                                                      | ^        | ^           |                   | 0                   |
| Female                                                                                                                                    | ^        | ^           |                   | 0                   |
| <b>Farmers' age</b>                                                                                                                       | -        | -           | -                 | -                   |
| 15–29 years                                                                                                                               | ^        | ^           |                   | 0                   |
| 30 years and older                                                                                                                        | ^        | ^           |                   | 0                   |
| <b>Prevalence of moderate and severe food insecurity in the population, based on the Food Insecurity Experience Scale<sup>2</sup> (%)</b> |          |             |                   |                     |
| <b>All households</b>                                                                                                                     | 10.7     | 8.9 – 12.4  |                   | 2,439               |
| <b>Gendered household type</b>                                                                                                            | -        | -           | *                 | -                   |
| Male and female adults                                                                                                                    | 10.2     | 8.0 – 12.4  |                   | 1,910               |
| Female adults only                                                                                                                        | 13.1     | 9.3 – 16.9  |                   | 467                 |
| Male adults only                                                                                                                          | 19.8     | 7.4 – 32.1  |                   | 52                  |
| Children only, no adults                                                                                                                  | -        | -           |                   | 10                  |
| <b>Severity</b>                                                                                                                           | -        | -           | -                 | -                   |
| Moderate                                                                                                                                  | 8.8      | n/a         |                   | 2,439               |
| Severe                                                                                                                                    | 1.9      | 1.3 – 2.4   |                   | 2,439               |
| <b>Prevalence of exclusive breastfeeding among children under six months of age<sup>c</sup> (%)</b>                                       |          |             |                   |                     |
| <b>All children</b>                                                                                                                       | 64.0     | 54.0 – 74.0 |                   | 105                 |
| <b>Children's sex</b>                                                                                                                     | -        | -           | n/s               | -                   |
| Male                                                                                                                                      | 63.7     | 50.0 – 77.3 |                   | 55                  |
| Female                                                                                                                                    | 64.4     | 49.6 – 79.2 |                   | 50                  |

<sup>2</sup> Empty items are not generated by the program.

| Feed the Future indicator                                                                         | Estimate | 95% CI      | Sig. <sup>a</sup> | Number <sup>b</sup> |
|---------------------------------------------------------------------------------------------------|----------|-------------|-------------------|---------------------|
| <b>Percent of children 6–23 months of age receiving a minimum acceptable diet<sup>c</sup> (%)</b> |          |             |                   |                     |
| <b>All children</b>                                                                               | 38.1     | 30.3 – 44.0 |                   | 284                 |
| <b>Children's sex</b>                                                                             | -        | -           | n/s               | -                   |
| Male                                                                                              | 38.3     | 29.1 – 45.1 |                   | 154                 |
| Female                                                                                            | 37.8     | 28.1 – 47.6 |                   | 130                 |
| <b>Percent of women of reproductive age consuming a diet of minimum diversity<sup>c</sup> (%)</b> |          |             |                   |                     |
| <b>All women</b>                                                                                  | 48.2     | 44.3 – 52.1 |                   | 1,999               |
| <b>Women's age</b>                                                                                | -        | -           | *                 | -                   |
| 15–18                                                                                             | 47.6     | 39.1 – 56.2 |                   | 232                 |
| 19–49                                                                                             | 48.3     | 44.4 – 52.2 |                   | 1,767               |
| <b>Prevalence of stunted children under five years of age<sup>c</sup> (%)</b>                     |          |             |                   |                     |
| <b>All children</b>                                                                               | 26.7     | 23.4 – 30.0 |                   | 1,016               |
| <b>Children's sex</b>                                                                             | -        | -           | n/s               | -                   |
| Male                                                                                              | 28.2     | 24.0 – 32.5 |                   | 533                 |
| Female                                                                                            | 25.0     | 20.6 – 29.4 |                   | 483                 |
| <b>Children's age</b>                                                                             | -        | -           | ***               | -                   |
| 0–11 months                                                                                       | 6.5      | 2.9 – 10.1  |                   | 190                 |
| 12–23 months                                                                                      | 27.9     | 20.9 – 35.0 |                   | 193                 |
| 24–35 months                                                                                      | 30.6     | 23.4 – 37.8 |                   | 209                 |
| 36–47 months                                                                                      | 32.7     | 25.7 – 39.7 |                   | 213                 |
| 48–59 months                                                                                      | 33.4     | 27.0 – 39.8 |                   | 211                 |
| <b>Prevalence of wasted children under five years of age<sup>c</sup> (%)</b>                      |          |             |                   |                     |
| <b>All children</b>                                                                               | 12.5     | 10.1 – 14.9 |                   | 1,009               |
| <b>Children's sex</b>                                                                             | -        | -           | n/s               | -                   |
| Male                                                                                              | 12.3     | 9.3 – 15.3  |                   | 528                 |
| Female                                                                                            | 12.7     | 9.3 – 16.1  |                   | 481                 |
| <b>Children's age</b>                                                                             | -        | -           | n/s               | -                   |
| 0–11 months                                                                                       | 14.5     | 8.7 – 20.2  |                   | 184                 |
| 12–23 months                                                                                      | 16.5     | 10.7 – 22.4 |                   | 194                 |
| 24–35 months                                                                                      | 14.2     | 9.0 – 19.4  |                   | 208                 |
| 36–47 months                                                                                      | 7.0      | 3.5 – 10.6  |                   | 212                 |
| 48–59 months                                                                                      | 10.8     | 6.4 – 15.3  |                   | 211                 |
| <b>Prevalence of healthy weight children under five years of age<sup>c</sup> (%)</b>              |          |             |                   |                     |
| <b>All children</b>                                                                               | 86.6     | 84.1 – 89.1 |                   | 1,009               |
| <b>Children's sex</b>                                                                             | -        | -           | n/s               | -                   |
| Male                                                                                              | 86.2     | 83.1 – 89.4 |                   | 528                 |
| Female                                                                                            | 87.1     | 83.7 – 90.5 |                   | 481                 |
| <b>Children's age</b>                                                                             | -        | -           | n/s               | -                   |
| 0–11 months                                                                                       | 83.5     | 77.6 – 89.5 |                   | 184                 |
| 12–23 months                                                                                      | 83.5     | 77.6 – 89.3 |                   | 194                 |
| 24–35 months                                                                                      | 84.8     | 79.4 – 90.2 |                   | 208                 |
| 36–47 months                                                                                      | 92.0     | 88.1 – 95.8 |                   | 212                 |
| 48–59 months                                                                                      | 88.7     | 84.2 – 93.3 |                   | 211                 |
| <b>Prevalence of underweight women of reproductive age<sup>c</sup> (%)</b>                        |          |             |                   |                     |
| <b>All non-pregnant women 15–49 years</b>                                                         | 17.6     | 15.5 – 19.8 |                   | 1,906               |
| <b>Women's age</b>                                                                                | -        | -           | ***               | 1,906               |
| 15–19                                                                                             | 31.3     | 25.8 – 37.3 |                   | 283                 |
| 20–24                                                                                             | 24.0     | 18.5 – 30.4 |                   | 294                 |



| Feed the Future indicator                                                               | Estimate | 95% CI      | Sig. <sup>a</sup> | Number <sup>b</sup> |
|-----------------------------------------------------------------------------------------|----------|-------------|-------------------|---------------------|
| 25–29                                                                                   | 14.3     | 9.9 – 20.2  |                   | 341                 |
| 30–34                                                                                   | 9.5      | 6.8 – 13.1  |                   | 328                 |
| 35–39                                                                                   | 9.0      | 5.7 – 13.9  |                   | 286                 |
| 40–44                                                                                   | 10.2     | 6.1 – 16.6  |                   | 208                 |
| 45–49                                                                                   | 16.6     | 10.3 – 25.6 |                   | 166                 |
| <b>Percent of households with access to basic sanitation service (%)</b>                |          |             |                   |                     |
| <b>All households</b>                                                                   | 73.5     | 70.7 – 76.1 |                   | 2,481               |
| <b>Gendered household type</b>                                                          | -        | -           | ***               | -                   |
| Male and female adults                                                                  | 76.8     | 74.2 – 79.3 |                   | 1,944               |
| Female adults only                                                                      | 62.6     | 56.2 – 68.6 |                   | 473                 |
| Male adults only                                                                        | 59.2     | 43.8 – 73.1 |                   | 54                  |
| Children only, no adults                                                                | ^        | ^           |                   | 10                  |
| <b>Residence</b>                                                                        | -        | -           | n/s               | -                   |
| Urban                                                                                   | 71.9     | 67.7 – 75.8 |                   | 1,351               |
| Rural                                                                                   | 75.5     | 72.2 – 78.5 |                   | 1,130               |
| <b>Percent of households with soap and water at handwashing station on premises (%)</b> |          |             |                   |                     |
| <b>All households</b>                                                                   | 51.1     | 47.2 – 54.9 |                   | 2,481               |
| <b>Gendered household type</b>                                                          | -        | -           | n/s               | -                   |
| Male and female adults                                                                  | 51.5     | 47.6 – 55.4 |                   | 1,944               |
| Female adults only                                                                      | 49.7     | 43.5 – 55.8 |                   | 473                 |
| Male adults only                                                                        | 43.3     | 27.3 – 60.8 |                   | 54                  |
| Children only, no adults                                                                | ^        | ^           |                   | 10                  |
| <b>Residence</b>                                                                        | -        | -           | ***               | -                   |
| Urban                                                                                   | 58.3     | 52.6 – 63.7 |                   | 1,351               |
| Rural                                                                                   | 41.7     | 35.8 – 46.8 |                   | 1,130               |

^ Results not statistically reliable, n<30

n/a=not available, CI=confidence interval

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Number is the number of units (individuals, households) in the sample.

<sup>c</sup> Estimates are based on de facto household members.

Notes:

Estimates are sample-weighted; numbers are unweighted.

Estimates are based on de jure household members, except where noted.

Source: Feed the Future Nepal ZOI Survey 2019

## Summary of key findings

### Household economic status

#### **Prevalence of poverty: Percent of people living on less than \$1.90/day, 2011 PPP (84.76 Rs)**

At baseline, 9.2 percent of individuals in the ZOI lived below the \$1.90/day (2011 PPP) poverty threshold. Higher levels of education, higher wealth quintiles, and lower exposure to shocks, and ecological zone were significantly associated with a lower prevalence of poverty at the \$1.90 threshold.

#### **Depth of poverty of the poor: Mean percent shortfall relative to the \$1.90/day (2011 PPP) poverty line (84.76 Rs)**

The depth of poverty of the poor in the ZOI was 19.9 percent of the poverty line, meaning that the average shortfall of the poor from the poverty line was \$0.38 in 2011 PPP. Thus, the average poor person in the ZOI lived at 80.1 percent of the poverty line, and his or her average daily consumption

was \$1.52 (2011 PPP).<sup>3</sup> Gendered household type, education, wealth quintile, shock exposure, and ecological zone were significantly associated with depth of poverty of the poor. Poor households with both adult males and adult females (M&F) experienced the greatest depth of poverty, at 20.1 percent of the poverty line, and poor households with adult female(s) and no adult male (FNM) experienced the shallowest depth of poverty, at 19.1 percent of the poverty line. Hill households lived at 21.1 percent of the poverty line compared to 8.6 percent for terai households.

***Prevalence of people who are “near-poor,” living on 100 percent to less than 125 percent of the \$1.90 (2011 PPP) poverty line (84.76 to <105.95 Rs) [Context Indicator]***

Overall, 10.9 percent of individuals lived at or above the \$1.90 poverty threshold but below 125 percent of that threshold (\$2.38 per day in 2011 PPP). Higher levels of household education, higher wealth quintiles, and lower shock exposure were associated with lower prevalence of people who are “near-poor” at the \$1.90 threshold.

***Percent of households below the comparative threshold for the poorest quintile of the asset-based comparative wealth index.***

Overall, 7.9 percent of households fell below the comparative threshold for poorest quintile of the asset-based CWI. A higher level of education is significantly associated with lower likelihood of falling below the poorest quintile of the asset-based CWI. Poverty and higher shock exposure were also significantly associated with higher likelihood of falling below the poorest quintile. Ecological zone was significantly associated as well; 13.7 percent of households in the hill zone fell below the poorest quintile of the asset-based CWI compared to 1.4 percent in the terai zone and 0.0 percent in the mountain zone.

## **Resilience**

***Ability to recover from shocks and stresses index***

The ARSSI is a measure of a household’s ability to recover from shocks and stresses that corrects for any differences between households in their exposure to 24 types of shocks. ARSSI scores among the sample ranged from 1.9–7.0, where a higher score represents a greater ability to recover. At baseline, households in the ZOI had a mean ARSSI score of 5.2. M&F households had higher ARSSI score, at 5.3, than FNM households, at 5.0. Household education, poverty status, and ecological zone were also significantly associated with ARSSI score.

***Index of social capital at the household level***

On average, households scored 0.71 on the social capital index, 0.81 on bonding, and 0.60 on bridging. Wealth quintile, shock exposure index (SEI) score, and ecological zone were associated with social capital index score.

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<sup>3</sup> The average value of consumption of a poor person is calculated as follows:  $(80.1 \div 100) * \$1.90/\text{day} = \$1.52/\text{day}$ .

### ***Percent of households that believe local government will respond effectively to future shocks and stresses***

84.3 percent of households in the ZOI believed that the local government would respond effectively to future shocks and stresses. Household education, poverty status, and SEI scores were significantly associated with the belief that the local government will respond effectively to future shocks and stresses. Whereas 83.7 percent of households with no education in the ZOI believed that the local government would respond effectively to future shocks and stresses, 90.6 percent of households with at least one household member who had completed secondary school and 88.8 percent of those with at least one household member who had completed higher education believed the same. Non-poor households were significantly more likely to hold this belief than poor households, while the share of households with this belief decreased with exposure to shocks.

### ***Percent of households participating in group-based savings, micro-finance, or lending programs***

Overall, 41.7 percent of households participated in group-based savings, micro-finance, or lending programs. Gendered household type was significantly associated with this behavior. 44.5 percent of M&F households borrowed, compared to 34.3 percent of FNM households, and just 11 percent of households with adult male(s) and no adult females (MNF). Wealth quintile and poverty status were also significantly associated with this behavior. 43.7 of households in the highest wealth quintile borrowed, compared to 48.9 in the middle quintile and 28.4 in the lowest quintile.

### **Abbreviated Women's Empowerment in Agriculture Index (A-WEAI)**

#### ***A-WEAI***

At baseline, women's A-WEAI score was 0.86. This figure did not vary significantly by age or province.

#### ***Average percent of women achieving adequacy across the six indicators of the A-WEAI***

25.4 percent of women achieved adequacy in the six A-WEAI indicators at baseline. This figure did not vary significantly by age.

### **Agriculture**

#### ***Yield of targeted agricultural commodities within target areas (mt/ha)***

Male maize farmers obtained a significantly higher yield of maize than female maize farmers. Male smallholder maize farmers obtained 3.0 metric tons per hectare (mt/ha) on average, whereas females obtained 2.4 mt/ha on average. Smallholder farmers aged 30 and above obtained 3.0 mt/ha on average, compared to 2.4 mt/ha on average among farmers younger than 30. These differences were also statistically significant. Due to the small sample size, data were not available for non-smallholder farmers.

Male rice farmers also generated a significantly higher yield of rice than female rice farmers. Male rice farmers obtained 4.9 mt/ha on average, compared to 4.0 mt/ha on average among women. Farmers aged 30 and above also obtained a significantly higher yield than younger farmers, at 4.7 mt/ha and 3.5 mt/ha on average, respectively. Due to the small sample size, data were not available for non-smallholder farmers.

Due to the small sample sizes, no yield estimates were available for cauliflower or tomatoes farmers.

### ***Percent of producers who have applied targeted improved management practices or technologies***

Overall, 77.7 percent of producers applied at least one of the promoted improved management practices or technologies. 83.8 percent of men compared to 71.0 percent of women applied at least one practice or technology, and these differences were statistically significant. 79.1 percent of farmers aged 30 and above applied at least one practice or technology, relative to 69.2 percent of farmers under 30. Again, these differences were statistically significant.

### **Food insecurity and dietary intake**

#### ***Prevalence of moderate and severe food insecurity in the population, based on the Food Insecurity Experience Scale***

10.7 percent of households experienced moderate to severe food insecurity during the 12 months preceding the survey based on the FIES.<sup>4</sup> Approximately 8.8 percent of households experienced moderate food insecurity and 1.9 percent experienced severe food insecurity. Gendered household type was significantly associated with food insecurity. Compared to M&F households, FNM and MNF households had a significantly higher prevalence of moderate to severe food insecurity, at 13.1 percent and 19.8 percent, respectively.

#### ***Prevalence of exclusive breastfeeding of children under six months of age***

At baseline, 64.0 percent of children under six months of age were exclusively breastfed. Ecological zone was significantly associated with breastfeeding status; 79.3 percent of children in hill zones were exclusively breastfed compared to 47.7 percent in terai zones.

#### ***Percent of children 6–23 months receiving a minimum acceptable diet (MAD)***

38.1 percent of children aged 6–23 months received a MAD. Older children were more likely than younger children to receive a MAD, with 48.6 percent of children between 18 and 23 months achieving a MAD, compared to 22.0 percent of children between six and 11 months.

#### ***Percent of women of reproductive age consuming a diet of minimum diversity***

48.2 percent of women consumed a diet of minimum diversity. Women aged 25 to 29 were the most likely to consume a diet of minimum diversity, with a prevalence of 53.5 percent. Women aged 30 to 34 were the least likely, with a prevalence of 41.4 percent. A higher level of education was significantly associated with a higher likelihood of consuming a diet of minimum diversity. Wealth quintile, poverty status, and SEI scores were associated with likelihood of consuming a diet of minimum diversity as well. A higher wealth quintile was associated with a higher likelihood of consuming a diet of minimum diversity, with 62.4 percent achieving a diet of minimum diversity in the highest quintile, compared to 34.9 in the lowest quintile. Non-poor households were significantly more likely to consume a diet of minimum diversity than poor households, and higher shock exposure was associated with a lower likelihood of consuming such a diet.

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<sup>4</sup> Details on FIES methodology can be found in Chapter 8: Food Insecurity and Dietary Intake.

## **Nutritional status of women and children**

### ***Prevalence of stunted children under five years of age***

26.7 percent of children were stunted. Age was significantly associated with stunting; children aged zero to 11 months were the least likely to be stunted, with a prevalence of 6.5 percent, and children aged 48 to 59 months were the most likely to be stunted, with a prevalence of 33.4 percent.

### ***Prevalence of wasted children under five years of age***

12.5 percent of children were wasted. Ecological zone was significantly associated with wasting: 19.3 percent of children in the Terai zone were wasted compared to 7.0 percent in the hill zone.

### ***Prevalence of healthy weight children under five years of age***

86.6 percent of children were at a healthy weight. Ecological zone was significantly associated with healthy weight status: 91.7 percent of children in the hill zone were of healthy weight compared to 80.4 percent in the Terai zone.

### ***Prevalence of underweight women of reproductive age***

17.6 percent of women were underweight. Age was significantly associated with underweight status: women aged 15 to 19 were the most likely to be underweight, with a prevalence of 31.3 percent, and women aged 35 to 39 were the least likely, with a prevalence of 9.0 percent.

## **Water, sanitation, and hygiene**

### ***Percent of households with access to a basic sanitation service***

73.5 percent of households had access to basic sanitation services, defined as a sanitation facility that hygienically separates human excreta from human contact that is not shared with other households. Gendered household type was significantly associated with access to these services. M&F households most commonly had access, with a prevalence of 76.8 percent, and MNF households most infrequently had access, with a prevalence of 59.2 percent. Urban or rural household location was not significantly associated with access to basic sanitation.

### ***Percent of households with soap and water at a handwashing station on premises***

At baseline, only 51.1 percent of households had soap and water at a handwashing station within their homes. Household location was significantly associated with access: 58.3 percent of urban households had a handwashing station with soap and water, compared to just 41.7 percent of rural households.

## I. BACKGROUND

This chapter provides background information on Feed the Future in Nepal, including a description of the program and the Feed the Future Zone of Influence (ZOI), demographic information on the ZOI population, and a summary of poverty, food security, nutrition, and agroclimatology in the ZOI.<sup>5</sup>

### I.1. Feed the Future overview

Feed the Future is a United States (U.S.) Government initiative that addresses global food insecurity by supporting agriculture sector growth, improving household income and resilience, and improving nutritional status in 12 target countries. Program efforts are designed to impact the population in ZOIs in Feed the Future target countries. One of the main tools to track progress in achieving Feed the Future's high-level objectives are population-based performance indicators collected at baseline and then periodically thereafter.

The purpose of the Feed the Future Nepal ZOI Survey is to provide the United States Agency for International Development (USAID) Mission Nepal, its U.S. Government interagency partners, the USAID Bureau for Resilience and Food Security (RFS), the Government of Nepal (GoN), and development partners with information on the current status of the Feed the Future population-based ZOI-level indicators. The survey was designed to (1) determine whether there has been statistically significant change over time in the Feed the Future Phase 1 ZOI key outcome and impact indicators within the Phase 1 ZOI and (2) establish the baseline status of Feed the Future Phase 2 ZOI indicators within the Phase 2 ZOI. Therefore, the 2019 Nepal ZOI Survey is intended to serve both as an endline for Feed the Future Phase 1 and a baseline for Feed the Future Phase 2 in Nepal. This report addresses the latter objective. The Feed the Future Phase 2 ZOI includes a total of 25 districts in Nepal, covering ten districts in Lumbini Province: Arghakhanchi, Gulmi, Kapilvastu, Palpa, Banke, Bardiya, Dang, Pyuthan, Rolpa, and East Rukum; five districts in Karnali Province: Salyan, Surkhet, Dailekh, Jajarkot, and West Rukum; six districts in Sudurpashchim Province: Achham, Baitadi, Dadeldhura, Doti, Kailali, and Kanchanpur; and four districts in Bagmati Province: Kavrepalanchok, Makwanpur, Nuwakot, and Sindhupalchowk, containing both hill and terai agro-ecological zones.<sup>6</sup>

### I.2 Feed the Future ZOI profile

The Feed the Future ZOI is the geographic area where the Feed the Future program is expected to have an impact on hunger, poverty, and nutrition. The Feed the Future Phase 1 ZOI in Nepal has changed since 2010. Following the devastating April 2015 earthquake in Nepal, four districts in Bagmati Province were added: Kavrepalanchok, Makwanpur, Nuwakot, and Sindhupalchowk. The Feed the Future Phase 2 ZOI in Nepal includes these 25 districts. A map of the Phase 2 ZOI in Nepal is provided in **Figure I.1**.

<sup>5</sup> Agroclimatology, or agricultural climatology, refers to the interaction between climate and agriculture (Wagner-Riddle, 2005). Current agroclimatology data for specific countries can be found on the Famine Early Warning Systems Network, <https://fews.net/>.

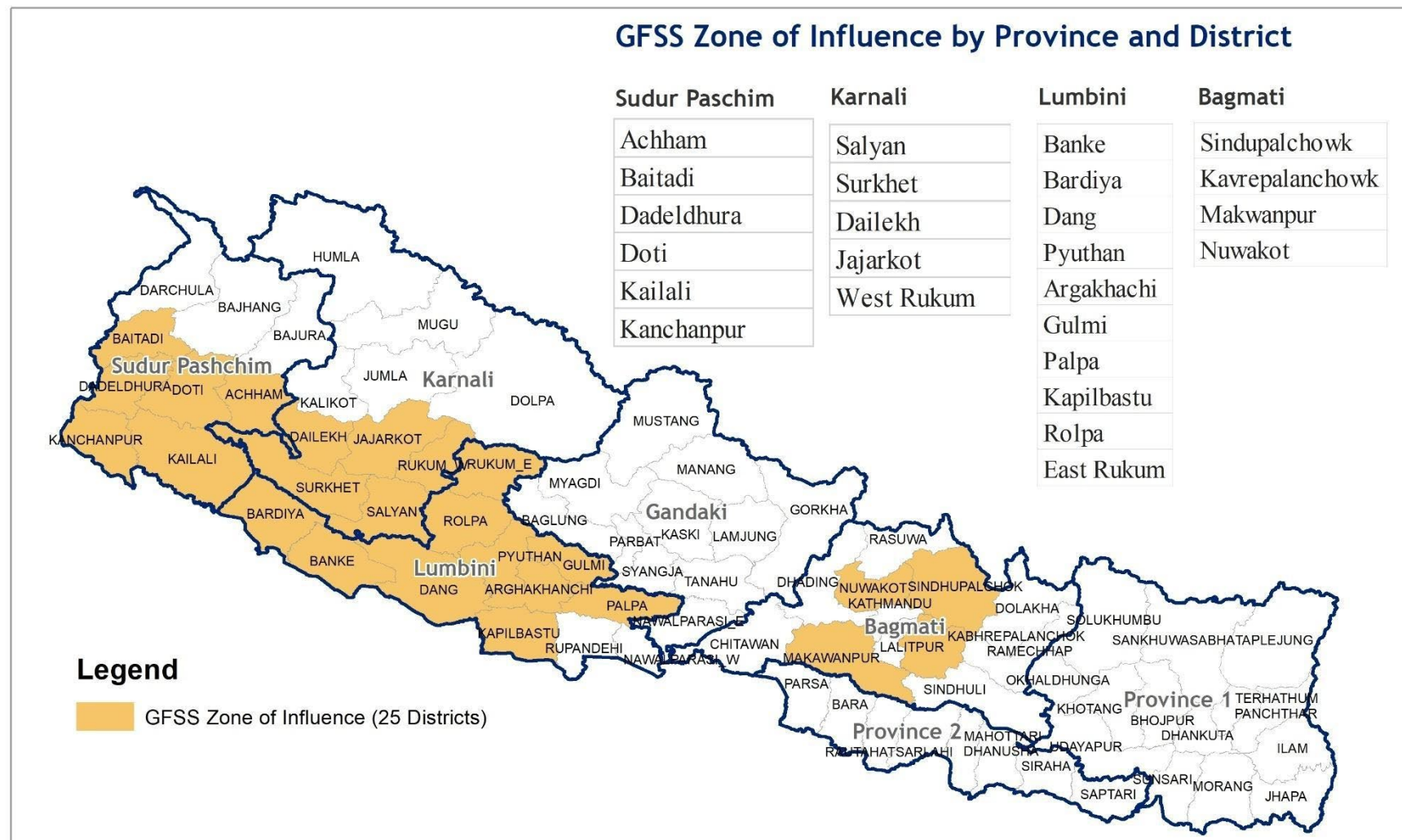
<sup>6</sup> Rukum used to be one province and was split into two provinces. Previous documentation refers to the Phase 1 ZOI with 20 districts and Phase 2 ZOI with 24 districts. As of 2018, Phase 1 ZOI had 21 districts and Phase 2 ZOI 25 districts.



Figure 1.1: Map of Nepal: Feed the Future Phase 2 ZOI



# USAID | NEPAL NEPAL GFSS ZONE OF INFLUENCE



The boundaries and names used on this map do not imply official endorsement or acceptance by the US Government or USAID.

Data Source: Survey Department, USAID/Nepal  
Map Produced: Jan 26, 2021

0 55 110 220  
KM



### 1.2.1 Rationale for ZOI selection

The Phase 2 ZOI includes the 21 districts in the Phase 1 ZOI in addition to four districts in Bagmati Province: Kavrepalanchok, Makwanpur, Nuwakot, and Sindhupalchowk. The 21 districts comprising the Feed the Future Phase 1 ZOI were selected for their higher sub-regional hunger indices, incidences of asset sales as a coping strategy, levels of out-migration, and numbers of female-headed households. Though these areas have high poverty rates, there is a substantial population and good potential returns. The GoN also prioritized the Far-Western and Mid-Western Regions in its Country Investment Plan. The four additional districts in the Phase 2 ZOI were added in response to the devastating April 2015 earthquake and were selected based on the total population affected, extent and potential of agricultural production, market access, and overlap with the Bureau for Humanitarian Assistance Action for Resilience and Food Security Activity. These selected districts also have the potential for surplus food production to sell to neighboring districts that were hard hit by the earthquake and thus could drive recovery and longer-term development in the area.

### 1.2.2 Demography of the ZOI

**Table 1.2.1** and **Table 1.2.2** present individual and household population estimates for the ZOI in 2019. Estimates of the total population and sub-populations of the ZOI are included. The sub-population categories correspond to the various sub-populations for the Feed the Future indicators and disaggregates.

As shown in **Table 1.2.1**, a total of 7.9 million individuals resided in the ZOI in 2019. Children under the age of five represented nearly 12.1 percent of the population. Youth aged 15 to 29 accounted for 27.5 percent of the ZOI population and women of reproductive age were 28.7 percent of the ZOI population. Rice and maize farmers were the most prevalent types of farmers, at 12.1 and 11.6 percent of the ZOI population, respectively. Cauliflower and tomato farmers each represented only 0.7 and 0.4 percent of the population, respectively.

The ZOI population was slightly more urbanized than rural in 2019. 57.2 percent of the population resided in an urban area and 42.8 percent resided in a rural area. The largest percentage of the ZOI was in Lumbini Province, at 45.9 percent of the ZOI population, and the smallest percentage of the ZOI (13.4) was in Karnali Province.

In 2019, 85.9 percent of individuals in the ZOI were residing in households that contained both male and female adults (M&F), and 13.2 percent of individuals were in households with female adults but no male adults (FNM). There were very few individuals living in male-adult-only (MNF) households and households with children and no adults (CNA), at 0.8 and 0.1 percent, respectively.

There were slightly more male than female children under five in all age categories. This pattern shifts for youth aged 15 to 29, with 15.8 percent female youth and 11.7 percent male youth. An estimated one percent of the ZOI population was a pregnant woman of reproductive age. 12.2 percent of the population was a primary adult female decision-maker between 18 and 29 years of age, and 22.8 percent was a primary adult female decision maker of 30 years or older.



**Table 1.2.1: Population of individuals in the ZOI, by category, Nepal 2019**

| Category of individuals                                        | Number <sup>a</sup> | Percent    |
|----------------------------------------------------------------|---------------------|------------|
| <b>Total number of individuals</b>                             | <b>7,855,373</b>    | <b>100</b> |
| <b>Total number of individuals, by key sub-population</b>      |                     |            |
| Children 0–5 months                                            | 76,485              | 1.0        |
| Children 0–23 months                                           | 342,685             | 4.4        |
| Children 6–23 months                                           | 266,199             | 3.4        |
| Children 0–59 months                                           | 946,944             | 12.1       |
| Youth 15–29 years                                              | 2,157,148           | 27.5       |
| Women of reproductive age (15–49 years)                        | 2,256,935           | 28.7       |
| Rice farmers                                                   | 946,694             | 12.1       |
| Maize farmers                                                  | 908,757             | 11.6       |
| Cauliflower farmers                                            | 53,284              | 0.7        |
| Tomato farmers                                                 | 34,118              | 0.4        |
| <b>Total number of individuals, by residence<sup>b</sup></b>   |                     |            |
| Urban                                                          | 4,495,658           | 57.2       |
| Rural                                                          | 3,359,715           | 42.8       |
| <b>Total number of individuals, by Province</b>                |                     |            |
| Bagmati Province                                               | 1,181,581           | 15.0       |
| Lumbini Province                                               | 3,608,071           | 45.9       |
| Karnali Province                                               | 1,049,415           | 13.4       |
| Sudurpashchim Province                                         | 2,016,306           | 25.7       |
| <b>Total number of individuals, by gendered household type</b> |                     |            |
| Male and female adults                                         | 6,744,150           | 85.9       |
| Female adults only                                             | 1,033,281           | 13.2       |
| Male adults only                                               | 66,688              | 0.8        |
| Children only, no adults                                       | 11,254              | 0.1        |
| <b>Children 0–5 months, by sex</b>                             |                     |            |
| Male                                                           | 42,256              | 0.5        |
| Female                                                         | 34,229              | 0.4        |
| <b>Children 6–23 months, by sex</b>                            |                     |            |
| Male                                                           | 143,892             | 1.8        |
| Female                                                         | 122,307             | 1.6        |
| <b>Children 0–59 months, by sex</b>                            |                     |            |
| Male                                                           | 503,583             | 6.4        |
| Female                                                         | 443,361             | 5.6        |
| <b>Youth 15–29 years, by sex</b>                               |                     |            |
| Male                                                           | 916,139             | 11.7       |
| Female                                                         | 1,241,009           | 15.8       |
| <b>Women of reproductive age, by pregnancy status</b>          |                     |            |
| Pregnant                                                       | 81,299              | 1.0        |
| Non-pregnant                                                   | 2,175,636           | 27.7       |
| <b>Primary adult female decision-makers, by age</b>            |                     |            |
| 18–29 years                                                    | 962,229             | 12.2       |
| 30 years or older                                              | 1,789,591           | 22.8       |

<sup>a</sup> Number is the number of individuals in the population.

<sup>b</sup> The urban/rural disaggregate uses the Nepal-specific definition of urban and rural reflected in the sampling frame at the time of sampling.  
Source: Feed the Future Nepal ZOI Survey 2019

Note: Disaggregate values may not sum to exactly 100.0% due to rounding.

As shown in **Table 1.2.2** below, there were an estimated 1.3 million farmers cultivating maize, rice, tomatoes, or cauliflower in the ZOI in 2019. Overall, there were slightly more male farmers (52.4 percent) than female farmers (47.6 percent). Farmers were more likely to be aged 30 years or older (85.7 percent), than 15 to 29 years old (14.3 percent). These trends are consistent across crop type.

The greatest number of farmers in the ZOI, nearly 950,000, cultivated rice. Of these farmers, more than 99 percent were smallholder farmers, and less than one percent were non-smallholders. More rice farmers were male than female. Rice farmers were much more likely to be aged 30 or older than aged 15 to 29.

Maize farmers were the second most prevalent type of farmer in the ZOI in 2019. Nearly 98 percent of maize farmers were smallholder farmers. Similar to rice farmers, more maize farmers were male.

Cauliflower was the third most cultivated crop in the ZOI, with 53,000 cauliflower farmers. All cauliflower farmers were smallholder farmers, and nearly two-thirds of these farmers were men. Again, the majority of these farmers were aged 30 or older.

Finally, tomato was the most infrequently cultivated crop in the ZOI, with 34,000 farmers. All of these were smallholder farmers, 61.3 percent of which were men. The majority of tomato farmers were aged 30 or older, although of all four value chain commodities (VCCs), tomato farmers were most commonly under 30 years of age.

**Table 1.2.2: Population of individual farmers of targeted value chain commodities in the ZOI, by category, Nepal 2019**

| Category of farmers            | Number <sup>a</sup> | Percent     |
|--------------------------------|---------------------|-------------|
| <b>Any targeted VCC</b>        |                     |             |
| <b>Total number of farmers</b> | <b>1,299,901</b>    | <b>100</b>  |
| <b>Farmers' sex</b>            |                     |             |
| Male                           | 681,528             | 52.4        |
| Female                         | 618,373             | 47.6        |
| <b>Farmers' age</b>            |                     |             |
| 15–29 years                    | 186,298             | 14.3        |
| 30 years and older             | 1,113,603           | 85.7        |
| <b>Maize</b>                   |                     |             |
| <b>Total farmers</b>           | <b>908,758</b>      | <b>100</b>  |
| <b>Smallholders</b>            | <b>889,794</b>      | <b>97.9</b> |
| <b>Farmers' sex</b>            |                     |             |
| Male                           | 462,948             | 50.9        |
| Female                         | 426,846             | 47.0        |
| <b>Farmers' age</b>            |                     |             |
| 15–29 years                    | 120,501             | 13.3        |
| 30 years and older             | 769,293             | 84.7        |
| <b>Non-smallholders</b>        | <b>18,964</b>       | <b>2.1</b>  |
| <b>Farmers' sex</b>            |                     |             |
| Male                           | ^                   | ^           |
| Female                         | ^                   | ^           |
| <b>Farmers' age</b>            |                     |             |

| Category of farmers     | Number <sup>a</sup> | Percent     |
|-------------------------|---------------------|-------------|
| 15–29 years             | ^                   | ^           |
| 30 years and older      | ^                   | ^           |
| <b>Rice</b>             |                     |             |
| <b>Total farmers</b>    | <b>946,694</b>      | <b>100</b>  |
| <b>Smallholders</b>     | <b>939,108</b>      | <b>99.2</b> |
| <b>Farmers' sex</b>     |                     |             |
| Male                    | 528,387             | 55.8        |
| Female                  | 410,721             | 43.4        |
| <b>Farmers' age</b>     |                     |             |
| 15–29 years             | 121,845             | 12.9        |
| 30 years and older      | 817,263             | 86.3        |
| <b>Non-smallholders</b> | <b>7,586</b>        | <b>0.8</b>  |
| <b>Farmers' sex</b>     |                     |             |
| Male                    | ^                   | ^           |
| Female                  | ^                   | ^           |
| <b>Farmers' age</b>     |                     |             |
| 15–29 years             | ^                   | ^           |
| 30 years and older      | ^                   | ^           |
| <b>Cauliflower</b>      |                     |             |
| <b>Total farmers</b>    | <b>53,284</b>       | <b>100</b>  |
| <b>Smallholders</b>     | <b>53,284</b>       | <b>100</b>  |
| <b>Farmers' sex</b>     |                     |             |
| Male                    | 34,188              | 64.2        |
| Female                  | 19,096              | 35.8        |
| <b>Farmers' age</b>     |                     |             |
| 15–29 years             | 8,921               | 16.7        |
| 30 years and older      | 44,363              | 83.3        |
| <b>Tomato</b>           |                     |             |
| <b>Total farmers</b>    | <b>34,118</b>       | <b>100</b>  |
| <b>Smallholders</b>     | <b>34,118</b>       | <b>100</b>  |
| <b>Farmers' sex</b>     |                     |             |
| Male                    | 20,924              | 61.3        |
| Female                  | 13,194              | 38.7        |
| <b>Farmers' age</b>     |                     |             |
| 15–29 years             | 5,912               | 17.3        |
| 30 years and older      | 28,206              | 82.7        |

<sup>a</sup> Number of farmers in the population.

^ Unable to compute due to lack of statistically representative sample (n<30).

Source: Feed the Future Nepal ZOI Survey 2019

As shown in **Table 1.2.3** below, there were 1.7 million households in the ZOI in 2019. The most common gendered household type was M&F households, at 77.7 percent, followed by FNM households, MNF households, and CNA households at 19.4, 2.5, and 0.5 percent of households, respectively.

A majority of households (56.4 percent) were located in urban areas. Rural households were 43.6 percent of the ZOI. Lumbini Province was home to the greatest number of ZOI households (44.9 percent) and Karnali Province was home to the fewest (12.8 percent).

**Table 1.2.3: Number of households in the ZOI, by category, Nepal 2019**

| Category of households                                        | Number <sup>a</sup> | Percent    |
|---------------------------------------------------------------|---------------------|------------|
| <b>Total number of households</b>                             | <b>1,745,364</b>    | <b>100</b> |
| <b>Total number of households, by gendered household type</b> |                     |            |
| Male and female adults                                        | 1,355,746           | 77.7       |
| Female adults only                                            | 338,118             | 19.4       |
| Male adults only                                              | 43,232              | 2.5        |
| Children only, no adults                                      | 8,268               | 0.5        |
| <b>Total number of households, by residence<sup>b</sup></b>   |                     |            |
| Urban                                                         | 985,026             | 56.4       |
| Rural                                                         | 760,338             | 43.6       |
| <b>Total number of households, by province</b>                |                     |            |
| Bagmati Province                                              | 316,807             | 18.2       |
| Lumbini Province                                              | 783,436             | 44.9       |
| Karnali Province                                              | 224,142             | 12.8       |
| Sudurpashchim Province                                        | 420,979             | 24.1       |

<sup>a</sup> Number of households in the population.

<sup>b</sup> The urban/rural disaggregate uses the Nepal-specific definition of urban and rural reflected in the sampling frame at the time the sample was drawn.

Source: Feed the Future Nepal ZOI Survey 2019

Note: Disaggregate values may not sum to exactly 100.0% due to rounding.

**Table 1.2.4** shows that an estimated 1.4 million households in the ZOI were engaged in agriculture in 2019. Rice was the most cultivated crop, grown by 56.2 percent of households involved in agriculture, followed by maize, grown by 55 percent of households involved in agriculture. Cauliflower and tomatoes were much less frequently grown, at three and two percent, respectively. These four crops are those supported by the Feed the Future program in Nepal.

Most households in the ZOI that engaged in agriculture owned goats (72.5 percent), chickens or other poultry (56.4 percent), milk cows or bulls (56.3 percent), and other types of livestock (50.2 percent). 5.8 percent of households owned sheep. Less than one percent of the population owned fish; other cattle; and horses, donkeys, or mules.

**Table 1.2.4: Number of households in the ZOI involved in agriculture, by category, Nepal 2019**

| Category of households                                | Number <sup>a</sup> | Percent    |
|-------------------------------------------------------|---------------------|------------|
| <b>Total number of households</b>                     | <b>1,745,364</b>    | <b>100</b> |
| Any crops                                             | 1,379,379           | 79.0       |
| Rice                                                  | 981,497             | 56.2       |
| Maize                                                 | 960,683             | 55.0       |
| Cauliflower                                           | 53,182              | 3.0        |
| Tomato                                                | 34,083              | 2.0        |
| <b>Total number of households, by livestock owned</b> | <b>1,383,165</b>    | <b>100</b> |
| Milk cows or bulls                                    | 779,207             | 56.3       |
| Other cattle                                          | 8,434               | 0.6        |
| Horses, donkeys, or mules                             | 7,323               | 0.5        |
| Goats                                                 | 1,002,633           | 72.5       |
| Sheep                                                 | 79,666              | 5.8        |
| Chickens or other poultry                             | 780,434             | 56.4       |
| Any other livestock                                   | 694,640             | 50.2       |

| Category of households | Number <sup>a</sup> | Percent |
|------------------------|---------------------|---------|
| Fish                   | 10,026              | 0.7     |

<sup>a</sup> Calculation of the percentage of households growing crops is based on the number of households in the population, where 1,745,364 equals 100 percent.

Note: "Involved in agriculture" refers to ownership of the livestock presented in the table or cultivation of any crops.

Note: Disaggregate percentages do not sum to 100 because households may grow more than one type of crop or own more than one type of livestock. Disaggregate numbers do not sum to the total number of households for the same reason.

Source: Feed the Future Nepal ZOI Survey 2019

### 1.2.3 Climate and agriculture in the ZOI

Agriculture is the foundation of economic progress in Nepal, with more than 60 percent of the population engaging in the sector.<sup>7</sup> Agriculture contributed 27.6 percent of Nepal's gross domestic product (GDP) in fiscal year 2017–2018, a significant proportion relative to other sectors. The agriculture sector also grew by 2.7 percent, in part because of an increase in the production of major grain and vegetable crops.<sup>8</sup> The government also invested in improvements in productivity and the promotion of sustainable agriculture, with the goals of ending hunger and ensuring food security. Moreover, the continued industrialization of agriculture generates employment, boosts income, and contributes to import substitution, all of which contribute to poverty alleviation.<sup>9</sup>

Nepal's climate and ecology are quite diverse. There are three major ecological belts in the country: mountain, hill, and terai. Of the 25 districts in the ZOI, one, eighteen, and six districts are in the mountain, hill, and terai belts, respectively. The precipitation levels and temperatures vary across these three ecological belts, which in turn impact the frequency and types of crops grown. Nepal is particularly vulnerable to the effects of climate change due to this variation in topography, ecology, and climate. Agricultural production is especially vulnerable in the ZOI in Bagmati Province, Karnali Province, and Sudurpashchim Province, as agriculture is primarily rain-fed and thus highly responsive to climate change.<sup>10</sup>

The topography of the country has a direct relationship with agricultural activities. The mountainous areas compose 35 percent of Nepal's total land area and are home to seven percent of the population. The hill regions occupy 42 percent of the country's land area and are home to 43 percent of the population. Finally, the terai territories make up 23 percent of the country's land area and are home to 50 percent of the population.<sup>11</sup> Soil quality is best in the terai territories, moderate in the hill regions, and poorest in the mountainous areas. Agricultural land comprises 28.7 percent of total land area, but only 53 percent of this agricultural land has irrigation facilities.<sup>12</sup> Agricultural land holdings are also unequally distributed. Small-scale farmers hold only 18 percent of all agricultural land, with average holdings of less than 0.5 hectares. In comparison, 22 percent of agricultural land is operated by large

<sup>7</sup> NPC, 2019. 15<sup>th</sup> Plan Approach Paper.

<sup>8</sup> MoF, 2019. Economic Survey Nepal 2018/ 19.

<sup>9</sup> NPC, 2019. 15<sup>th</sup> Plan Approach Paper.

<sup>10</sup> MoALD, 2019. Integrating Climate Change Adaptation into Agriculture Sector Planning of Nepal.

<sup>11</sup> Central Bureau of Statistics, 2014a. Population Monograph of Nepal. Volume I (Demographic Analysis). Government of Nepal. National Planning Commission Secretariat. Kathmandu.

<sup>12</sup> World Bank, 2017. World Development Indicators. (also available at <https://data.worldbank.org/indicator>); Central Bureau of Statistics, 2014b. Population Monograph of Nepal. Volume III (Economic Demography). Government of Nepal. National Planning Commission Secretariat. Kathmandu.

farmers with more than two hectares, on average.<sup>13</sup> Finally, the remaining 60 percent of agricultural land is operated by medium-sized landholders, with an average of 0.5 to two hectares.

Subsistence agriculture and crop-livestock integration are prominent features of the agricultural sector in Nepal. All three ecological zones have different altitudes, climates, and agricultural production systems. Rice, maize, and wheat are the key food crops nationally. These three crops are cultivated on approximately 31, 18, and 15 percent of the total harvested area, respectively, and contribute 7.5, 1.7, and 1.5 percent, respectively, to the national GDP.<sup>14</sup> In the mountains, rain-fed crops such as potatoes, barley, and buckwheat are cultivated. Temperate fruits like apples and pears are grown and livestock, including hilly cattle, goats, and sheep, are common. The mid-hill region contains both rain-fed terraced land and irrigated land. Maize, millet, potato, ginger, cardamom, and temperate fruits like citrus are primarily grown in the terraced land, whereas paddy rice and wheat are commonly grown in the irrigated land, especially in the river basin and valley. Dairy and commercial vegetable production are also rapidly growing. The terai region contains highly fertile soil, and paddy rice, wheat, chickpeas, lentils, oilseed, mustard, sugarcane, and tropical fruits such as mango and litchi are commonly grown. Farmers in this region also raise cattle, buffalo, and goats.

Both women and men work in agriculture, though females tend to rely on agricultural employment more frequently than males: the World Bank estimated in that in 2019, 74 percent of female employment was in the agriculture sector compared to 52 percent of male employment.<sup>15</sup> Women tend to be more frequently involved in non-cash-related activities, whereas men more frequently engage in cash-generating activities, such as crop production and livestock sales. Both cash and in-kind wage discrimination persist in the agricultural sector. Women receive 25 percent less than their male counterparts, on average. In recent years, women have tended to shoulder heavier workloads, both at home and in agriculture, because of male migration.<sup>16</sup>

Despite several government initiatives, Nepalese farmers are struggling to modernize their agricultural systems and increase productivity. Land quality has deteriorated because of the rampant use of chemical fertilizer, antibiotics, and pesticides. Natural disasters, including drought, floods, and landslides, adversely affect agricultural practices. Rain patterns have gradually transformed in recent years because of climate change.<sup>17</sup> Additionally, inadequate infrastructure, including poor irrigation and a lack of roads, markets, cold stores, agricultural product collection centers, and stable power supplies, is a major challenge. Finally, the dearth of high-quality agricultural inputs and equipment and the partition of land pose challenges for the optimization of the existing agricultural system.<sup>18</sup>

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<sup>13</sup> While the Feed the Future definition of “smallholder farmer” is holding less than five hectares of land, what is considered large in Nepal is generally much smaller. All disaggregated figures on farm size presented in this report use the Feed the Future definition.

<sup>14</sup> CIAT, 2017. *Climate Smart Agriculture in Nepal*.

<sup>15</sup> World Bank, 2019. *World Development Indicators*.

<sup>16</sup> FAO, 2019. *Country Gender Assessment of Agriculture and the Rural Sector in Nepal*.

<sup>17</sup> MoALD, 2015. *Agriculture Development Strategy*.

<sup>18</sup> NPC, 2019. *15<sup>th</sup> Plan Approach Paper*.

### **I.3 Purpose of this assessment**

The purpose of this assessment is to provide USAID Mission Nepal, its U.S. Government interagency partners, RFS, the GoN, and development partners with a baseline for Feed the Future Phase 2 population-based ZOI indicators and enable the measurement of changes in indicator estimates and select demographic and household characteristics between 2019 and future Feed the Future ZOI Surveys. However, the Feed the Future ZOI Surveys are not designed to support conclusions of causality or program attribution.



## 2. METHODOLOGY FOR OBTAINING VALUES FOR FEED THE FUTURE INDICATORS

This chapter describes the methodology used to obtain the Feed the Future population-based ZOI indicators. It provides information on the data sources and describes measures and reporting conventions used throughout the report.

### 2.1 Methodology

This section describes the Feed the Future Nepal ZOI Survey 2019, including the sample design (including targeted sample size), questionnaire customization, fieldwork, response rates, and limitations of the survey.<sup>19</sup> Appendix 2.1 provides additional details on the sampling and weighting methodology.

#### 2.1.1 Survey sample design

The Feed the Future Nepal ZOI Survey 2019 included a representative, random sample of the entire population living in the Phase 2 ZOI for the baseline assessment. The ZOI Survey used a cross-sectional multi-stage cluster sampling design. The design ensured that the total sample size included the necessary number of households in the Phase 2 ZOI to assess changes in key Phase 2 indicators.

The Feed the Future Nepal ZOI Survey 2019 sampling frame was stratified by province, rural-urban location and hill, terai, and mountainous areas to create 14 strata, since some strata did not include any enumeration areas (EAs). The number of EAs in each stratum was proportional to the total population in the stratum. A total of 165 EAs (137 in the Phase 1 ZOI and 28 in the new areas for Phase 2) were selected based on 15 households to be interviewed per EA. Replacement households were also selected during the sampling process and randomly assigned to the replacement list. The Food Insecurity Experience Scale (FIES) indicator had the largest final sample size requirement and therefore was used to set the overall sample size for the survey: 2,461 households, which was rounded up to 2,475 based on 15 households per EA.

Before main fieldwork began, a complete household listing was conducted in each selected EA or segment, from which 2,475 households (2,055 in the Phase 1 ZOI and an additional 420 households in the new Phase 2 areas in Bagmati Province) were selected for interview using fractional interval systematic sampling; this constituted the second stage of sampling.<sup>20</sup> The Central Bureau of Statistics provided the cluster lists for the Feed the Future ZOI based on the Nepal 2011 Census and New ERA developed the household listings of clusters. In the third stage, eligible individuals were selected within the households using a “take all” approach: all eligible individuals were selected for the sample, with the exception of Module 4, where one eligible woman was randomly selected. For soil testing, one plot per VCC was randomly selected, and for area measurement a maximum of two plots per VCC were randomly selected. During fieldwork, if more than one household was discovered in a single dwelling

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<sup>19</sup> Survey methodological requirements and supporting documentation for Feed the Future ZOI Surveys are available online at <https://www.agrilinks.org/post/feed-future-zoi-survey-methods>.

<sup>20</sup> Some results tables show a total sample size of 2,481 households. In addition to the 2,475 core sampled households, an additional 1,650 households were identified as ordered replacements, as described in the sampling annex. Some households did not fully complete a survey and were replaced, but their data was used when an entire indicator was completed.

unit and the additional households were not listed separately, all households at the residence were interviewed. Appendix 2 provides additional details on the sampling and weighting methodology.

### **2.1.2 Questionnaire design**

Social Impact used the core ZOI documentation to produce a customized, country-specific questionnaire, including a Nepal-specific module. Updates to the core instrument included customized response options, Nepal-appropriate units of measure, and customized food items. New ERA translated all survey documentation including the questionnaire, informed consent form, manuals, and training materials into Nepali. The survey instrument was also translated into Tharu and Awadhi, as these are the native languages of over ten percent of the population in the ZOI. All translated versions of the questionnaire were provided to the field teams in hard copy and loaded onto the tablets.

Ahead of the training of trainers (ToT), New ERA conducted a pretest using the paper versions of the questionnaire to ensure that the questions and translations achieved their intended meanings. Survey sites were selected with consideration for the pretest requirements, including the presence of households that speak all three survey languages, their engagement in agriculture, and proximity for easy access and the paper-based pretest was ultimately conducted in rural areas of the Rupandehi district. Survey sites were selected with consideration for the pretest requirements, including the presence of households that speak all three survey languages, their engagement in agriculture, and proximity for easy access. The pretest was initially planned for three days but was extended for another day to complete the required 60 surveys. The pretest questionnaire consisted of the questions to be used during data collection and probing questions for each module. The goals of the pretest were to test question wording and response options, check and revise survey logic and skip patterns, and identify and correct any translation issues.

Concerns regarding the length of the survey instrument were initially flagged following the end of the pretest. Household surveys took an average of three to four hours to administer. Moreover, the initial pretest instrument omitted key content that was still under development at the time of the pretest including the VCC modules, plot measurements, and soil assessments. These modules were pretested independently. The New ERA team subsequently made recommended changes to the questionnaire, translations, and fieldwork processes. Social Impact worked with USAID and New ERA to implement minor changes to question phrasings, answer options, and redundancies.

Following the pretest adjustments, the Social Impact team refined and tested the programmed questionnaire in the Census and Survey Processing System (CSPPro) software to ensure that the data entry program was error-free and fully functional. However, programming and fully debugging the instrument was a challenge that continued partway through the training. At the end of the ToT, Social Impact and New ERA tested the full questionnaire, data entry program, and transmission procedures.

New ERA conducted a two-phased pilot exercise at the end of enumerator training. The pilot differed from the pre-test in that its goal was to test the full fieldwork process, including field logistics. The first pilot was conducted over two days directly following enumerator training in hill areas outside of Kathmandu (Lele) with 61 households. Issues with the survey content, electronic data entry program, and survey duration were identified and addressed, and enumerators subsequently received additional training. The second piloting exercise was conducted under actual field conditions in Rupandehi and

Argakhanchi districts, with 73 and 14 households interviewed in each district. These sites were selected due to their similar cultural, social, and livelihood characteristics to the survey EAs. Field teams participated in debriefing sessions led by New ERA after each round of piloting. Senior leaders from New ERA gave feedback on field teams' performance and provided clarification on the questionnaire and survey protocols to team members, supervisors, and the quality control team.

Survey duration concerns persisted following the pilot and several key edits were made, including the decision that only one eligible woman of reproductive age would be surveyed, that field teams would randomly select two plots per VCC for plot measurements and one plot per VCC for soil assessments, and that Modules 8 and 9 would be condensed.

### **2.1.3 Timing of the survey**

The baseline survey took place from May to early August 2019. Data collection concluded August 2, which marks the beginning of the monsoon season, when food shortages are expected to begin. Data were collected when food availability was generally modest, as were income and other expenditures.

### **2.1.4 Listing**

New ERA completed a listing of all households in the 165 selected clusters prior to the selection of the household sample. Each listing team was comprised of an experienced field supervisor, a lister, and a cartographer. The listing teams visited each EA to map, number, and list all structures, dwelling units, and households within the designated boundaries of the EA. Field teams also recorded the name of a responsible adult household member for each listed household.

The total number of listed households was key to household selection and survey weights. Some of the selected clusters in the survey had a very large number of households. Following Feed the Future guidance, clusters with more than 300 households were subdivided into smaller segments with 200-300 households and only one segment was randomly selected to be included in the survey and listed. The segmentation was carried out based on different geographic landmarks. If there were more than ten segments in a cluster, a random number was used to select one segment as a cluster for the household listing. If there were fewer than ten segments in any ward, one segment was selected as a cluster for the household listing by drawing a name from a hat including all segments for that cluster.

The listing teams ascertained the availability of electricity and internet access, assessed how far agricultural plots were from household residences on average, and identified options for food and lodging. New ERA also conducted community sensitization with community leaders to explain the purpose of the survey and to request community cooperation. Listing teams provided the community leader with a letter from the Ministry of Agriculture and materials describing the survey and benefits that may accrue to the country and community from the survey findings. After the complete listing, information for a selected EA was transported to the New ERA central office, where the staff entered the information into an Excel spreadsheet, cleaned the data, and shared it with Social Impact. The Social Impact team also met with the Central Bureau of Statistics to inform them of the survey and discuss the upcoming fieldwork.

### **2.1.5 Training for main fieldwork**

Social Impact provided a ToT for New ERA supervisors, who subsequently trained the enumerators with Social Impact oversight. Two distinct paper-based pretests were held, one prior to the ToT and one alongside the ToT. Both pretests were conducted by a subset of the field teams who participated in data collection. Following the pretests and ToT, New ERA conducted enumerator training. 138 enumerators were trained on survey procedures, fieldwork preparation, questionnaire content, human subjects protection, fieldwork procedures, data management, reporting, and communications. Training was conducted over a 20-day period and included ten days of classroom learning, two days of field practice for plot measurement and soil assessments, four days of field practice for the full instrument, two days of travel, and two days of debriefing. The classroom training was split into two parallel sessions for social science interviewers and agricultural interviewers. The social science interviewers received additional technical training for anthropometry and agricultural interviewers received training and practice sessions. The trainings covered the use of all technical equipment used in the survey. The two days of field practice for plot measurement and soil assessments included a practical session on the Land Potential Knowledge System app and land measurement and was carried out at nearby locations. After the classroom and practical training, field teams conducted a pilot test covering a total of 148 households to test all field procedures. A total of 124 trainees were hired for fieldwork based on daily performance rankings conducted by supervisors during training. New ERA hired four more interviewers than needed for fieldwork to allow for attrition during the early phases of fieldwork.

### **2.1.6 Fieldwork**

Fieldwork was conducted between May 24, 2019, and August 2, 2019. There were 20 field teams, with five interviewers and one supervisor per team. The interviewers included two teams of two social survey interviewers and an agricultural survey specialist. Teams traveled with a shared set of New ERA vehicles. Because of the gender-sensitive nature of some aspects of the questionnaire, each interviewer team had at least one female interviewer who interviewed female respondents. The supervisor organized logistics such that the agriculture interviewer was not working alone to implement the agriculture modules.

Each field team was regularly visited by a Quality Control Support team to ensure that the team had needed supplies and to promptly identify any problems that required central administration support. The Quality Control Support teams also provided moral support and an additional layer of field supervision and quality assurance. They accompanied interviews and answered questions raised by supervisors as needed.

Any households that could not be interviewed due to refusal or for other reasons were replaced. Of the 2,481 total households completed, 266 households were replacements (10.7 percent). Replacement households were selected during sampling and randomly assigned to the replacement list.

### **2.1.7 Data management and analysis**

The baseline data was collected on Android tablets using CSPro software for data entry. Social Impact used remote data quality monitoring and field-based supervision to ensure the collection of high-quality data. Social Impact generated field check tables weekly using the aggregated data. These tables were

used to identify data collection problems at the interviewer, team, and cluster levels. Rigorous field supervision was also provided by several layers of supervisory staff. Field supervisors reviewed each questionnaire summary closely before transmitting data, observed all interviewers, spot checked a random sample of interviewed households, and provided additional instruction to interviewers as needed. Field Quality Control Support teams and Social Impact's Data Quality Assurance Monitor visited the field teams during fieldwork to provide supervision and additional quality assurance.

Social Impact completed a Data Treatment and Analysis Plan in accordance with Feed the Future guidance. This plan, along with the *Feed the Future Indicator Handbook* and the *Guide to Feed the Future Statistics* guided Social Impact's analysis.<sup>21</sup> The analysis plan included indicator calculation and statistical tests of association between disaggregates and outcomes, as well as differences between some disaggregate groups. All data management, cleaning, and analysis was completed in Stata, apart from the FIES analysis, which was completed in R.

### 2.1.8 Limitations of the survey

#### Segmentation of clusters

As noted in the listing section, several clusters had large numbers of households. Since a complete household listing of these clusters was impractical, these clusters were subdivided into smaller segments, only one of which was further selected and listed. In non-selected segments, the number of households was not recorded and were not used in calculating sampling weights for the segment. Social Impact and New ERA staff had to assume an equal number of households across all segments in one cluster. While ideally the segments would be approximately of equal size, the segmentation was done using easily identifiable boundaries, which could result in the clusters selected having a probability slightly disproportionate to their sizes.

#### Length of the questionnaire

As noted previously, the length of the instrument was a substantial concern leading up to and during data collection. Even with the reductions intended to cut survey time, the instrument often took more than three hours to administer, excluding plot measurements and soil assessments. As such, some estimates may be biased due to interviewee fatigue.

### 2.1.9 ZOI Survey response rates

**Table 2.1** presents the response rates for the Nepal ZOI Survey 2019. The table presents components and response rates for each group for which a sampling weight was generated: sampled households, women of reproductive age (15–49), primary adult male and female decision-makers, children under five years of age, children under two years of age, producers of any targeted commodity, and producers of each targeted commodity separately. Response rates are presented by rural and urban residence as well as for the total sample.

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<sup>21</sup> The Feed the Future Indicator Handbook: Definition Sheets are available at: <https://feedthefuture.gov/resource/feed-future-handbook-indicator-definitions>.

**Table 2.1: Results of Household and Individual Interviews for the Feed the Future Nepal ZOI Survey 2019, in Total and by Residence**

| Response rates                                              | Total | Residence |       |
|-------------------------------------------------------------|-------|-----------|-------|
|                                                             |       | Urban     | Rural |
| Households                                                  |       |           |       |
| Number of households selected (including buffer households) | 3,425 | 1,925     | 1,500 |
| Number of households occupied                               | 2,747 | 1,497     | 1,250 |
| Number of households interviewed                            | 2,481 | 1,351     | 1,130 |
| Household response rate (%) <sup>a</sup>                    | 90.3% | 90.2%     | 90.4% |
| Women of reproductive age (15–49 years) <sup>b</sup>        |       |           |       |
| Number of eligible women                                    | 2,132 | 1,195     | 937   |
| Number of eligible women interviewed                        | 2,049 | 1,144     | 905   |
| Eligible women response rate (%) <sup>c</sup>               | 96.1% | 95.7%     | 96.6% |
| Primary adult female decision-makers (18+ years)            |       |           |       |
| Number of eligible women                                    | 2,406 | 1,315     | 1,091 |
| Number of eligible women interviewed                        | 1,681 | 869       | 812   |
| Eligible women response rate (%) <sup>c</sup>               | 69.9% | 66.1%     | 74.4% |
| Primary adult male decision-makers (18+ years)              |       |           |       |
| Number of eligible men                                      | 1,916 | 1,041     | 875   |
| Number of eligible men interviewed                          | 1,430 | 739       | 691   |
| Eligible men response rate (%) <sup>c</sup>                 | 74.6% | 71.0%     | 79.6% |
| Children under 5 years of age                               |       |           |       |
| Number of eligible children                                 | 1,333 | 736       | 597   |
| Number of caregivers of eligible children interviewed       | 1,023 | 548       | 475   |
| Eligible children response rate (%) <sup>c</sup>            | 76.7% | 74.5%     | 79.6% |
| Children under 2 years of age                               |       |           |       |
| Number of eligible children                                 | 446   | 245       | 201   |
| Number of caregivers of eligible children interviewed       | 389   | 207       | 182   |
| Eligible children response rate (%) <sup>c</sup>            | 87.2% | 84.5%     | 90.5% |
| Farmers of any targeted value chain commodity <sup>d</sup>  |       |           |       |
| Number of eligible farmers                                  | 2,083 | 1,044     | 1,039 |
| Number of eligible farmers interviewed                      | 1,874 | 937       | 937   |
| Eligible farmer response rate (%) <sup>c</sup>              | 90.0  | 89.8      | 90.2  |
| Maize farmers                                               |       |           |       |
| Number of eligible maize farmers                            | 1,431 | 607       | 824   |
| Number of eligible maize farmers interviewed                | 1,276 | 543       | 733   |
| Eligible maize farmer response rate (%) <sup>c</sup>        | 89.2% | 89.5%     | 89.0% |
| Rice farmers                                                |       |           |       |
| Number of eligible rice farmers                             | 1,474 | 824       | 650   |
| Number of eligible rice farmers interviewed                 | 1,347 | 740       | 607   |
| Eligible rice farmer response rate (%) <sup>c</sup>         | 91.4% | 89.8%     | 93.4% |
| Cauliflower farmers                                         |       |           |       |
| Number of eligible cauliflower farmers                      | 80    | 44        | 36    |
| Number of eligible cauliflower farmers interviewed          | 67    | 35        | 32    |
| Eligible cauliflower farmer response rate (%) <sup>c</sup>  | 83.8% | 79.5%     | 88.9% |
| Tomato farmers                                              |       |           |       |
| Number of eligible tomato farmers                           | 53    | 23        | 30    |

| Response rates                                        | Total | Residence |       |
|-------------------------------------------------------|-------|-----------|-------|
|                                                       |       | Urban     | Rural |
| Number of eligible tomato farmers interviewed         | 46    | 19        | 27    |
| Eligible tomato farmer response rate (%) <sup>c</sup> | 86.8% | 82.6%     | 90.0% |

<sup>a</sup> Household response rates are calculated based on the result codes of Module 1, the household roster, and are defined as the number of households interviewed divided by the number of households occupied. Households that were found to be vacant, not a dwelling unit, or destroyed were considered unoccupied and thus excluded from the response rates.

<sup>b</sup> Due to the length of the survey, only one randomly selected women of reproductive age per household was interviewed, weighed, and measured. Thus, the number of eligible women of reproductive age presented in this table is a maximum of one per household, and the number interviewed is the number of randomly selected women who consented to the relevant module.

<sup>c</sup> Individual response rates are calculated based on the result codes in the relevant individual modules (i.e., Modules 4, 5, 6, and 7). These rates are defined as the number of eligible individuals interviewed divided by the number of eligible individuals. Eligibility determination for Modules 4, 5, and 6 is initiated in the household roster and confirmed in the respective module. Note that for children under five years of age (Module 5), the primary caregivers of the children served as the respondents, not the children directly. Eligibility determination for Module 7 is initiated in Module 2, *Dwelling characteristics*, and confirmed in Module 7.

<sup>d</sup> The targeted value chains in the Feed the Future Nepal ZOI Survey 2019 were maize, rice, tomatoes, and cauliflower.

Source: Feed the Future Nepal ZOI Survey 2019

## 2.2 Measures and reporting conventions used throughout this report

### 2.2.1 Standard indicator disaggregates

A standard set of indicator disaggregate variables appears in tables throughout this report. This section lists each of the standard disaggregate variables and their definitions. Topic-specific disaggregates will be described within the relevant chapter (e.g., livelihood production system disaggregates will be described in the chapter that discusses the agriculture indicators).

#### Age in years

Data on household members' age in years are collected in the household roster. For women 15–49 years of age and children under six years of age, more detailed age data are collected in subsequent questionnaire modules to confirm eligibility to respond to the module questions; these more detailed age data are used where available. Age is generally presented in the tables in five or ten-year age groups.

#### Age in months

The age of children in months is collected in the child nutrition-focused module of the questionnaire, rather than in the household roster, so children's parents or primary caregivers can be prompted to provide the most accurate age possible. Children's age in months is presented by monthly age groups as appropriate for the children's dietary intake and anthropometry tables. For example, for the minimum acceptable diet (MAD) table (**Table 8.3.2**), which presents the MAD indicator for children 6–23 months of age, children's age in months is disaggregated into six-month age groups as follows: 6–11 months, 12–17 months, and 18–23 months. For the children's anthropometry tables (**Table 9.2.1** and **Table 9.2.2**), which present the prevalence of stunting, wasting, and underweight for all children under five years of age, children's age in months is disaggregated into 12-month age groups as follows: 0–11 months, 12–23 months, 24–35 months, 36–47 months, and 48–59 months.

#### Sex

Sex, male or female, is a standard disaggregate for the tables presenting children's indicators (e.g., children's anthropometry in **Table 9.2.1** and **Table 9.2.2**), as well as agricultural indicators. The sex of household members is collected in the household roster.



### **Educational attainment (household)**

Household educational attainment reflects the highest level of education attained by any member of the household, as reported in the household roster. This variable is used in tables that present household-level data and comprises five categories: no education (households with no member who has received formal education); less than primary (households with at least one member who has received formal schooling, but with no member who has completed primary); completed primary (households with at least one member who has completed primary, but with no member who has completed secondary); completed secondary (households with at least one member who has completed secondary, but with no member who has completed any higher formal education); and higher (households with at least one member who has completed formal education higher than secondary, even if only one year). Households are categorized in only one of the five categories.

### **Educational attainment (individual)**

Educational attainment at the individual level reflects the highest level of education attained by individual household members, as reported in the household roster. This variable comprises five categories: no education (those who have not received any formal education); less than primary (those who have received formal education but who have not complete primary); completed primary (those who have completed primary but who have not completed secondary); completed secondary (those who have completed secondary but who have not completed any higher formal education); and higher (those who have completed formal education higher than secondary, even if only for one year).

### **Gendered household type**

Feed the Future disaggregates household-level indicators by gendered household type—that is: (1) M&F households that include both male and female adults, 18 years of age or older; (2) FNM households that include female adults, but no male adults; (3) MNF households that include male adults, but no female adults; and (4) CNA households with only members under 18 years of age (households with children only and no adult members). This approach to conceptualizing household type is distinct from the standard “head of household” approach, which is embedded with presumptions about household gender dynamics, and may perpetuate existing social inequalities and prioritization of household responsibilities that may be detrimental to women. This variable is calculated using data on the age and sex of household members, which are collected in the household roster.

### **Wealth quintile**

The asset-based wealth index characterizes households into quintiles according to their wealth index score, which considers various dwelling characteristics and ownership of various assets, which are collected in Module 2. Wealth quintiles are used as a disaggregate for many household-level indicators, as well as some person-level nutrition and agriculture indicators. More details can be found in Section 4.2 and additional information about construction of the wealth index can be found in Appendix 2.2.b.

### **Poverty status**

Poverty status characterizes households as poor if household members live below the poverty threshold of less than \$1.90 per person per day at 2011 Purchasing Power Parity (PPP), or as non-poor if household members live at or above the poverty threshold. Poverty status is calculated using data

collected in Module 8. Poverty status is used as a disaggregate for many household-level indicators, as well as some person-level nutrition and agriculture indicators.

### **Shock exposure index**

The shock exposure index (SEI) assigns households a score depending on the number and severity of shocks the household experienced during the 12 months preceding the ZOI Survey. For the SEI, disaggregate households are categorized into one of four categories based on their score: did not experience any shocks (SEI score=0), low (SEI scores 2–8), moderate (SEI scores 9–18), and high (SEI scores 19–144). The low, medium, and high categories are meant to split households with an SEI score greater than zero into roughly even categories. The SEI is calculated using data collected in Module 3 and is used as a disaggregate for many household-level indicators, as well as some person-level nutrition and agriculture indicators. See Section 5.2 for greater detail on the SEI.

### **Ecological zone**

Ecological zone is a standard disaggregate presented in most tables throughout the report. Ecological zones of hill, terai, and mountain were assigned to households using the classification in the 2011 census data used for sampling.

## **2.2.2 Reporting conventions**

This section provides an overview of the conventions used in reporting the descriptive results from the Feed the Future Nepal ZOI Survey 2019.

- In the tables throughout this report, weighted point estimates and unweighted sample sizes are presented.
- Most estimates are shown to one decimal place, with the specific exceptions of Abbreviated Women's Empowerment in Agriculture Index (A-WEAI), the five domains of empowerment (5DE), and gender parity index (GPI) indicators, which are shown to two decimal places. Unweighted sample sizes in all tables and the population estimates in Section 1.2.2 tables are shown as whole numbers.
- Values in the tables are suppressed when the unweighted sample size is insufficient to calculate a reliable point estimate ( $n < 30$ ); this is denoted by the symbol “^” in the designated row and an explanatory footnote.
- Tests of statistical difference are performed to determine whether there is an association between the outcome and the indicator disaggregates. Statistically significant differences are designated with asterisks in tables: \* indicates a  $p < 0.05$ , \*\* indicates a  $p < 0.01$ , and \*\*\* indicates a  $p < 0.001$ . For disaggregates that are categorical variables presented in rows, the level of significance is indicated in the “Sig.” column of disaggregate heading row, which is usually shaded light blue. In these cases, the “Sig.” column is greyed out for the category rows. For disaggregates presented in columns (e.g., many of the agriculture tables), the significance results are displayed in the same row as the estimates.

Analyses were performed in Stata using ‘svy’ commands to handle features of data collected through the use of complex survey designs, including sampling weights, cluster sampling, and stratification.

### **2.2.3 Understanding results tables in this report**

Tables in the Feed the Future Nepal ZOI Survey 2019 Baseline Report present sample-weighted estimates for key indicators, household demographics, and ZOI characteristics (outcomes), both overall and by selected disaggregates, the unweighted sample size (denominator) for each estimate, and the effect of each disaggregate on the outcome. Narrative and figures found throughout this report highlight key findings presented in the tables, but not every finding can be discussed or displayed graphically. For this reason, data users should be comfortable reading and interpreting tables correctly, even without having to consult the text of the report. This is important because users of reports will later cite results in tables without referencing the text.

The following examples and exercises introduce the organization of tables in the Feed the Future Nepal ZOI Survey 2019 Baseline Report and describe how to interpret them.

## Example I: One Binary Outcome; Disaggregates in Rows

**Table 5.3.1: Percent of households in the ZOI that believe local government will help the community cope with future shocks and stresses, in total and by selected household characteristics**

| Household characteristic       | Percent | Sig. <sup>a</sup> | Number of households <sup>b</sup> |
|--------------------------------|---------|-------------------|-----------------------------------|
| <b>All households</b>          | 84.3    |                   | 2,332                             |
| <b>Gendered household type</b> |         | n/s               | 2,332                             |
| Male and female adults         | 83.7    |                   | 1,825                             |
| Female adults only             | 85.3    |                   | 446                               |
| Male adults only               | 93.3    |                   | 52                                |
| Children only, no adults       | ^       |                   | 9                                 |
| <b>Household education</b>     |         | **                | 2,332                             |
| No education                   | 83.7    |                   | 147                               |
| Less than primary              | 82.1    |                   | 503                               |
| Completed primary              | 82.0    |                   | 1,062                             |
| Completed secondary            | 90.6    |                   | 321                               |
| Higher                         | 88.8    |                   | 299                               |
| <b>Wealth quintile</b>         |         | n/s               | 2,332                             |
| Highest (wealthiest)           | 84.8    |                   | 462                               |
| Fourth                         | 86.4    |                   | 478                               |
| Middle                         | 85.4    |                   | 457                               |
| Second                         | 87.6    |                   | 462                               |
| Lowest (poorest)               | 76.5    |                   | 473                               |
| <b>Poverty status</b>          |         | **                | 2,279                             |
| Poor                           | 76.3    |                   | 198                               |
| Non-poor                       | 84.9    |                   | 2,081                             |
| <b>Shock exposure index</b>    |         | ***               | 2,332                             |
| Did not experience any shocks  | 93.0    |                   | 535                               |
| Low                            | 87.8    |                   | 678                               |
| Moderate                       | 81.3    |                   | 542                               |
| High                           | 73.7    |                   | 577                               |
| <b>Ecological zone</b>         |         | n/s               | 2,332                             |
| Hill                           | 85.7    |                   | 1,261                             |
| Terai                          | 81.0    |                   | 984                               |
| Mountain                       | 100     |                   | 87                                |

^ Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Records missing information for the disaggregate variables have been excluded from the disaggregated estimates. The unweighted sample size reflects this loss in observations; therefore, the sum of disaggregate sample sizes may not equal the overall sample size.

Note: Estimates are based on de jure household members.

Source: Feed the Future Nepal ZOI Survey 2019

**Step 1:** Read the table title and review the footnotes, highlighted in orange in Example I.<sup>22</sup> Note the unit of analysis, whether the table refers to households or individuals (e.g., women of reproductive age, children under five years of age, maize farmers). In this example, the table presents the percentage of

<sup>22</sup> Footnotes contain definitions of symbols, abbreviations, and acronyms included in the table, information about significance tests, and notes about specific estimates or denominators, such as inclusion or exclusion criteria.

households in the ZOI that believe that the local government will help the community cope with future shocks and stressors, in total and by selected household characteristics. The selected household characteristics (i.e., disaggregates or factors of interest), are identified in Step 2.

**Step 2:** Scan the row headings in the first column, which is highlighted in purple in Example 1. This “Household characteristic” column indicates that estimates are being presented for all households and by five disaggregates: gendered household type, household education, wealth quintile, poverty status, and SEI.<sup>23</sup> What are the household education disaggregate categories? They are: “No education,” “Less than primary,” “Completed primary,” “Completed secondary” and “Higher.”

**Step 3:** Scan the columns in green that contain data. In Example 1, there are three columns that contain data: (1) “Percent,” which contains sample-weighted estimates that were generated using household weights; (2) “Sig.,” which contains symbols indicating the results of the test of statistical significance assessing the relationship between the disaggregate and the outcome (see footnote “a” and Step 5); and (3) “Number of households,” which contains the unweighted number of sampled households used to calculate the indicator.<sup>24</sup>

**Step 4:** Now that you understand the contents of the table, you can begin to examine the data. Look at the “Percent” and “Number of households” columns. What percentage of all households believe that the local government will help the community cope with future shocks and stressors? Looking at the “Percent” column, we can see that this is 84.3 percent (circled in blue in the “All households” row). How many households are included in the calculation of the indicator? Looking at the “Number of households” column, we can see that there are 2,332 households, also circled in blue. Footnote “b” indicates that this is the total number of households that experienced at least one shock or stressor during the 12 months preceding the survey and includes households that reported, yes, the local government will help, or no, the local government will not help. These estimates exclude households that reported the local government will not need to help the community cope with shocks or stressors in the future.

What percentage of M&F households believe that the local government will help the community cope with future shocks and stressors? This is 83.7 percent, circled in blue. How many M&F households are in the sample? There are 1,825 households, circled in blue. For the gendered household type disaggregate, estimates for CNA households are not shown; instead, carets (^) are displayed. When symbols appear in a table, they are defined in a footnote. The caret (^) means that there are not enough observations to obtain a statistically reliable estimate, fewer than 30, so the estimate is suppressed.

**Step 5:** How do we interpret the effects disaggregates have on the outcome, that is, is a result likely due to chance (or sampling error) or some factor of interest? Look at the “Sig.” (statistical significance) column. As noted in Step 3, the “Sig.” column contains symbols indicating the results of the test of statistical significance assessing the relationship between the disaggregates and the outcome or “n/a” if a

<sup>23</sup> Each of these disaggregates is defined in Section 2.2.1.

<sup>24</sup> Sample-weighted estimates are population-representative estimates obtained by applying a sampling weight that accounts for the survey sampling design and non-response among eligible respondents. The unweighted number of households is the sampled number of households included in the denominator of the indicator estimate calculation.

test of statistical significance could not be performed. A value of “n/s” (not significant) indicates that the p-value is greater or equal to 0.05; one asterisk (\*) indicates that the p-value is less than 0.05 but greater or equal to 0.01; two asterisks (\*\*) indicate that the p-value is less than 0.01 but greater or equal to 0.001; and three asterisks (\*\*\*) indicate that the p-value is less than 0.001.

Does belonging to a particular wealth quintile have an effect on the percentage of households that believe that the local government will help the community cope with future shocks and stressors? No. The “Sig.” column shows “n/s” circled in red in the wealth quintile disaggregate header row. This indicates that the p-value for the chi-squared test performed to assess the relationship between the binary outcome and the wealth quintile disaggregate is greater than or equal to 0.05, and we can say that the results show that wealth quintile does not affect the percentage of households that believe that the local government will help the community cope with future shocks and stressors. In other words, we cannot say that the percentage of households that believe that the local government will help the community cope with future shocks and stressors differs across wealth quintiles; any differences in percentages are likely due to chance or sampling error.

**NOTE:** When carets (^), “n/a,” or “n/s” are used in a table, the explanation will be noted under the table in the footnotes.

**Example 2: Binary, categorical, and continuous outcomes; disaggregates in columns**

**Table 3.3.1: Household dwelling characteristics in the ZOI, in total and by residence and gendered household type**

| Household characteristic                                 | Residence |       |       |                   | Gendered household type |                    |                  |               |                   |
|----------------------------------------------------------|-----------|-------|-------|-------------------|-------------------------|--------------------|------------------|---------------|-------------------|
|                                                          | Total     | Urban | Rural | Sig. <sup>a</sup> | Male and female adults  | Female adults only | Male adults only | Children only | Sig. <sup>a</sup> |
| Percent using solid fuel for cooking <sup>b</sup>        | 71.9      | 63.0  | 83.5  | ***               | 72.9                    | 70.1               | 61.1             | ^             | n/s               |
| Percent with access to electricity                       | 56.1      | 61.4  | 49.1  | **                | 57.0                    | 54.8               | 43.7             | ^             | n/s               |
| Mean number of persons per sleeping room <sup>c</sup>    | 2.0       | 2.0   | 2.0   | n/s               | 2.1                     | 1.7                | 1.1              | ^             | *                 |
| <b>Household roof materials (%)<sup>d</sup></b>          |           |       |       | *                 |                         |                    |                  |               | n/s               |
| Natural                                                  | 7.7       | 5.9   | 10.0  |                   | 7.3                     | 7.7                | 17.8             | ^             |                   |
| Rudimentary                                              | 0.2       | 0.0   | 0.5   |                   | 0.2                     | 0.1                | 0                | ^             |                   |
| Finished                                                 | 91.9      | 93.7  | 89.5  |                   | 92.1                    | 92.1               | 82.2             | ^             |                   |
| Other                                                    | 0.2       | 0.4   | 0     |                   | 0.2                     | 0                  | 0                | ^             |                   |
| <b>Household exterior wall materials (%)<sup>e</sup></b> |           |       |       | ***               |                         |                    |                  |               | n/s               |
| Natural                                                  | 47.0      | 35.9  | 61.5  |                   | 47.0                    | 48.6               | 39.6             | ^             |                   |
| Rudimentary                                              | 4.6       | 5.9   | 2.9   |                   | 4.4                     | 4.8                | 5.9              | ^             |                   |
| Finished                                                 | 44.1      | 53.6  | 31.7  |                   | 44.0                    | 44.2               | 41.3             | ^             |                   |
| Other                                                    | 4.3       | 4.7   | 3.9   |                   | 4.6                     | 2.3                | 13.2             | ^             |                   |
| <b>Household floor materials (%)<sup>f</sup></b>         |           |       |       | ***               |                         |                    |                  |               | n/s               |
| Natural                                                  | 67.0      | 59.0  | 77.3  |                   | 67.4                    | 67.5               | 54.5             | ^             |                   |
| Rudimentary                                              | 0.9       | 0     | 2.2   |                   | 0.8                     | 0.7                | 7.3              | ^             |                   |
| Finished                                                 | 32.1      | 41.0  | 20.5  |                   | 31.8                    | 31.8               | 38.2             | ^             |                   |
| Other                                                    | 0.03      | 0     | 0.07  |                   | 0.0                     | 0.0                | 0.0              | ^             |                   |
| <b>Number of households</b>                              | 2,481     | 1,351 | 1,130 |                   | 1,944                   | 473                | 54               | 10            |                   |

<sup>a</sup> Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Solid fuel is defined as charcoal, wood, animal dung, straw/shrubs/grass, and agriculture crop residue. Households in the “no food cooked in household” category are removed from percentages.

<sup>c</sup> The average number of persons per sleeping room is a common indicator of crowding (United Nations Development Programme, 2003).

<sup>d</sup> Natural roof includes no roof, thatch (straw, reed, sticks), and sod or bamboo. Rudimentary roof includes wood planks, cardboard, and plastic sheeting. Finished roofs include metal/galvanized iron, wood, calamine/cement fiber, ceramic tiles, cement/concrete, roofing shingles, and tile/slate.

<sup>e</sup> Natural wall includes no walls, earth/mud/dirt, cane/tree trunks/bamboo/sticks, bamboo with mud, and stone with mud. Rudimentary walls include plywood, cardboard, reused wood, and unbaked bricks. Finished walls include concrete/flagstone/cement, stone with lime/cement, tile/bricks, cement blocks, unbaked bricks covered with plaster, wood planks/shingles, and metal/galvanized iron.

<sup>f</sup> Natural floors include earth/sand/mud, dung, and earth/sand/mud and stones. Rudimentary floors include wood planks and bamboo slats. Finished floors include parquet/polished wood, vinyl or asphalt strips, ceramic tiles/bricks, concrete/flagstone/cement, and wall-to-wall carpet.

Note: Estimates are based on de jure household members. Source: Feed the Future Nepal ZOI Survey 2019



**Step 1:** Read the title and review the footnotes, highlighted in orange in Example 2. Note the unit of analysis, whether the table refers to households or individuals. In this example, the table is about household dwelling characteristics in the ZOI, in total and by two standard disaggregates: residence and gendered household type.

**Step 2:** Scan the purple column that shows the indicators presented in Example 2. Unlike Example 1, which presents only one indicator, Example 2 includes multiple indicators, which are listed in the “Household characteristic” column. There are two indicators with binary outcomes (percent using solid fuel for cooking and percent with access to electricity), one indicator that is a mean (mean number of persons per sleeping room), and three indicators with categorical outcomes (household roof materials, household exterior wall materials, and household floor materials). In tables that include disaggregates in columns:

- Indicators with categorical outcomes have a header row that is light blue, and the outcome categories are indented in the white rows beneath the header row. Looking at the first column in Example 2, we can see that the household roof, exterior wall, and floor materials indicators each have four categories: “Natural,” “Rudimentary,” “Finished,” and “Other.”
- Indicators with binary or continuous outcomes do not include a header row; the overall estimate and estimates for the disaggregate categories are presented across one row, as shown for the first indicator, “Percent using solid fuel for cooking.”

**Step 3:** Scan the panels containing data.<sup>25</sup> The table includes three panels in green: “Total,” “Residence,” and “Gendered household type.” The “Total” panel includes one column that shows the estimates for all households in the ZOI. The “Residence” panel includes two columns that present data for the first disaggregate, urban and rural households, and a third column that presents the results of the statistical test of significance that assesses the relationship between the outcomes and residence. The “Gendered household type” panel includes four columns that present data for the second disaggregate, by M&F households, FNM households, MNF households, and CNA households, and a fifth column that presents the results of the statistical test of significance that assesses the overall relationship between the outcomes and gendered household type.

**Step 4:** Find the row at the bottom of the table that shows the number of observations. This row shows the denominator for all estimates in each column. In this table, it shows the number of households, 2,481 (circled in yellow). How many of these are rural households? There are 1,130 rural households (circled in yellow) in the “Rural” column).

**Step 5:** Now that you understand the contents of the table, you can begin to examine the data. Look at the “Total” panel. What is the mean number of persons per sleeping room for all households? Look at the number circled in blue in that indicator row; there are 2.0 persons per sleeping room, and we know from Step 4 that this is out of 2,481 households. Now look at the “Residence” panel. What percentage of rural households use solid fuel for cooking? Of the 1,130 rural households in the sample, 83.5 percent

<sup>25</sup> In tables with disaggregates as columns, a “panel” refers to a set of columns that have all data for a disaggregate. A panel commonly includes an estimate column for each disaggregate category and a significance column. In some tables, the panel may also include a sample size column. There will always be a panel with a single column for the overall estimate of each outcome in the table.

use solid fuel for cooking (circled in blue in the “Rural” column of that indicator row).

**Step 6:** How do we interpret the effects of disaggregates on the outcome, that is, is a result likely due to chance (or sampling error) or some factor of interest? When the disaggregates are included in a table as columns, note the following:

- For continuous outcomes (mean number of persons per sleeping room) and binary outcomes (percentage of households using solid fuel for cooking), the statistical significance is noted in the same row showing the outcome.
- For categorical outcomes (e.g., household roof materials), the statistical significance is noted in the light blue row showing the outcome or disaggregate header, and the other rows in the significance column are shaded gray.

Look at the “Sig.” column in each disaggregate panel.

- Does residence have an effect on the mean number of persons per sleeping room? No. The significance is denoted by “n/s” (circled in red in the indicator row). This outcome is a continuous variable (a mean), so a regression was performed to assess the relationship between the outcome and the disaggregate. Because the value in the “Sig.” column is “n/s,” we know that the overall p-value for the regression is greater than or equal to 0.05, and we can say that the results show that residence does not affect the mean number of persons per sleeping room. In other words, we cannot say that the mean number of persons per sleeping room differs by residence; any difference in percentages for urban and rural households is likely due to chance or sampling error.
- Does gendered household type have an effect on the same outcome? Yes, although the sample sizes for CNA household estimates are too small to report estimates for these categories, we can see from the one asterisk “\*” circled in red in the indicators row that gendered household type does have an effect on the mean number of persons per sleeping room for M&F households, FNM households, and MNF households.
- For binary outcomes, the Pearson’s chi-square statistical test tells us whether there is a statistically significant relationship between the outcome and disaggregate. Does residence have an effect on the percentage of households that have access to electricity? Yes. two asterisks “\*\*” circled in red in the indicator row indicate that there is an effect and the results cannot be attributed to chance or sampling error. Looking at the estimates for urban households (61.4 percent) and rural households (49.1 percent), we can say that urban households are significantly more likely to have access to electricity, compared to rural households ( $p < 0.01$ ).
- For categorical outcomes, the Pearson’s chi-square statistical test also tells us whether there is a statistically significant relationship between the outcome and disaggregate. Does residence have any effect on the type of floor material households for their dwellings? Yes. the three asterisks “\*\*\*” circled in red in the indicator header row indicate that there is a significant effect. The type of floor material used (i.e., natural, rudimentary, finished, or other) is significantly associated with residence (i.e., urban or rural) at the  $p < 0.001$  significance level. However, we cannot say which types of floor materials are significantly different for urban and rural households without further statistical analysis and testing.

**Example 3: Binary outcomes—multi-response questions or multiple yes/no questions within a category; disaggregates in columns**

**Table 7.1.5: Maize farmers' fertilizer use, types of fertilizer, and timing of application in the ZOI, in total and by farmers' sex and age**

| Characteristic or practice                     | Total (%) | Sex        |          | Sig. <sup>a</sup> | Age (years) |         | Sig. <sup>a</sup> |
|------------------------------------------------|-----------|------------|----------|-------------------|-------------|---------|-------------------|
|                                                |           | Female (%) | Male (%) |                   | 15–29 (%)   | 30+ (%) |                   |
| Applied fertilizer                             | 92.9      | 92.0       | 93.8     | n/s               | 91.0        | 93.2    | n/s               |
| Number of maize farmers                        | 1,275     | 633        | 642      |                   | 166         | 1,109   |                   |
| Type <sup>b</sup>                              |           |            |          |                   |             |         |                   |
| Soil-based organic                             | 96.0      | 96.0       | 95.9     | n/s               | 97.0        | 95.8    | n/s               |
| Soil-based inorganic                           | 43.7      | 42.4       | 44.9     | n/s               | 33.7        | 45.2    | *                 |
| Organic foliar feeds                           | 0.2       | 0.4        | 0        | n/s               | 0           | 0.2     | n/s               |
| Inorganic foliar feeds                         | 0.3       | 0.7        | 0        | n/s               | 0           | 0.4     | n/s               |
| Timing of application <sup>b</sup>             |           |            |          |                   |             |         |                   |
| Planting                                       | 92.8      | 93.5       | 92.1     | n/s               | 97.1        | 92.1    | *                 |
| Early growth stage                             | 28.1      | 26.8       | 29.3     | n/s               | 20.3        | 29.2    | n/s               |
| Mid-crop                                       | 14.8      | 14.5       | 15.2     | n/s               | 12.1        | 15.2    | n/s               |
| Number of maize farmers who applied fertilizer | 1,179     | 578        | 601      |                   | 150         | 1,029   |                   |

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Farmers were allowed to give more than one response, so the percentages may not add up to 100 percent.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating maize.

Source: Feed the Future Nepal ZOI Survey 2019

**Step 1:** Read the title and review the footnotes, highlighted in orange in Example 3. Note the unit of analysis, that is, whether the table refers to households or individuals. In this example, the table is about fertilizer use among maize farmers, in total and by two disaggregates: farmers' sex and age.

**Step 2:** Scan the purple column that shows the indicators that are presented. In Example 3, they are listed in the “Characteristic or practice” column. Unlike in the first two examples, there are multiple indicators listed under the “Type” and “Timing of application” light blue header rows. These indicators are binary outcomes created from single questions that allow for multiple responses. Because each response option can be considered a separate outcome with the same denominator, they are grouped together and indented under a light blue header row. The first indicator in the table, “Applied fertilizer,” is presented without a header row because it was generated from a question that allowed for only one response.

**Step 3:** Scan the green panels containing data. There are three panels: “Total,” “Sex,” and “Age.” The “Total” panel includes one column that shows the overall data for all *de jure* maize farmers in the ZOI. The “Sex” panel includes two columns that present data broken down by the first disaggregate, by female and male maize farmers, and a third column that presents the results of the statistical tests of significance that assesses the relationship between the outcomes and sex. The “Age” panel includes two columns that present data broken down by the second disaggregate, by farmers who are 15-29 years of age and farmers who are 30 years of age or older, and a third column that presents the results of the statistical test of significance that assesses the relationship between the outcomes and age category.

**Step 4:** Find the two yellow rows that show the number of observations, or sample sizes, in Example 3. Tables that present disaggregates in columns with estimates calculated for different populations will have multiple sample size rows. The first sample size row shows the denominator (number of maize farmers) for all estimates in each column above that row. This row shows the sample sizes for only the first outcome (applying fertilizer). The second sample size row shows the sample sizes for all estimates in each column beneath the first sample size row and includes only maize farmers who applied fertilizer in the 12 months preceding the survey. How many maize farmers are there in total? There are 1,275 maize farmers (circled in yellow in the “Total” column). How many of those maize farmers applied fertilizer in the 12 months preceding the survey? There are 1,179 maize farmers who applied fertilizer (circled in yellow in the “Total” column). 96 maize farmers did not apply fertilizer in the year preceding the survey.

**Step 5:** Now that you understand the contents of the table, you can begin to examine the data. Look at the “Total” column. What percentage of maize farmers applied fertilizer? Of the 1,275 maize farmers, 92.9 percent applied fertilizer in the 12 months preceding the survey (circled in blue in the “Total” column of the “Applied fertilizer” row). Now look at the “Age” panel. What percentage of maize farmers 15-29 years of age who applied fertilizer used soil-based inorganic fertilizers? Of the 150 farmers 15-29 years of age who applied fertilizer, 33.7 percent used soil-based inorganic fertilizers (circled in blue in the “15-29” column and the “Soil-based inorganic” row).

Note that there is a footnote in the outcome header row for both “Type” and “Timing of fertilizer application.” Footnote “b” states that farmers were allowed to provide more than one response, so percentages may not add up to 100 percent.

**Step 6:** How do we interpret the effects of disaggregates on the outcome, that is, is a result likely due to chance (or sampling error) or some factor of interest? Look at the “Sig.” column in each disaggregate panel.

- Does age group have an effect on the percentage of maize farmers who applied fertilizer? No. The significance is denoted by “n/s” (circled in red in “Applied fertilizer” row) to indicate that age group does not have an effect on the percentage of farmers who apply fertilizer. Looking at the estimates for the two age groups, we cannot say that the percentage of maize farmers 30 years of age or older who applied fertilizer is greater than the percentage of maize farmers 15-29 years of age who did so.
- Does age group have an effect on the percentage of maize farmers who applied soil-based inorganic fertilizers, among maize farmers who applied any fertilizer? Yes. The significance is the one asterisk “\*” circled in red in “Soil-based inorganic” row.

Because the type of fertilizer used and timing of fertilizer application questions allowed for multiple responses and each response option was converted to a binary outcome, we can perform a statistical test of significance assessing the relationship between each outcome (response option) and disaggregate using a Pearson’s chi-squared test. For example, for the timing of fertilizer application, we can say whether farmers’ age has an effect on whether farmers applied fertilizer during the planting phase, during the early growth phase, during the mid-crop phase, and during any other phase.

If, however, farmers were asked when they *mainly* applied fertilizer, and farmers had to provide only one

response, then a Pearson's chi-squared test would indicate whether there is a statistically significant difference among the three possible outcomes by age, but it would not indicate for which groups the difference is statistically significant.

### 3. DEMOGRAPHIC CHARACTERISTICS IN THE ZOI

This chapter describes the background characteristics of the ZOI population, using data from the Nepal ZOI Survey 2019.

#### 3.1 Household demographics

**Table 3.1.1** presents demographic characteristics of the households in the ZOI for all households and by gendered household type. This table presents the average de jure household size, as well as the average number of de jure household members by key categories, the percentages of de jure adult household members who are male and female, and the percent distribution of households across size and education categories. Level of education is defined as the highest level of education of any de facto member of the household.

The mean household size at baseline was 4.4 individuals. Gendered household type is significantly associated with mean household size; M&F households were the largest at an average of 4.9 household members, compared to 2.9 in FNM households and 1.5 in MNF households. This trend remained consistent across the age categories listed below. The mean number of males in a household was 1.2 and females in a household was 1.6. 39.8 percent of household members were male, compared to 60.2 percent who were female. An average of 0.8 household members were a producer of any targeted commodity. Gendered household type was significantly associated with mean number of producers of any targeted commodity; the mean for M&F households was 0.9, compared to 0.7 in FNM and 0.4 in MNF households.

Approximately three-quarters of households were considered small, with between one and five members. Approximately one-quarter of households were considered medium, with between six and ten members. Gendered household type was significantly associated with household size.

Finally, 70.1 percent of households had at least one household member with a completed primary education or above. Only 7.7 percent of households had no education. Gendered household type was significantly associated with a household's educational attainment. MNF households had the greatest prevalence of both no education and higher education across gendered household types. M&F households had the greatest prevalence of at least one household member with completion of primary or secondary education across gendered household types.

**Table 3.1.1: Household demographic characteristics in the ZOI, in total and by gendered household type**

| Household characteristic                        | All households | Gendered household type |                    |                  |               | Sig. <sup>a</sup> |
|-------------------------------------------------|----------------|-------------------------|--------------------|------------------|---------------|-------------------|
|                                                 |                | Male and female adults  | Female adults only | Male adults only | Children only |                   |
| Mean household size                             | 4.4            | 4.9                     | 2.9                | 1.5              | ^             | ***               |
| Mean number of children under two years of age  | 0.2            | 0.2                     | 0.1                | 0.01             | ^             | ***               |
| Mean number of children under five years of age | 0.5            | 0.5                     | 0.5                | 0.04             | ^             | ***               |

| Household characteristic                                        | All households | Gendered household type |                    |                  |               | Sig. <sup>a</sup> |
|-----------------------------------------------------------------|----------------|-------------------------|--------------------|------------------|---------------|-------------------|
|                                                                 |                | Male and female adults  | Female adults only | Male adults only | Children only |                   |
| Mean number of children five years of age or older (5–17 years) | 1.2            | 1.2                     | 1.3                | 0.3              | ^             | ***               |
| Mean number of youth (15–29 years)                              | 1.2            | 1.4                     | 0.7                | 0.5              | ^             | ***               |
| Mean number of women of reproductive age (15–49 years)          | 1.3            | 1.4                     | 1.1                | 0.1              | ^             | ***               |
| Mean number of adult male household members <sup>b</sup>        | 1.2            | 1.5                     | 0                  | 1.1              | ^             | -                 |
| Mean number of adult female household members <sup>b</sup>      | 1.6            | 1.7                     | 1.3                | 0                | ^             | -                 |
| Mean number of producers of any targeted commodity <sup>c</sup> | 0.8            | 0.9                     | 0.7                | 0.4              | -             | ***               |
| Percent of adults who are male (%) <sup>b</sup>                 | 39.8           | 47.8                    | 0                  | 100              | -             | -                 |
| Percent of adults who are female (%) <sup>b</sup>               | 60.2           | 52.2                    | 100                | 0                | -             | -                 |
| <b>Household size (%)</b>                                       |                |                         |                    |                  |               | ***               |
| Small (1–5 members)                                             | 74.5           | 68.0                    | 96.7               | 100              | ^             |                   |
| Medium (6–10 members)                                           | 24.2           | 30.2                    | 3.3                | ^                | ^             |                   |
| Large (11 or more members)                                      | 1.4            | 1.8                     | ^                  | ^                | ^             |                   |
| <b>Number of households</b>                                     | <b>2,481</b>   | <b>1,944</b>            | <b>473</b>         | <b>54</b>        | <b>10</b>     |                   |
| <b>Household education (%)<sup>d</sup></b>                      |                |                         |                    |                  |               | ***               |
| No education                                                    | 7.7            | 5.9                     | 11.9               | 28.2             | ^             |                   |
| Less than primary                                               | 22.3           | 20.6                    | 29.6               | 22.9             | ^             |                   |
| Completed primary                                               | 44.4           | 45.1                    | 43.1               | 19.8             | ^             |                   |
| Completed secondary                                             | 13.7           | 15.4                    | 7.5                | 11.0             | ^             |                   |
| Higher                                                          | 12.0           | 12.6                    | 7.9                | 18.1             | ^             |                   |
| <b>Number of households</b>                                     | <b>2,475</b>   | <b>1,942</b>            | <b>470</b>         | <b>54</b>        | <b>9</b>      |                   |

<sup>a</sup> Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.001, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Feed the Future defines adult as an individual 18 years of age or older. Females and males 15–17 years of age are of reproductive age but are not considered adults by this definition.

<sup>c</sup> Targeted commodities in Nepal include maize, rice, tomatoes, and cauliflower.

<sup>d</sup> Estimates are based on de facto household members and do not include “other” responses for this category.

Note: Estimates are based on de jure household members, except where noted.

Source: Feed the Future Nepal ZOI Survey 2019

**Table 3.1.2** shows characteristics of the primary adult female and male decision-makers in the sampled households in the ZOI. The primary adult female and male decision-makers are household members who are 18 years of age or older and who self-identify as the primary adult male or primary adult female responsible for both social and economic decision-making in the household. When both exist in a single household, primary adult female and male decision-makers are typically, but not necessarily, husband and wife. **Table 3.1.2** shows the age group, marital status, educational attainment, and participation in economic activity for these household members.

As shown in **Table 3.1.2**, gender was significantly correlated with the age of primary adult decision-makers. Female primary decision-makers were slightly younger than male primary decision-makers.

Furthermore, a greater proportion of females than males were aged 18 to 44. However, there was a greater proportion of male decision-makers above the age of 44 than female decision-makers.

Most of both female and male primary adult decision-makers were married at baseline, at 90.3 percent and 91.7 percent, respectively. The second most common marital status for women was being widowed, at six percent. For men, the second most common marital status was never being married or in a union, at three percent. Gender was also significantly correlated with marital status at baseline.

Men were more educated than women, and gender was significantly associated with educational attainment. Most women (60.1 percent) had no education at all, compared to just 27.6 percent of men who had no education. Moreover, a greater proportion of men than women completed each level of educational attainment.

Finally, significantly more women than men participated in some form of economic activity, at 90.0 percent and 87.2 percent, respectively. More women than men participated in farm and wage or salaried labor relative to men. However, more than twice as many men participated in non-farm labor than women.

**Table 3.1.2: Characteristics of primary adult decision-makers in the ZOI, by sex**

| Background characteristic                                     | Female (%)   | Male (%)     | Sig. <sup>a</sup> |
|---------------------------------------------------------------|--------------|--------------|-------------------|
| <b>Age</b>                                                    |              |              | ***               |
| 18–24                                                         | 7.5          | 5.1          |                   |
| 25–29                                                         | 11.4         | 7.9          |                   |
| 30–34                                                         | 13.6         | 10.2         |                   |
| 35–39                                                         | 14.2         | 12.5         |                   |
| 40–44                                                         | 12.0         | 11.8         |                   |
| 45–49                                                         | 11.5         | 11.6         |                   |
| 50–54                                                         | 10.4         | 11.2         |                   |
| 55–59                                                         | 7.2          | 10.6         |                   |
| 60+                                                           | 12.2         | 18.9         |                   |
| <b>Marital status</b>                                         |              |              | **                |
| Married                                                       | 90.3         | 91.7         |                   |
| Living in a consensual union                                  | 0.04         | 0.1          |                   |
| Widowed                                                       | 6.3          | 2.6          |                   |
| Divorced or separated                                         | 2.0          | 2.7          |                   |
| Never married or in a union                                   | 1.3          | 2.8          |                   |
| <b>Highest educational attainment</b>                         |              |              | ***               |
| No education                                                  | 60.1         | 27.6         |                   |
| Less than primary                                             | 17.5         | 34.4         |                   |
| Completed primary                                             | 15.9         | 27.5         |                   |
| Completed secondary                                           | 3.5          | 5.1          |                   |
| Higher                                                        | 3.0          | 5.4          |                   |
| <b>Economic activity<sup>b</sup></b>                          |              |              | **                |
| Participates in some form of economic activity                | 90.0         | 87.2         |                   |
| <b>Participation in economic activity by type<sup>c</sup></b> |              |              |                   |
| Farm                                                          | 87.6         | 83.1         | ***               |
| Non-farm                                                      | 24.3         | 53.2         | **                |
| Wage or salaried                                              | 7.5          | 6.9          | n/s               |
| <b>Number of primary adult decision-makers<sup>d</sup></b>    | <b>2,402</b> | <b>1,916</b> |                   |



<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ ; n/s=not significant.

<sup>b</sup> Both paid and unpaid types of economic activity are included. Domestic work, such as caring for children and the elderly or cooking and cleaning, is not included.

<sup>c</sup> Farm work includes food crop farming, cash crop farming, livestock raising, or fishing/fishpond culture; non-farm work includes running small businesses or self-employment; and wage/salaried employment includes both agriculture or non-agriculture-based work that is salaried. Percentages do not add up to 100 percent because individuals can engage in more than one type of economic activity.

<sup>d</sup> Records missing information for the disaggregate variables have been excluded from the disaggregated estimates. The unweighted sample size reflects this loss in observations; therefore, the sum of disaggregate sample sizes may not equal the overall sample size.

Note: Estimates are based on primary adult decision-makers who are de jure household members.

Source: Feed the Future Nepal ZOI Survey 2019

### 3.2 Household member education

**Table 3.2.1** and **Table 3.2.2** present school attendance and educational attainment in the ZOI. **Table 3.2.1** presents the percentage of all de facto household members between five and 24 years of age who currently attend school, in total and by sex. **Table 3.2.2** presents the percentage of household members ten years of age or older who have completed primary school, in total and by sex. The tables also include sex ratios for school attendance and attainment of primary education.

In Nepal, the Education Act of 1971 defines primary education as “education given from class one to class five.”<sup>26</sup> In 2016, the GoN amended the education act and implemented structural changes. Previously, grades 1–5 were considered “primary,” grades 6–8 “lower secondary,” grades 9–10 “secondary,” and grades 11–12 “higher secondary.” However, after the eighth amendment in 2016, grades 1–8 were deemed “basic education” and grades 9–12 “secondary education.” Grades 1–5 are still considered primary education within the larger category of basic education.

The academic school year in Nepal begins at the start of the Nepalese new year, which takes place between April 10 and 17. School holidays take place during the monsoon season, when students help in the fields.<sup>27</sup> Baseline data were collected from May to August, when students were likely to be on holiday from school. Children aged 10 to 14 were most likely to be attending school, and youth aged 20 to 24 were least likely to be attending school or a formal educational institution. Gender was significantly associated with school attendance. However, while boys aged five to 14 were more likely attending school at the time of the survey than girls, girls aged 15 to 24 were more likely attending school than boys.

<sup>26</sup> Education Act. 1971, Eighth Amendment.

<sup>27</sup> Namaste Nepal (n.d.) “The School Year in Nepal.” Retrieved from: <http://www.namastenepal.cz/en/produkty/usmev-z-nepalu/o-projektu/nepalsky-skolni-rok/>.

**Table 3.2.1: School attendance at time of survey among children and youth 5–24 years of age in the ZOI, in total and by age and sex**

| Age (years)         | Total   |                 | Female  |     | Male    |     | Sig. <sup>a</sup> | Female to male ratio |
|---------------------|---------|-----------------|---------|-----|---------|-----|-------------------|----------------------|
|                     | Percent | n <sup>28</sup> | Percent | n   | Percent | n   |                   |                      |
| <b>Age category</b> |         |                 |         |     |         |     | <b>**</b>         |                      |
| 5–9                 | 34.2    | 1,109           | 32.7    | 546 | 35.8    | 563 |                   | 0.9                  |
| 10–14               | 38.2    | 1,262           | 37.3    | 631 | 39.1    | 631 |                   | 1.0                  |
| 15–19               | 22.5    | 1,081           | 24.1    | 612 | 20.8    | 469 |                   | 1.2                  |
| 20–24               | 5.1     | 863             | 5.9     | 541 | 4.3     | 322 |                   | 1.4                  |

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

Note: Estimates are based on de facto household members.

Source: Feed the Future Nepal ZOI Survey 2019

Completion of primary education among individuals ten years of age or older, as shown in **Table 3.2.2**, was relatively low at baseline. Youth aged 15 to 19 were the most likely to have completed primary school, with a completion rate of 25.6 percent, followed by individuals aged 20 to 24, with a 19.2 percent completion rate. For individuals aged 40 and above, completion rates were below five percent. Sex was significantly associated with completion of primary education. However, as demonstrated by the female to male ratio, females were more likely to have completed primary education up until the age of 30, after which males were more likely to have completed primary school.

**Table 3.2.2: Completion of primary education among individuals ten years of age or older in the ZOI, in total and by age and sex**

| Age (years)         | Total   |       | Female  |     | Male    |     | Sig. <sup>a</sup> | Female to male ratio |
|---------------------|---------|-------|---------|-----|---------|-----|-------------------|----------------------|
|                     | Percent | n     | Percent | n   | Percent | n   |                   |                      |
| <b>Age category</b> |         |       |         |     |         |     | <b>***</b>        |                      |
| 10–14               | 11.1    | 1,262 | 12.1    | 631 | 10.1    | 631 |                   | 1.2                  |
| 15–19               | 25.6    | 1,081 | 28.2    | 612 | 22.9    | 469 |                   | 1.2                  |
| 20–24               | 19.2    | 863   | 23.3    | 541 | 15.0    | 322 |                   | 1.5                  |
| 25–29               | 15.2    | 800   | 17.3    | 488 | 12.9    | 312 |                   | 1.3                  |
| 30–34               | 9.4     | 668   | 8.7     | 404 | 10.1    | 264 |                   | 0.9                  |
| 35–39               | 6.6     | 668   | 5.8     | 397 | 7.4     | 271 |                   | 0.8                  |
| 40–44               | 4.1     | 542   | 2.3     | 315 | 6.0     | 227 |                   | 0.4                  |
| 45–49               | 3.4     | 526   | 1.3     | 298 | 5.5     | 228 |                   | 0.2                  |
| 50–54               | 2.2     | 522   | 0.6     | 292 | 3.9     | 230 |                   | 0.2                  |
| 55–59               | 1.5     | 429   | 0.2     | 210 | 2.9     | 219 |                   | 0.1                  |
| 60+                 | 1.7     | 1,081 | 0.2     | 564 | 3.3     | 517 |                   | 0.1                  |

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

Note: Estimates are based on de facto household members.

Source: Feed the Future Nepal ZOI Survey 2019

<sup>28</sup> The sample sizes represent the number of individuals that meet the row criteria, regardless of whether these individuals meet the column criteria. This approach is used throughout this report.

### 3.3 Dwelling characteristics and living conditions

**Table 3.3.1** shows dwelling characteristics of the households in the ZOI. The table presents the percentage of households that have access to electricity, the average number of people per sleeping room, the percentage of households that use solid cooking fuel, and the main roof, exterior wall, and floor materials of households' dwellings. Solid cooking fuels are not considered clean fuels and can have negative health impacts; they include charcoal, wood, animal dung, crop residues, straw, shrubs, and grass.<sup>29</sup>

These characteristics at baseline are disaggregated by residence and gendered household type. 71.9 percent of households used solid cooking fuel at baseline. A household's residence in an urban or rural location, was significantly associated with the likelihood of a household using solid cooking fuel. 83.5 percent of rural households used solid cooking fuel, compared to 63.0 percent of urban households.

56.1 percent of households at baseline had access to electricity. Residence was significantly associated with access to electricity; 49.1 percent of rural households and 61.4 percent of urban households had access to electricity.

The mean number of persons per sleeping room at baseline was two. Though these estimates do not vary significantly by residence, gendered household type was significantly associated with mean number of persons per sleeping room. M&F households had the greatest number of sleeping rooms (2.1) and MNF households had the fewest number of rooms (1.1).

At baseline, most households (91.9 percent) had finished roofs, followed by natural roofs (7.7 percent). Most households had either natural or finished walls, at 47.0 and 44.1 percent, respectively. Households were most likely to have either natural or finished floors, at 67.0 and 32.1 percent, respectively. Residence was significantly associated with roof type, wall type, and floor type. Urban households had more finished roofs, walls, and floors and more rural households had natural roofs, walls, and floors. Gendered household type was not significantly associated with roofing, wall, or flooring materials.

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<sup>29</sup> Smith & Pillarisetti, 2015.

**Table 3.3.1: Household dwelling characteristics in the ZOI, in total and by residence and gendered household type**

| Household characteristic                                 | Residence    |              |              |                   | Gendered household type |                    |                  |               | Sig. <sup>a</sup> |
|----------------------------------------------------------|--------------|--------------|--------------|-------------------|-------------------------|--------------------|------------------|---------------|-------------------|
|                                                          | Total        | Urban        | Rural        | Sig. <sup>a</sup> | Male and female adults  | Female adults only | Male adults only | Children only |                   |
| Percent using solid fuel for cooking (%) <sup>b</sup>    | 71.9         | 63.0         | 83.5         | ***               | 72.9                    | 70.1               | 61.1             | ^             | n/s               |
| Percent with access to electricity (%)                   | 56.1         | 61.4         | 49.1         | **                | 57.0                    | 54.8               | 43.7             | ^             | n/s               |
| Mean number of persons per sleeping room <sup>c</sup>    | 2.0          | 2.0          | 2.0          | n/s               | 2.1                     | 1.7                | 1.1              | ^             | *                 |
| <b>Household roof materials (%)<sup>d</sup></b>          |              |              |              | *                 |                         |                    |                  |               | n/s               |
| Natural                                                  | 7.7          | 5.9          | 10.0         |                   | 7.4                     | 7.7                | 17.8             | ^             |                   |
| Rudimentary                                              | 0.2          | 0.0          | 0.5          |                   | 0.2                     | 0.2                | 0.0              | ^             |                   |
| Finished                                                 | 91.9         | 93.7         | 89.5         |                   | 92.1                    | 92.1               | 82.2             | ^             |                   |
| Other                                                    | 0.2          | 0.4          | 0.0          |                   | 0.3                     | 0.0                | 0.0              | ^             |                   |
| <b>Household exterior wall materials (%)<sup>e</sup></b> |              |              |              | ***               |                         |                    |                  |               | n/s               |
| Natural                                                  | 47.0         | 35.9         | 61.5         |                   | 47.0                    | 48.6               | 39.6             | ^             |                   |
| Rudimentary                                              | 4.6          | 5.9          | 2.9          |                   | 4.4                     | 4.8                | 5.9              | ^             |                   |
| Finished                                                 | 44.1         | 53.6         | 31.7         |                   | 44.0                    | 44.2               | 41.3             | ^             |                   |
| Other                                                    | 4.3          | 4.7          | 3.9          |                   | 4.6                     | 2.3                | 13.2             | ^             |                   |
| <b>Household floor materials (%)<sup>f</sup></b>         |              |              |              | ***               |                         |                    |                  |               | n/s               |
| Natural                                                  | 67.0         | 59.0         | 77.3         |                   | 67.4                    | 67.5               | 54.5             | ^             |                   |
| Rudimentary                                              | 0.9          | 0.0          | 2.2          |                   | 0.8                     | 0.7                | 7.3              | ^             |                   |
| Finished                                                 | 32.1         | 41.0         | 20.5         |                   | 31.8                    | 31.8               | 38.2             | ^             |                   |
| Other                                                    | 0.0          | 0.0          | 0.1          |                   | 0.0                     | 0.0                | 0.0              | ^             |                   |
| <b>Number of households</b>                              | <b>2,481</b> | <b>1,351</b> | <b>1,130</b> |                   | <b>1,944</b>            | <b>473</b>         | <b>54</b>        | <b>10</b>     |                   |

<sup>a</sup> Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Solid fuel is defined as charcoal, wood, animal dung, straw/shrubs/grass, and agriculture crop residue. Households in the “no food cooked in household” category are removed from percentages.

<sup>c</sup> The average number of persons per sleeping room is a common indicator of crowding (United Nations Development Programme, 2003).

<sup>d</sup> Natural roof includes no roof, thatch (straw, reed, sticks), and sod or bamboo. Rudimentary roof includes wood planks, cardboard, and plastic sheeting. Finished roofs include metal/galvanized iron, wood, calamine/cement fiber, ceramic tiles, cement/concrete, roofing shingles, and tile/slate.

<sup>e</sup> Natural wall includes no walls, earth/mud/dirt, cane/tree trunks/bamboo/sticks, bamboo with mud, and stone with mud. Rudimentary walls include plywood, cardboard, reused wood, and unbaked bricks. Finished walls include concrete/flagstone/cement, stone with lime/cement, tile/bricks, cement blocks, unbaked bricks covered with plaster, wood planks/shingles, and metal/galvanized iron.

<sup>f</sup> Natural floors include earth/sand/mud, dung, and earth/sand/mud and stones. Rudimentary floors include wood planks and bamboo slats. Finished floors include parquet/polished wood, vinyl or asphalt strips, ceramic tiles/bricks, concrete/flagstone/cement, and wall-to-wall carpet.

Note: Estimates are based on de jure household members.

Source: Feed the Future Nepal ZOI Survey 2019

### 3.4 Water, sanitation, and hygiene

This section presents water, sanitation, and hygiene indicators that align with the Sustainable Development Goals (SDG) definitions.<sup>30</sup> **Table 3.4.1** presents the percentage of households that use an improved water source, use improved sanitation, practice a correct drinking water treatment method, and practice open defecation.

Drinking water may be contaminated with human or animal feces containing pathogens or chemical and physical contaminants with harmful effects on health; therefore, improving water quality is critical to preventing transmission of diarrhea and other diseases. In addition to improving water quality, it is also important to improve the accessibility and availability of drinking water, especially for women and girls, who often bear the primary responsibility for collecting water from distant sources.<sup>31</sup> Therefore, in addition to collecting information on types of drinking water and treatment method, the ZOI Survey collected information on the accessibility and availability of drinking water services (i.e., main source of drinking water that the household uses and time it takes to travel to and get water from the source).

At baseline, 78.4 percent of households had a regularly available improved water source. Residence and gendered household type were not significantly associated with whether households had access to this type of water source.

Very few households at baseline (16.6 percent) used correct drinking water treatment practices or technologies, defined as methods that effectively kill or remove pathogens.<sup>32</sup> These practices did not vary significantly based on household residence, although they did vary significantly by gendered household type. FNM households were the most likely to use these practices, whereas M&F households were the least likely.

Inadequate sanitation and lack of sanitation are closely associated with diarrheal diseases, which in turn exacerbate malnutrition. Open defecation is when people use fields, forests, open bodies of water, or other open spaces rather than toilets. Open defecation and inadequate sanitation are dangerous because contact with human waste can cause diseases such as cholera, typhoid, hepatitis, diarrhea, worm infestation, and under-nutrition. Although access to a hygienic toilet facility is critical in reducing the transmission of pathogens, the sharing of sanitation facilities is also an important consideration, given the negative impacts on dignity, privacy, and personal safety, especially for women and girls.<sup>33</sup> According to the World Health Organization (WHO)/United Nations Children's Fund (UNICEF) Joint Monitoring Programme for Water Supply, Sanitation, and Hygiene, a basic sanitation service consists of a sanitation

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<sup>30</sup> UNSTATS, n.d.

<sup>31</sup> Core questions on water, sanitation and hygiene for household surveys: 2018 Update. New York: UNICEF/WHO, 2018.

<sup>32</sup> Improved water sources include piped water into the dwelling, piped water into the yard, public tap/ standpipe, tubewell/ borehole, protected dug well, protected spring, rainwater, bottled water, sachet water, tanker-truck, and cart with small drum (UNICEF & WHO, 2018). The proportion of the population using safely managed drinking water services is SDG indicator 6.1.1 (UNSD, n.d.). The indicator presented includes an indication of regularity in access to the water source, namely, that (a) water is available from this source all year round and (b) water from this source was available every day in the two weeks preceding the survey.

<sup>33</sup> Core questions on water, sanitation and hygiene for household surveys: 2018 Update. New York: UNICEF/WHO, 2018.

facility that hygienically separates human excreta from human contact (i.e., an improved sanitation facility) that is not shared with other households.<sup>34</sup>

At baseline, 73.5 percent of households had access to a basic sanitation service. Gendered household type was significantly associated with access to basic sanitation; M&F households had the highest prevalence at 76.8 percent while MNF households had the lowest, at 59.2 percent.

The second most used system was a shared improved sanitation facility, defined as a shared facility that separates human excreta from human contact. 18.4 percent of households used this kind of facility at baseline. Both residence and gendered household type were significantly associated with access to a shared improved sanitation facility. More specifically, urban households were more likely than rural households to use this type of facility. MNF households were also the most likely to use a shared improved facility, and M&F households were the least likely.

Next, 8.2 percent of households used an unimproved facility, which does not adequately separate human excreta from human contact. Residence was not significantly associated with use of this type of facility, although gendered household type was. FNM households were the most likely to use this type of facility, and M&F households were the least likely.

Finally, 6.4 percent of households practiced open defecation, with rural households significantly more likely than urban households to do so. Gendered household type was not significantly associated with open defecation.

Handwashing with soap and water is among the most cost-effective interventions for reducing the transmission of diseases. Research has demonstrated a clear link between handwashing with soap among child caretakers (at critical junctures) and the reduction of diarrheal disease, a major cause of child morbidity and mortality in developing countries.<sup>35</sup> A handwashing station is a location where people wash their hands; they are fixed locations or movable devices that can be placed in a convenient spot for use. During data collection, interviewers visited household handwashing facilities and observed whether water and soap in bar, powder, or liquid form were present.

Only slightly more than half of households had soap and water at a handwashing station within their homes. Residence was significantly associated with these materials being present in the home, with 58.3 percent of urban households and 41.7 percent of rural households meeting these conditions.

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<sup>34</sup> WHO/ UNICEF. JMP Methodology. 2017 Update &SDG Baselines. March 2018. Available at <https://washdata.org/sites/default/files/JMP%20methodology-Apr-2018-5.pdf>.

<sup>35</sup> E.-Nwadiaro, et al., 2015.

**Table 3.4.1: Household water, sanitation, and hygiene characteristics in the ZOI, in total and by residence and gendered household type**

| Indicator                                                                    | Residence    |              |              |                   | Gendered household type    |                        |                      |                   | Sig. <sup>a</sup> |
|------------------------------------------------------------------------------|--------------|--------------|--------------|-------------------|----------------------------|------------------------|----------------------|-------------------|-------------------|
|                                                                              | Total (%)    | Urban (%)    | Rural (%)    | Sig. <sup>a</sup> | Male and female adults (%) | Female adults only (%) | Male adults only (%) | Children only (%) |                   |
| Use a regularly available improved water source <sup>b</sup>                 | 78.4         | 79.5         | 77.1         | n/s               | 79.5                       | 75.0                   | 75.8                 | ^                 | n/s               |
| Use correct water treatment practice or technology <sup>c</sup>              | 16.6         | 17.0         | 16.1         | n/s               | 15.4                       | 21.6                   | 15.9                 | ^                 | *                 |
| Have soap and water at handwashing station family members use <sup>d,i</sup> | 51.1         | 58.3         | 41.7         | ***               | 51.5                       | 49.7                   | 43.3                 | ^                 | n/s               |
| Have basic sanitation (improved sanitation, not shared) <sup>e,i</sup>       | 73.5         | 71.9         | 75.5         | n/s               | 76.8                       | 62.6                   | 59.2                 | ^                 | ***               |
| Use improved sanitation, shared <sup>f</sup>                                 | 18.4         | 21.0         | 14.9         | *                 | 16.1                       | 25.1                   | 32.7                 | ^                 | **                |
| Use unimproved sanitation <sup>g</sup>                                       | 8.2          | 7.1          | 9.6          | n/s               | 7.1                        | 12.3                   | 8.0                  | ^                 | *                 |
| Practice open defecation <sup>h</sup>                                        | 6.4          | 5.0          | 8.2          | *                 | 5.7                        | 6.7                    | 8.0                  | ^                 | n/s               |
| <b>Number of households</b>                                                  | <b>2,481</b> | <b>1,351</b> | <b>1,130</b> |                   | <b>1,944</b>               | <b>473</b>             | <b>54</b>            | <b>10</b>         |                   |

<sup>a</sup> Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Improved water sources include *piped water into the dwelling, piped water into the yard, public tap/standpipe, tube well/borehole, protected dug well, protected spring, rainwater, bottled water, sachet water, tanker-truck, and cart with small drum* (UNICEF & WHO, 2018). The proportion of the population using safely managed drinking water services is SDG indicator 6.1.1 (UNSD, n.d.). The indicator presented includes an indication of regularity in access to the water source—namely, that (a) water is available from this source all year round and (b) water from this source was available every day in the two weeks preceding the survey.

<sup>c</sup> Correct water treatment practice or technology refers to methods that effectively kill or remove pathogens. This includes *boiling the water, adding bleach or chlorine, using a water filter* (ceramic, sand, composite), and *solar disinfection* (WHO & UNICEF, 2006). Practices such as *straining through a cloth* and *letting it stand and settle* are not considered effective approaches to water treatment. *Other* is also not considered an effective approach.

<sup>d</sup> A handwashing station is a location where people wash their hands. These can be fixed locations or movable devices that may be placed in a convenient spot for use. The soap may be in bar, powder, or liquid form. The cleansing product must be at the handwashing station or reachable by hand when standing in front of it. The proportion of the population with a basic handwashing facility with soap and water available on premises is SDG indicator 6.2.1b (UNSD, n.d.).

<sup>e</sup> A basic sanitation service consists of a sanitation facility that hygienically separates human excreta from human contact (i.e., an improved sanitation facility) that is not shared with other households. Having an improved sanitation facility is necessary, but it is not sufficient to define a household as having a basic sanitation service (UNICEF & WHO, 2019). The proportion of the population using safely managed sanitation services is SDG indicator 6.2.1a (UNSD, n.d.).

<sup>f</sup> Improved sanitation facilities are those that separate human excreta from human contact; they include the categories *flush to piped sewer system, flush to septic tank, flush/pour flush to pit latrine, composting toilet, ventilated improved pit latrine* (only if there is also a slab), and *pit latrine with a slab* (UNICEF & WHO, 2018).

<sup>g</sup> Unimproved sanitation facilities are those that do not adequately separate human excreta from human contact. This includes the following: *flush/pour flush to open drain, flush/pour flush to elsewhere, pit latrine without a slab/open pit, bucket, and hanging toilet*. Households that report having no sanitation facility or using the bush or field are considered as using an unimproved sanitation facility (UNICEF & WHO, 2018).

<sup>h</sup> Households that report having no sanitation facility or using the bush or field are considered as practicing open defecation.

<sup>i</sup> Feed the Future Phase 2 ZOI-level indicator.

Note: Estimates are based on de jure household members.

Source: Feed the Future Nepal ZOI Survey 2019

## 4. HOUSEHOLD ECONOMIC STATUS

This chapter includes a background discussion of monetary poverty in Nepal, the poverty indicators, and the wealth index. Appendix A2.2a provides an overview of the methodology used to calculate the poverty indicators and Appendix A2.2b provides an overview of the methodology used to calculate the wealth index. Additional details are provided in the *Guide to Feed the Future Statistics*.<sup>36</sup>

The Feed the Future poverty ZOI indicators presented in this chapter include the prevalence of poverty, the depth of poverty of the poor, and the prevalence of people who are “near-poor,” or who live between 100 percent and 125 percent of the poverty line. These indicators are presented for the \$1.90 poverty line at 2011 PPP (Section 4.1) and at Nepal’s national poverty threshold of Rs. 19,262 per person per year in 2010 (Section 4.2). Because Nepal’s Central Bureau of Statistics produces poverty estimates based on the Nepal Living Standards Survey, the national poverty line for Nepal is an absolute poverty line based on the cost of basic food and non-food needs.

As of 2018, Nepal replaced traditional monetary poverty measurements with the Multidimensional Poverty Index (MPI).<sup>37</sup> The MPI, which counts the joint deprivations individuals face based on the Alkire-Foster method, uses ten indicators that address health, education, and living standards.<sup>38</sup> The latest Nepal MPI report indicated that 28.6 percent of Nepal’s population is multidimensionally poor, predominantly because of undernutrition and insufficient education.<sup>39</sup> The Nepal MPI illustrates that seven percent of the urban population and 33 percent of the rural population are multidimensionally poor.<sup>40</sup> Multidimensional poverty is most severe in Lumbini Province and Sudurpashchim Province, with 50 percent and 30 percent of the population experiencing multidimensional poverty, respectively.<sup>41</sup> However, Nepal halved its multidimensional poverty rate between 2006 and 2014, with multidimensional poverty decreasing from 59 percent to 29 percent.<sup>42</sup> Moreover, during this period, Nepal made statistically significant progress across all ten index indicators.<sup>43</sup> Maintaining this positive progress will require continued investments in health and education, especially those targeting the poorest of the poor.<sup>44</sup>

The Household Roster and Household Consumption Expenditure modules of the questionnaire were used to calculate the poverty indicators. The Household Consumption Expenditure module is similar to the Living Standards Measurement Study, in which consumption of various food and non-food items proxies household income and well-being (household expenditure totals proxy household incomes on the assumption that a household’s consumption is closely related to its income). Household consumption and expenditures are often preferred to income when measuring poverty because it is

<sup>36</sup> Feed the Future ZOI Survey Methods Toolkit. Available at: <https://www.agrilinks.org/post/feed-future-zoi-survey-methods>.

<sup>37</sup> Nepal’s Multidimensional Poverty Index: Analysis Towards Action, 2018.

<sup>38</sup> Ibid.

<sup>39</sup> Ibid.

<sup>40</sup> Ibid.

<sup>41</sup> Ibid.

<sup>42</sup> Ibid.

<sup>43</sup> Ibid.

<sup>44</sup> Ibid.



difficult to accurately measure income. According to Deaton, expenditure data are less prone to error, easier to recall, and more stable over time than income data.<sup>45</sup> In this approach, a per capita daily consumption aggregate combines every purchased and non-purchased item consumed by each household into a daily monetary value, summing across all items to obtain a total daily expenditure in goods and services consumed by a household and then dividing by the number of household members to obtain each household's daily per capita expenditures. This approach assumes that every household member has an equal share of total consumption, regardless of age or other characteristics.<sup>46</sup>

#### 4.1 Measures of poverty in the ZOI

The prevalence of poverty, sometimes called the poverty headcount ratio, is measured by determining the percentage of individuals living below a poverty threshold. Estimates of poverty prevalence are sensitive to the poverty thresholds used to identify the poor. A standardized poverty threshold of \$1.90 per person per day in adjusted 2011 United States Dollars (USD) is used to track global changes in poverty across countries.<sup>47</sup> \$1.90 is, in effect, the extreme poverty threshold and represents the poverty line typical of the world's poorest countries.<sup>48</sup> Poverty estimates are also presented for Nepal's poverty threshold.

Although poverty prevalence indicates how *many* individuals are impacted by poverty, it does not speak to how *much* people are impacted by poverty. The depth of poverty of the poor is a useful poverty-related indicator because it describes the extremity of poverty by estimating the average gap between consumption expenditure levels and the poverty line among the poor.<sup>49</sup> The prevalence and depth of poverty indicators complement each other to present a more complete picture of the poverty situation in the ZOI. A third indicator that provides additional context is the prevalence of people who are “near-poor,” or living on 100 percent to less than 125 percent of the \$1.90 2011 PPP poverty line. The applicable “near-poor” line is 125 percent of the poverty line, or \$2.38 per day at 2011 PPP. Many “near-poor” households find themselves technically above the poverty line but one adverse event away from falling into poverty. A high prevalence of “near-poor” individuals can make an agri-food or

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<sup>45</sup> Deaton, 2008.

<sup>46</sup> Guidelines on constructing the consumption aggregate can be found in: Deaton, A. and S. Zaidi (2002), A Guide to Aggregating Consumption Expenditures, Living Standards Measurement Study, Working Paper 135. Available at: <http://siteresources.worldbank.org/INTPA/Resources/429966-1092778639630/deatonZaidi.pdf>.

<sup>47</sup> Adjustments are made according to PPP conversions. These conversions are established by the World Bank to allow currencies to be compared across countries in terms of how much an individual can buy in a specific country. The \$1.90 in 2011 PPP means that \$1.90 could buy the same amount of goods in another country as \$1.90 could in the United States in 2011.

<sup>48</sup> World Bank. 2015. Poverty & Equality Data FAQs. <http://go.worldbank.org/PYLADRLUN0>.

<sup>49</sup> This indicator differs from the depth of poverty indicator used by the World Bank and previously by Feed the Future. As modified, this indicator only tracks the depth of poverty of households under the poverty threshold, rather than including all households and assigning non-poor households a shortfall of zero. Including the poor and non-poor households means the depth of poverty can decrease either because poor households have crossed the poverty threshold or because poor households have become less poor. One of the limitations of removing the non-poor households from the calculation is that it is possible that the depth of poverty of the poor may increase over time, because previously poor households cross the poverty threshold, leaving only households that may have started with deeper levels of poverty. Changes in this indicator must be analyzed in conjunction with changes in the prevalence of poverty indicator to capture that dynamic.

economic system vulnerable.<sup>50</sup> A reduction in the prevalence of “near-poor” individuals is a positive change in the resilience of the system.

#### 4.1.1 The \$1.90 poverty threshold

##### Poverty prevalence

9.2 percent of individuals in the ZOI live below the \$1.90 poverty threshold. Gendered household type was not significantly associated with prevalence of poverty at the \$1.90 threshold. Household education was significantly associated with the prevalence of poverty: households with less than a primary education were most likely to fall below the poverty line, at nearly 18.0 percent, and households with a higher education were least likely to do so, at 2.9 percent. Unsurprisingly, a household’s wealth quintile and SEI scores were both significantly associated with the prevalence of poverty, with a higher wealth quintile associated with a lower likelihood of poverty at the \$1.90 threshold, and higher shock exposure associated with a greater likelihood of poverty.

##### Depth of poverty of the poor

The depth of poverty of the poor in the ZOI is 19.9 percent of the poverty line, meaning that the average shortfall of the poor from the poverty line is \$0.38 in 2011 PPP. Thus, the average poor person in the ZOI lives at 80.1 percent of the poverty line, and their average consumption is \$1.52 per day (2011 PPP).<sup>51</sup>

Depth of poverty of the poor can indicate the amount of resource transfers that, if *perfectly* targeted to poor households, would be needed to bring everyone in the ZOI up to the poverty line. With a ZOI population of 7.9 million, \$276,184 per day would need to be transferred to the poor to bring their income or expenditures up to the poverty threshold.<sup>52</sup>

Gendered household type was significantly associated with the depth of poverty of the poor. The average poor M&F household lived 20.1 percent below the poverty line, compared to 19.1 percent for poor FNM households. Depth of poverty of the poor at the \$1.90 threshold was also significantly associated with household education, wealth quintiles, and SEI scores. Poor households with no education lived 22.8 percent below the poverty line, compared to 18.8 percent for poor households that completed a primary education, and 20.8 percent of poor households that completed higher education. Unsurprisingly, poor households in the highest wealth quintile lived the closest to the poverty line, at 12.3 percent below the \$1.90 threshold, while those in the lowest wealth quintile lived the furthest below the poverty line, at 21 percent. Depth of poverty of the poor was significantly varied by ecological zone, with poor hill households living on average 21.1 percent below the poverty line compared to 18.2 percent for poor terai households and 8.6 percent for poor mountain households.

<sup>50</sup> Diwakar, Albert, Vizamos, & Shepherd, 2019.

<sup>51</sup> The average value of consumption of a poor person is calculated as follows:  $(80.1 \div 100) * \$1.90/\text{day} = \$1.52/\text{day}$ .

<sup>52</sup> The average daily cost of raising the income or consumption expenditures of the poor up to the poverty threshold is calculated as follows:  $(9.2 \div 100) * (\$1.90/\text{day} - \$1.52/\text{day}) * 7,900,000 = \$276,184/\text{day}$ . The prevalence of poverty in the ZOI is 9.2 percent; the poverty threshold is \$1.90/ day, the average consumption among the poor is \$1.52/ day, and the population is 7.9 million.

### “Near-poor” prevalence

Some 10.9 percent of individuals in the ZOI live at or above the \$1.90 poverty threshold but below 125 percent of that threshold (\$2.38 per day in 2011 PPP). Household educational attainment, wealth quintile, and shock exposure were significantly associated with whether a household was “near-poor.” Households with less than a primary education were the most likely to be “near-poor,” and households with a higher education were the least likely to be “near-poor.” As to be expected, the highest wealth quintile was the least likely to be “near-poor,” and the lowest wealth quintile was the most likely to be “near-poor.”

**Table 4.1.1** presents poverty estimates at the \$1.90 per person per day, 2011 PPP threshold. This table presents poverty estimates for all households in the ZOI, disaggregated by household characteristics, including gendered household type, household educational attainment, wealth quintile, severity of shock exposure, and ecological zone.

**Table 4.1.1: Poverty indicators at the \$1.90 (2011 PPP) per person per day threshold in the ZOI (84.76 Rs), in total and by selected household characteristics**

| Household characteristic      | Prevalence of poverty <sup>a</sup> |                   | Prevalence of “near-poor” <sup>c</sup> |                   | Number of households <sup>d</sup> | Depth of poverty of the poor <sup>e</sup> |                   | Number of households <sup>d</sup> |
|-------------------------------|------------------------------------|-------------------|----------------------------------------|-------------------|-----------------------------------|-------------------------------------------|-------------------|-----------------------------------|
|                               | Percent                            | Sig. <sup>b</sup> | Percent                                | Sig. <sup>b</sup> |                                   | Percent of poverty line                   | Sig. <sup>b</sup> |                                   |
| <b>All households</b>         | 9.2                                |                   | 10.9                                   |                   | 2,407                             | 19.9                                      |                   | 205                               |
| <b>Gender Household Type</b>  |                                    | n/s               |                                        | n/s               |                                   |                                           | **                |                                   |
| Male and female adults        | 9.0                                |                   | 10.6                                   |                   | 1,891                             | 20.1                                      |                   | 160                               |
| Female adults only            | 11.0                               |                   | 13.6                                   |                   | 459                               | 19.1                                      |                   | 44                                |
| Male adults only              | 2.0                                |                   | 3.8                                    |                   | 53                                | ^                                         |                   | 1                                 |
| Children only, no adults      | ^                                  |                   | ^                                      |                   | 4                                 | ^                                         |                   | 0                                 |
| <b>Household education</b>    |                                    | ***               |                                        | ***               |                                   |                                           | **                |                                   |
| No education                  | 10.2                               |                   | 13.8                                   |                   | 150                               | 22.8                                      |                   | 14                                |
| Less than primary             | 18.0                               |                   | 18.8                                   |                   | 521                               | 20.8                                      |                   | 85                                |
| Completed primary             | 9.1                                |                   | 10.7                                   |                   | 1,100                             | 18.8                                      |                   | 87                                |
| Completed secondary           | 14.2                               |                   | 8.6                                    |                   | 334                               | 20.4                                      |                   | 11                                |
| Higher                        | 2.9                                |                   | 3.5                                    |                   | 302                               | 20.8                                      |                   | 8                                 |
| <b>Wealth quintile</b>        |                                    | ***               |                                        | ***               |                                   |                                           | *                 |                                   |
| Highest (wealthiest)          | 0.7                                |                   | 1.9                                    |                   | 472                               | 12.3                                      |                   | 3                                 |
| Fourth                        | 4.8                                |                   | 6.1                                    |                   | 483                               | 16.6                                      |                   | 21                                |
| Middle                        | 9.0                                |                   | 12.5                                   |                   | 481                               | 18.5                                      |                   | 37                                |
| Second                        | 7.9                                |                   | 15.2                                   |                   | 482                               | 21.2                                      |                   | 32                                |
| Lowest (poorest)              | 24.7                               |                   | 20.7                                   |                   | 489                               | 21.0                                      |                   | 112                               |
| <b>Shock exposure index</b>   |                                    | **                |                                        | *                 |                                   |                                           | *                 |                                   |
| Did not experience any shocks | 4.8                                |                   | 10.7                                   |                   | 556                               | 18.3                                      |                   | 31                                |
| Low                           | 8.1                                |                   | 7.5                                    |                   | 687                               | 16.5                                      |                   | 50                                |
| Moderate                      | 11.8                               |                   | 12.5                                   |                   | 547                               | 20.8                                      |                   | 55                                |
| High                          | 11.8                               |                   | 13.6                                   |                   | 590                               | 22.2                                      |                   | 68                                |
| <b>Ecological zone</b>        |                                    | **                |                                        | n/s               |                                   |                                           | ***               |                                   |
| Hill                          | 11.1                               |                   | 12.1                                   |                   | 1,328                             | 21.1                                      |                   | 135                               |
| Terai                         | 7.4                                |                   | 10.0                                   |                   | 993                               | 18.2                                      |                   | 66                                |
| Mountain                      | 2.5                                |                   | 6.1                                    |                   | 86                                | 8.6                                       |                   | 4                                 |

<sup>a</sup> Results not statistically reliable, n<30

<sup>a</sup> The prevalence of poverty is the percentage of individuals living below the \$1.90 2011 PPP per person per day poverty threshold.

<sup>b</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ ; n/s=not significant.

<sup>c</sup> The prevalence of “near-poor” is the percentage of individuals living at or above the \$1.90 per person per day poverty threshold (2011 PPP) but below 125 percent of that threshold, \$2.38 per day.

<sup>d</sup> Records missing information for the disaggregate variables have been excluded from the disaggregated estimates. The unweighted sample size reflects this loss in observations; therefore, the sum of disaggregate sample sizes may not equal the overall sample size.

<sup>e</sup> The depth of poverty of the poor measures, on average, how far the consumption of the poor is below the \$1.90 (2011 PPP) per person per day poverty threshold.

Note: Estimates are based on de jure household members.

Source: Feed the Future Nepal ZOI Survey 2019

#### 4.1.2 The national poverty threshold

Nepal's Central Bureau of Statistics determined Nepal's national poverty threshold to be Rs. 19,262 per person per year in 2010. This threshold uses poverty estimates based on the Nepal Living Standards Survey and is an absolute poverty line based on the cost of basic food and non-food needs.

The prevalence of poverty and the prevalence of “near-poor” households are greater according to the national poverty threshold, relative to the \$1.90 (2011 PPP) threshold. The rates of the depth of poverty are nearly the same, at 19.9 percent for the \$1.90 threshold and 20.7 percent for the national poverty line.

#### Poverty prevalence

11.9 percent of individuals in the ZOI live below the Rs. 19,262 national poverty threshold. Gendered household type was not significantly associated with prevalence of poverty at the national poverty threshold. Household educational attainment was significantly associated with poverty at the national threshold. Households with less than a primary education were the most likely to fall below the poverty line, at 23.7 percent, and households with a higher education were the least likely to do so, at 3.2 percent. Finally, unsurprisingly, a household's wealth quintile and SEI score were both significantly associated with prevalence of poverty. Households in the lowest wealth quintile were the most likely to fall below the poverty line, at 29.4 percent, while households the highest wealth quintile were the least likely to do so, at just 0.7 percent. Similarly, households with a moderate or high SEI score were the most likely to fall below the poverty line, at 15.0 percent and 14.5 percent, respectively, while households that did not experience any shocks were the least likely to fall below the poverty line, at 7.6 percent.

#### Depth of poverty of the poor

The depth of poverty of the poor in the ZOI is 20.7 percent of the national poverty line, meaning that the average shortfall of the poor from the poverty line is Rs. 3,987. Thus, the average poor person in the ZOI lives at 79.3 percent of the national poverty line and their average consumption is Rs. 15,275 per year.<sup>53</sup>

Depth of poverty of the poor can indicate the amount of resource transfers that, if *perfectly* targeted to poor households, would be needed to bring everyone in the ZOI up to the poverty line. With a ZOI population of 7.9 million, Rs. 3,748,178,700 per year would need to be transferred to the poor to bring their income or expenditures up to the national poverty threshold.<sup>54</sup>

Gendered household type, household education, wealth quintile, SEI, and ecological zone were all significantly associated with the depth of poverty of the poor. Poor households with no education fell the farthest below the poverty line, at 24.6 percent, while those that completed secondary education fell

<sup>53</sup> The average value of consumption of a poor person is calculated as follows:  $(79.3 \div 100) * \text{Rs. } 19,262/\text{ day} = \text{Rs. } 15,275/\text{ day}$ .

<sup>54</sup> The average daily cost of raising the income or consumption expenditures of the poor up to the poverty threshold is calculated as follows:  $(11.9 \div 100) * (\text{Rs. } 19,262/\text{ day} - \text{Rs. } 15,275/\text{ day}) * 7,900,000 = \text{Rs. } 3,748,178,700/\text{ day}$ . The prevalence of poverty of the poor in the ZOI is 10.0 percent; the poverty threshold is Rs. 19,262/ day, the average consumption among the poor is Rs. 15,332/ day, and the population is 7.9 million.

16.3 below this threshold. The depth of poverty of the poor largely decreases with wealth quintile, with the highest quintile falling 18.6 percent below the poverty line and the lowest wealth quintile falling 23.1 percent below the poverty line. The depth of poverty also decreases with exposure to shocks. Those that have a high SEI status fell 23.5 percent below the poverty line, while those who did not experience any shocks fell just 16.7 percent below the poverty line. The depth of poverty of the poor at the national level was 22.8 percent in hill regions, compared to 18.2 percent in terai regions and 8.7 percent in the mountain regions.

### “Near-poor” prevalence

Some 12.5 percent of individuals in the ZOI live at or above the Rs. 19,262 national poverty threshold but below 125 percent of that threshold (Rs. 24,078). Gendered household type was not significantly associated with whether a household was “near-poor.” However, household educational attainment, household wealth quintile, SEI scores, and ecological zone were significantly associated with a household’s “near-poor” status. Households with less than a primary education were the most likely to be “near-poor,” at 19.6 percent, and households with a higher education were the least likely to be “near-poor,” at 5.1 percent. As expected, the highest wealth quintile was the least likely to be “near-poor” (2.9 percent), and the lowest wealth quintile was the most likely to be “near-poor” (23.4 percent). Households with a high SEI were the most likely to be “near-poor,” at 17.8 percent, and households that did not experience any shocks were the least likely to be “near-poor,” at 9.7 percent. Prevalence of “near-poor” status was highest in the hill zone (14.6 percent) compared to the terai zone (10.8 percent) and mountain zone (3.6 percent).

**Table 4.1.2** presents poverty estimates at the national poverty threshold for Nepal. Similar to the \$1.90 per day figures, this table presents poverty estimates for all households in the ZOI and disaggregated by household characteristics, including gendered household type, household educational attainment, wealth quintile, and severity of shock exposure.

**Table 4.1.2: Poverty indicators at the national poverty threshold of Rs, 19,262 per person per day (52.77 Rs) in the ZOI, in total and by selected household characteristics**

| Household characteristic       | Prevalence of poverty <sup>a</sup> |                   | Prevalence of “near-poor” <sup>c</sup> |                   | Number of households <sup>d</sup> | Depth of poverty of the poor <sup>e</sup> |                   | Number of households <sup>d</sup> |
|--------------------------------|------------------------------------|-------------------|----------------------------------------|-------------------|-----------------------------------|-------------------------------------------|-------------------|-----------------------------------|
|                                | Percent                            | Sig. <sup>b</sup> | Percent                                | Sig. <sup>b</sup> |                                   | Percent of poverty line                   | Sig. <sup>b</sup> |                                   |
| <b>All households</b>          | 11.9                               |                   | 12.5                                   |                   | 2,407                             | 20.7                                      |                   | 269                               |
| <b>Gendered household type</b> | n/s                                |                   | n/s                                    |                   |                                   | ***                                       |                   |                                   |
| Male and female adults         | 11.7                               |                   | 12.0                                   |                   | 1,891                             | 20.7                                      |                   | 209                               |
| Female adults only             | 14.0                               |                   | 16.2                                   |                   | 459                               | 20.6                                      |                   | 55                                |
| Male adults only               | 2.0                                |                   | 3.8                                    |                   | 53                                | 12.9                                      |                   | 1                                 |
| Children only, no adults       | ^                                  |                   | 3.6                                    |                   | 4                                 | ^                                         |                   | 0                                 |
| <b>Household education</b>     | ***                                |                   | ***                                    |                   |                                   | *                                         |                   |                                   |
| No education                   | 12.7                               |                   | 16.8                                   |                   | 150                               | 24.6                                      |                   | 18                                |
| Less than primary              | 23.7                               |                   | 19.6                                   |                   | 521                               | 21.1                                      |                   | 111                               |
| Completed primary              | 11.2                               |                   | 12.2                                   |                   | 1,100                             | 20.8                                      |                   | 108                               |
| Completed secondary            | 7.4                                |                   | 7.9                                    |                   | 334                               | 16.3                                      |                   | 19                                |
| Higher                         | 3.2                                |                   | 5.1                                    |                   | 302                               | 24.8                                      |                   | 9                                 |
| <b>Wealth quintile</b>         | ***                                |                   | ***                                    |                   |                                   | *                                         |                   |                                   |
| Highest (wealthiest)           | 0.7                                |                   | 2.9                                    |                   | 472                               | 18.6                                      |                   | 132                               |
| Fourth                         | 6.7                                |                   | 7.0                                    |                   | 483                               | 17.3                                      |                   | 48                                |
| Middle                         | 13.1                               |                   | 14.0                                   |                   | 481                               | 18.0                                      |                   | 53                                |
| Second                         | 11.2                               |                   | 17.1                                   |                   | 482                               | 20.2                                      |                   | 29                                |
| Lowest (poorest)               | 29.4                               |                   | 23.4                                   |                   | 489                               | 23.1                                      |                   | 3                                 |
| <b>Shock exposure index</b>    | **                                 |                   | ***                                    |                   |                                   | *                                         |                   |                                   |
| Did not experience any shocks  | 7.6                                |                   | 9.7                                    |                   | 556                               | 16.7                                      |                   | 44                                |
| Low                            | 10.4                               |                   | 7.9                                    |                   | 687                               | 18.0                                      |                   | 65                                |
| Moderate                       | 15.0                               |                   | 14.8                                   |                   | 547                               | 21.8                                      |                   | 72                                |
| High                           | 14.5                               |                   | 17.8                                   |                   | 590                               | 23.5                                      |                   | 83                                |
| <b>Ecological zone</b>         | n/s                                |                   | **                                     |                   |                                   | *                                         |                   |                                   |
| Hill                           | 13.5                               |                   | 14.6                                   |                   | 1,328                             | 22.8                                      |                   | 164                               |
| Terai                          | 10.4                               |                   | 10.8                                   |                   | 993                               | 18.2                                      |                   | 94                                |
| Mountain                       | 5.9                                |                   | 3.6                                    |                   | 86                                | 8.7                                       |                   | 7                                 |

^ Results not statistically reliable, n<30

<sup>a</sup> The prevalence of poverty is the percentage of individuals living below the Rs. 19,262 per person per day poverty threshold.

<sup>b</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.



<sup>c</sup> The prevalence of “near-poor” is the percentage of individuals living at or above the Rs. 19,262 per person per day poverty threshold but below 125 percent of that threshold, or Rs. 24,078 per day.

<sup>d</sup> Records missing information for the disaggregate variables have been excluded from the disaggregated estimates. The unweighted sample size reflects this loss in observations; therefore, the sum of disaggregate sample sizes may not equal the overall sample size.

<sup>e</sup> The depth of poverty of the poor measures, on average, how far the consumption of the poor is below the Rs. 19,262 per person per day poverty threshold.

Notes: Estimates are based on de jure household members.

Sources: Feed the Future Nepal ZOI Survey 2019, Central Bureau of Statistics based on the Nepal Living Standard Survey

## 4.2 Asset-based wealth index and comparative wealth index

Asset ownership can be used to predict a household's long-term welfare, or its capacity to earn income and withstand shocks in the future. The number and type of assets a household owns are associated with household resilience across national contexts,<sup>55</sup> and asset-based wealth indices have increasingly been used as alternatives to income and consumption expenditure-based measures for several reasons, including the following: (1) they are more stable measures of socioeconomic well-being, (2) they are able to better detect differences in equity, and (3) they are easier to collect and require shorter interviews.<sup>56</sup>

The asset-based wealth index was calculated using data on household characteristics from Module 2, Dwelling Characteristics, in the Feed the Future Nepal ZOI Survey 2019 questionnaire. The index comprises the following variables: presence of domestic servants in the household; agricultural land ownership and amount of land; number of people per sleeping room; house ownership; drinking water source; type of sanitation facility; floor material; roof material; wall material; cooking fuel; type and number of farm animals; household possessions, including large and small durable goods; and whether any member of the household holds a bank account. A wealth score is generated for each surveyed household, and then households are grouped into quintiles based on their relative distribution. Appendix 2.2b contains additional information about the methodology used to calculate the wealth index.

**Table 4.2.1** presents the wealth quintiles for the population living in the Nepal ZOI. Estimates in **Table 4.2.1** are shown for the de jure household population and disaggregated by household characteristics, including gendered household type, household educational attainment, poverty status, severity of shock exposure, and ecological zone.

At baseline, 18.3 percent of households fell into the lowest wealth quintile while 21.9 percent of households fell in the highest wealth quintile. Gendered household type was not significantly associated with wealth quintile; however, household education was. Households with less than a primary and no education were more likely to be in the lowest or second-to-lowest quintiles. Households that completed secondary education or higher were more likely to be in the highest quintile. Poverty status was also significantly associated with wealth quintile. Most poor households fell into the lowest wealth quintile. Although a sizeable proportion of non-poor households fell into all five quintiles, the plurality of non-poor households fell in the highest wealth quintile. The SEI was also significantly associated with wealth quintile: households that experienced no or low shocks were much more likely to fall in the highest wealth quintile, whereas households experiencing moderate and high shocks were more likely to fall in the lowest quintile. Finally, ecological zone was significantly associated with asset-based wealth as well, with 31.7 percent of hill households falling in the lowest wealth quintile, compared to only 3.0 percent of terai households and 3.3 percent of mountain households.

<sup>55</sup> Boukary, Diaw, & Wünscher, 2016; Phadera, Michelson, Winter-Nelson, & Goldsmith, 2019.

<sup>56</sup> Chakraborty, Fry, Behl, & Longfield, 2016; Dekker, 2006; Filmer & Pritchett, 2001.

**Table 4.2.1: Percent distribution of households in the ZOI by quintile according to the Nepal Asset-Based Wealth Index, in total and by selected household characteristics**

| Household characteristic       | Wealth quintile |            |            |            |            | Sig. <sup>a</sup> | High/low ratio | Number of households <sup>b</sup> |
|--------------------------------|-----------------|------------|------------|------------|------------|-------------------|----------------|-----------------------------------|
|                                | Lowest          | Second     | Middle     | Fourth     | Highest    |                   |                |                                   |
| <b>All households</b>          | 18.3            | 18.7       | 20.5       | 20.6       | 21.9       |                   | 1.2            | 2,481                             |
| <b>Gendered household type</b> |                 |            |            |            |            | n/s               |                | 2,481                             |
| Male and female adults         | 18.4            | 18.6       | 20.2       | 20.7       | 22.2       |                   | 1.2            | 1,944                             |
| Female adults only             | 19.3            | 19.0       | 21.6       | 20.6       | 19.5       |                   | 1.0            | 473                               |
| Male adults only               | 13.1            | 23.6       | 18.3       | 21.6       | 23.4       |                   | 1.8            | 54                                |
| Children only, no adults       | ^               | ^          | ^          | ^          | ^          |                   | -              | 10                                |
| <b>Household education</b>     |                 |            |            |            |            | ***               |                | 2,481                             |
| No education                   | 25.7            | 28.6       | 23.5       | 16.9       | 5.4        |                   | 0.2            | 158                               |
| Less than primary              | 29.8            | 23.7       | 19.3       | 19.2       | 8.1        |                   | 0.3            | 536                               |
| Completed primary              | 16.2            | 18.2       | 22.9       | 22.9       | 19.8       |                   | 1.2            | 1,132                             |
| Completed secondary            | 13.1            | 14.        | 19.6       | 20.9       | 31.6       |                   | 2.4            | 340                               |
| Higher                         | 9.5             | 11.8       | 13.4       | 16.7       | 48.7       |                   | 5.1            | 315                               |
| <b>Poverty status</b>          |                 |            |            |            |            | ***               |                | 2,411                             |
| Poor                           | 53.0            | 15.9       | 19.8       | 9.6        | 1.7        |                   | 0.0            | 205                               |
| Non-poor                       | 15.7            | 18.9       | 20.5       | 21.6       | 23.3       |                   | 1.5            | 2,206                             |
| <b>Shock exposure index</b>    |                 |            |            |            |            | ***               |                | 2,440                             |
| Did not experience any shocks  | 9.3             | 19.0       | 17.8       | 21.9       | 32.1       |                   | 3.5            | 571                               |
| Low                            | 13.3            | 19.0       | 21.6       | 21.9       | 24.3       |                   | 1.8            | 709                               |
| Moderate                       | 18.6            | 15.7       | 25.2       | 22.1       | 18.4       |                   | 1.0            | 561                               |
| High                           | 34.7            | 21.6       | 16.7       | 16.6       | 10.4       |                   | 0.3            | 599                               |
| <b>Ecological zone</b>         |                 |            |            |            |            | ***               |                | 2,481                             |
| Hill                           | 31.7            | 27.5       | 14.6       | 12.2       | 14.0       |                   | 0.4            | 1,353                             |
| Terai                          | 3.0             | 7.8        | 26.3       | 29.9       | 33.0       |                   | 11.0           | 1,038                             |
| Mountain                       | 3.3             | 17.9       | 35.7       | 33.7       | 9.5        |                   | 2.9            | 90                                |
| <b>Number of households</b>    | <b>497</b>      | <b>496</b> | <b>496</b> | <b>496</b> | <b>496</b> |                   | -              | <b>2,481</b>                      |

<sup>a</sup> Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Records missing information for the disaggregate variables have been excluded from the disaggregated estimates. The unweighted sample size reflects this loss in observations; therefore, the sum of disaggregate sample sizes may not equal the overall sample size.

Note: Estimates are based on de jure household members.

Source: Feed the Future Nepal ZOI Survey 2019

Although the wealth index is useful for studying economic inequalities in a particular country at a given time, it cannot be directly compared across countries or over time. Hence, Rutstein, and Staveteig (2014) developed a methodology to calculate a Comparative Wealth Index (CWI) that allows for direct comparison of economic status across countries and over time. Feed the Future adopted the CWI methodology to develop its ZOI-level indicator: the percentage of households below the threshold of the poorest quintile of the asset-based CWI.

This indicator reflects the percentage of households in the Feed the Future ZOI whose ownership (or lack thereof) of selected assets places the household below a fixed threshold that defines the poorest quintile (bottom 20 percent) in the comparative baseline wealth index that was used to create a cross-nationally, cross-temporally comparable asset-based wealth index. The use of a fixed threshold across ZOIs is possible because the CWI indicator is calculated relative to the reference wealth index. This means that the CWI scores can be compared across ZOI Surveys and over time.

Constructing the CWI indicator involves calculating the wealth index for the selected reference survey, the 2017 Senegal Demographic and Health Survey (DHS), just as was done for Nepal using ZOI Survey data. It also involves calculating anchoring points, four of which are based on unmet basic needs and four of which are based on asset ownership, for both the reference survey and the ZOI Survey.<sup>57</sup> The wealth index scores for the households sampled for the ZOI Survey are then converted into comparable CWI scores using the anchoring points calculated for the ZOI Survey and the reference survey. Finally, the percentage of households below the comparative threshold for the poorest quintile of the reference survey is calculated using the reference survey quintile cutoffs.

**Table 4.2.2** presents the percentage of households by comparative wealth quintile. The percentage of households that fall below the comparative threshold for the poorest quintile of the asset-based CWI in the ZOI is 7.9 percent. Estimates are shown for all households and disaggregated by household characteristics, including gendered household type, household educational attainment, poverty status, severity of shock exposure, and ecological zone.

At baseline, the plurality of households fell into the second wealth quintile (44.8 percent), followed by the third quintile (22.5 percent), fifth quintile (14.4 percent), fourth quintile (10.7 percent), and lastly, the first quintile (7.9 percent). Gendered household type was not significantly associated with wealth quintile; however, household education, poverty status, SEI score, and ecological zone were all significantly associated with CWI quintiles. A majority of households with no education fell into the second quintile (58.7 percent) when compared to households with higher education, where the plurality of households fell into the fifth quintile (36.9 percent). Of non-poor households, 15.1 percent fell into the fifth quintile, compared to zero percent of poor households. The distribution between wealth quintiles for households with a high SEI was concentrated between quintiles one and three, while the distribution was more evenly spread across quintiles two through five for households experiencing no shocks. Lastly, among the hill zone, a majority of households fell into quintile two (57.3 percent), whereas the distributions were more even for terai across quintiles two through five, and mountain households across quintiles two and three.

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<sup>57</sup> The reference country quintile cutoffs and anchoring points are calculated only once but used for the CWI indicator across all ZOI Surveys.

**Table 4.2.2: Percent distribution of households in the ZOI, by quintile according to the Comparative Wealth Index, in total and by selected household characteristics**

| Household characteristic       | Wealth quintile |              |            |            |            | Sig. <sup>a</sup> | High/<br>low<br>ratio <sup>58</sup> | Number of<br>households <sup>b</sup> |
|--------------------------------|-----------------|--------------|------------|------------|------------|-------------------|-------------------------------------|--------------------------------------|
|                                | 1               | 2            | 3          | 4          | 5          |                   |                                     |                                      |
| <b>All households</b>          | 7.9             | 44.8         | 22.5       | 10.7       | 14.4       |                   | 1.8                                 | 2,481                                |
| <b>Gendered household type</b> |                 |              |            |            |            | n/s               |                                     | 2,481                                |
| Male and female adults         | 8.0             | 44.0         | 23.3       | 10.4       | 14.3       |                   | 1.8                                 | 1,944                                |
| Female adults only             | 7.7             | 48.9         | 18.6       | 12.2       | 12.6       |                   | 1.6                                 | 473                                  |
| Male adults only               | 6.4             | 39.7         | 30.6       | 6.5        | 16.9       |                   | 2.6                                 | 54                                   |
| Children only, no adults       | ^               | ^            | ^          | ^          | ^          |                   | ^                                   | 10                                   |
| <b>Household education</b>     |                 |              |            |            |            | ***               |                                     | 2,481                                |
| No education                   | 12.9            | 58.7         | 20.7       | 4.7        | 3.1        |                   | 0.2                                 | 158                                  |
| Less than primary              | 13.6            | 54.7         | 22.1       | 6.5        | 3.2        |                   | 0.2                                 | 536                                  |
| Completed primary              | 7.5             | 44.8         | 24.4       | 12.2       | 11.1       |                   | 1.5                                 | 1,132                                |
| Completed secondary            | 3.9             | 39.3         | 21.2       | 12.3       | 23.3       |                   | 6.0                                 | 340                                  |
| Higher                         | 2.1             | 28.6         | 18.9       | 13.5       | 36.9       |                   | 17.6                                | 315                                  |
| <b>Poverty status</b>          |                 |              |            |            |            | ***               |                                     | 2,411                                |
| Poor                           | 29.6            | 57.4         | 11.4       | 1.7        | 0.0        |                   | n/a                                 | 205                                  |
| Non-poor                       | 6.3             | 43.6         | 23.6       | 11.4       | 15.1       |                   | 2.4                                 | 2,206                                |
| <b>Shock exposure index</b>    |                 |              |            |            |            | ***               |                                     | 2,440                                |
| Did not experience any shocks  | 4.4             | 36.6         | 23.7       | 12.5       | 22.8       |                   | 5.2                                 | 571                                  |
| Low                            | 5.0             | 44.4         | 23.1       | 11.7       | 15.9       |                   | 3.2                                 | 709                                  |
| Moderate                       | 7.5             | 45.5         | 26.1       | 10.2       | 10.8       |                   | 1.4                                 | 561                                  |
| High                           | 16.1            | 53.3         | 17.9       | 7.6        | 5.1        |                   | 0.3                                 | 599                                  |
| <b>Ecological zone</b>         |                 |              |            |            |            | ***               |                                     | 2,481                                |
| Hill                           | 13.7            | 57.3         | 13.7       | 4.4        | 10.9       |                   | 0.8                                 | 1,353                                |
| Terai                          | 1.4             | 29.3         | 31.3       | 18.7       | 19.3       |                   | 13.8                                | 1,038                                |
| Mountain                       | 0.0             | 43.8         | 44.2       | 9.7        | 2.4        |                   | -                                   | 90                                   |
| <b>Number of households</b>    | <b>223</b>      | <b>1,155</b> | <b>542</b> | <b>248</b> | <b>313</b> |                   | -                                   | <b>2,481</b>                         |

^ Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Records missing information for the disaggregate variables have been excluded from the disaggregated estimates. The unweighted sample size reflects this loss in observations; therefore, the sum of disaggregate sample sizes may not equal the overall sample size.

Note: Estimates are based on de jure household members.

Source: Feed the Future Nepal ZOI Survey 2019

<sup>58</sup> High-to-low ratios were calculated by comparing the highest quintile (5) to the lowest quintile (1) for which data above the value of zero was available.

## 5. RESILIENCE

According to USAID, resilience is “the ability of people, households, communities, and systems to mitigate, adapt to, and recover from shocks and stresses in a manner that reduces chronic vulnerability and facilitates inclusive growth.”<sup>59</sup> Based on this definition, household resilience is the ability of a household to mitigate, adapt to, and recover from shocks and stresses. The shocks and stresses are events and trends that impact well-being outcomes and future resilience capacities.

Resilience measurement comprises measures related to shocks and stressors experienced, coping capacities, and well-being outcomes.<sup>60</sup> No single indicator measures resilience. This chapter presents shock exposure and severity statistics in Section 5.1, followed by findings on four key Feed the Future ZOI-level resilience indicators: (1) the Ability to Recover from Shocks and Stresses Index (ARSSI); (2) the proportion of households that believe local government will respond effectively to future shocks and stresses; (3) the proportion of households participating in group-based savings, micro-finance, or lending programs; and (4) the index of social capital at the household level.

Although information on shocks and stressors is specific to the resilience chapter, and capacities related to local government response, social capital, and savings are also reflected in this chapter, other capacities and well-being outcomes are captured in other report chapters. Decision-making capacities are captured in the A-WEAI module, coping strategies used during period of food shortages are captured in the food security module, and well-being outcomes are included in the chapters on poverty, food security, and nutrition.

### 5.1 Shock exposure and severity

Respondents to the resilience and food security module of the ZOI Survey were asked whether their households experienced 24 shocks or stressors during the 12 months preceding the survey. For any experienced, the respondents were asked to rate the severity of the shock or stressor on the household’s income and food consumption using the same four-point scale for each. This information is used to calculate the SEI. Because each surveyed household did not experience the same types of shocks or stressors of the same severity, it is necessary to create the SEI as a measure of the household’s ability to recover from the shocks and stressors that it experienced. In other words, SEI is a weighted sum of the incidence of each shock, weighted by perceived severity of the shock.

The 24 shocks and stresses included in the questionnaire, specific to the Nepal ZOI, were as follows: too much rain, too little rain, storms, hail, landslides, earthquakes, erosion of land, loss of land, increases in food price, stealing belongings, fire, divorce, loss of job, end of assistance, lack of crop inputs, disease affected crops, pest affected crops, stealing of crops, lack of livestock inputs, disease affected livestock, stealing of animals, inability to sell crops or livestock for a fair price, severe illness of a family member, and death of a family member.

After indicating whether each shock was experienced in the last 12 months, respondents were asked about the severity of each on income security and food consumption. Responses range from not severe

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<sup>59</sup> USAID, 2012.

<sup>60</sup> Resilience resources can be found on REAL (FSNNETWORK, n.d.).

(assigned a value of one) to extremely severe (assigned a value of four). The responses to the two questions are combined into one severity variable that has a minimum value of four and a maximum value of eight for each shock and stressor. The SEI is a weighted sum of the incidence of each shock (a variable equal to one if the shock or stressor was experienced and zero otherwise), weighted by the perceived severity of the shock. The SEI ranges from 0 to 192 (if all 24 shocks and stressors were experienced by the households at the highest level of severity).

**Table 5.1.1** presents the percentage of households that were exposed to each of the 24 shocks and stressors included in the survey during the year preceding the survey. The table also presents the perceived severity of each shock or stressor on the household's income and food consumption, among the households that experienced it.

Shocks and stressors that affect the highest percentage of households include pests affecting crops (39.0 percent), disease affecting crops (35.3 percent), severe illness in the family (30.0 percent), and a sharp increase in food prices (27.1 percent). Of the households that experienced these shocks, a plurality perceived the impact of pests affecting crops on income and on food consumption to be somewhat severe (51.1 percent and 40.8 percent, respectively). Similarly, of the households that experienced these shocks, the largest percentage perceived the impact of disease affecting crops on income and on food consumption to be somewhat severe (46.8 percent and 40.9 percent, respectively). Of the households that experienced a severe illness in the family, 47.6 percent perceived the impact of such a shock on income to be extremely severe, while 55.6 percent of households perceived the impact of such a shock on food consumption to be not severe. Of the households that experienced a sharp increase in food prices, 43.3 percent perceived the impact of such a shock on income to be somewhat severe, while 28.2 percent perceived the impact of such a shock on income to be extremely severe.

The modal perception of the impact of any shock on income is somewhat severe. The exceptions include loss of land, severe illness in family, and death in household. While only 3.3 percent of households experienced loss of land, of those that did, 30.4 percent perceived the impact on income to be extremely severe. 3.7 percent of households experienced a death in the household, and 49.8 percent of these households perceived the impact of that death on income to be extremely severe. Most notably, 30.0 percent of households experienced a severe illness in the family, which was the third most common type of shock or stressor. 47.6 percent of those households perceived the impact of that illness on income to be extremely severe. Thus, severe illness in the family impacts the greatest quantity of households' incomes most severely.

**Table 5.1.1: Percent of households in the ZOI exposed to each shock or stressor and perceived severity of shocks on household income and food consumption during the 12 months preceding the survey**

| Shock or stressor                 | Experienced | Perceived impact on income |                 |        |                  | Perceived impact on food consumption |                 |        |                  | # of households |
|-----------------------------------|-------------|----------------------------|-----------------|--------|------------------|--------------------------------------|-----------------|--------|------------------|-----------------|
|                                   |             | Not severe                 | Somewhat severe | Severe | Extremely severe | Not severe                           | Somewhat severe | Severe | Extremely severe |                 |
| Too much rain                     | 16.6        | 27.4                       | 35.6            | 18.4   | 18.6             | 26.7                                 | 34.6            | 21.1   | 17.6             | 413             |
| Too little rain                   | 24.8        | 29.5                       | 42.1            | 14.6   | 13.8             | 35.7                                 | 34.3            | 15.0   | 14.9             | 652             |
| Storms*                           | 18.0        | 28.8                       | 36.0            | 16.1   | 19.0             | 55.2                                 | 26.8            | 10.4   | 7.7              | 443             |
| Hail*                             | 16.9        | 25.4                       | 37.3            | 17.5   | 19.8             | 23.4                                 | 33.7            | 21.9   | 21.0             | 444             |
| Landslide*                        | 4.4         | 32.9                       | 29.8            | 21.1   | 16.1             | 28.0                                 | 31.8            | 21.8   | 18.4             | 109             |
| Earthquakes*                      | ^           | ^                          | ^               | ^      | ^                | ^                                    | ^               | ^      | ^                | 1               |
| Erosion of land                   | 3.2         | 23.1                       | 55.8            | 13.9   | 7.2              | 19.9                                 | 39.8            | 21.0   | 19.3             | 83              |
| Loss of land                      | 3.3         | 17.1                       | 27.1            | 25.5   | 30.4             | 24.8                                 | 40.1            | 8.8    | 26.4             | 80              |
| Sharp increase in food prices     | 27.1        | 6.4                        | 43.3            | 22.1   | 28.2             | 28.0                                 | 34.9            | 20.7   | 16.4             | 690             |
| Belongings stolen or destroyed    | 4.0         | 15.6                       | 41.5            | 16.8   | 26.1             | 59.1                                 | 25.5            | 3.2    | 12.2             | 99              |
| Fire*                             | 0.8         | 19.0                       | 4.6             | 13.3   | 63.1             | 45.4                                 | 16.3            | 2.1    | 36.2             | 23              |
| Divorce*                          | 0.8         | 20.3                       | 19.0            | 22.3   | 38.5             | 30.6                                 | 21.4            | 23.6   | 24.5             | 19              |
| Loss of job*                      | 5.4         | 2.2                        | 23.5            | 28.9   | 45.4             | 37.3                                 | 24.9            | 20.5   | 17.3             | 133             |
| End of assistance*                | 4.5         | 3.1                        | 31.9            | 29.4   | 35.6             | 27.3                                 | 31.8            | 22.4   | 18.5             | 109             |
| Unable to access crop inputs      | 11.2        | 18.0                       | 53.6            | 11.2   | 17.1             | 43.2                                 | 34.4            | 12.7   | 9.7              | 230             |
| Disease affecting crops           | 35.3        | 24.1                       | 46.8            | 17.6   | 11.5             | 26.9                                 | 40.9            | 20.4   | 11.8             | 729             |
| Pests affecting crops             | 39.0        | 25.8                       | 51.1            | 15.6   | 7.5              | 32.9                                 | 40.8            | 17.0   | 9.4              | 800             |
| Theft of crops                    | ^           | ^                          | ^               | ^      | ^                | ^                                    | ^               | ^      | ^                | 14              |
| Unable to access livestock inputs | 2.6         | 8.6                        | 45.2            | 22.5   | 23.8             | 35.5                                 | 21.6            | 27.0   | 15.9             | 53              |
| Disease affecting livestock       | 23.6        | 11.4                       | 50.8            | 16.9   | 20.9             | 58.1                                 | 26.8            | 9.2    | 5.9              | 488             |



| Shock or stressor                                    | Experienced  | Perceived impact on income |                 |        |                  | Perceived impact on food consumption |                 |        |                  | # of households |
|------------------------------------------------------|--------------|----------------------------|-----------------|--------|------------------|--------------------------------------|-----------------|--------|------------------|-----------------|
|                                                      |              | Not severe                 | Somewhat severe | Severe | Extremely severe | Not severe                           | Somewhat severe | Severe | Extremely severe |                 |
| Animals stolen                                       | ^            | ^                          | ^               | ^      | ^                | ^                                    | ^               | ^      | ^                | 13              |
| Unable to sell crops, livestock, etc., at fair price | 5.6          | 5.2                        | 53.9            | 21.4   | 19.5             | 54.2                                 | 25.5            | 14.7   | 5.6              | 146             |
| Severe illness in family                             | 30.0         | 5.4                        | 26.9            | 20.1   | 47.6             | 55.6                                 | 23.8            | 9.4    | 11.3             | 747             |
| Death in household                                   | 3.7          | 17.3                       | 19.5            | 13.5   | 49.8             | 57.0                                 | 15.7            | 8.8    | 18.5             | 96              |
| <b>Number of households</b>                          | <b>2,440</b> |                            |                 |        |                  |                                      |                 |        |                  |                 |

^ Results not statistically reliable, n<30

\* Signifies Nepal-specific shock added to the Feed the Future core questionnaire.

Note: Estimates are based on de jure household members.

Source: Feed the Future Nepal ZOI Survey 2019

The average number of shocks experienced by households in the ZOI is between two and three. On average, respondents considered the shocks that their households experienced to have a somewhat severe impact on their household's food consumption. **Table 5.1.2** categorizes households by their SEI score: the number and severity of shocks and stressors that they experienced during the 12 months preceding the survey. SEI scores were organized according to the following categories: no shocks (SEI 0), low shocks (SEI 2–8), moderate shocks (SEI 9–18), and high shocks (SEI 19–144). A roughly similar proportion of households fell into each of these four categories. However, the largest percentage (29.6) of households experienced low shocks, and the smallest percentage (22.2) experienced moderate shocks.

Gendered household type was significantly associated with shock severity. For M&F households, shock status was relatively equal across the four categories, with the largest proportion (28.9 percent) of M&F households experiencing low shocks, and the smallest (23.4 percent) experiencing no shocks. There is slightly greater diversity within FNM households. The largest percentage (32.7 percent) of FNM households experienced low shocks, and the smallest percentage (16.3 percent) experienced moderate shocks. There was much greater variation within MNF households, although the sample size was small (57): the greatest proportion of MNF households experienced no shocks (46.3 percent), and the smallest proportion (11.1 percent) experienced moderate shocks. It is interesting to note that MNF households were much more likely than M&F and FNM household types to experience no shocks. Among the households that did experience shocks, however, FNM or M&F households were more likely to experience a high number of shocks than MNF households.

**Table 5.1.2: Percent distribution of households in the ZOI by SEI score, in total and by gendered household type**

| Indicator                     | SEI scores | Total | Gendered household type |                    |                  |               | Sig. <sup>a</sup> |
|-------------------------------|------------|-------|-------------------------|--------------------|------------------|---------------|-------------------|
|                               |            |       | Male and female adults  | Female adults only | Male adults only | Children only |                   |
| Shock severity                |            |       |                         |                    |                  |               | **                |
| Did not experience any shocks | 0          | 24.9  | 23.4                    | 27.9               | 46.3             | ^             |                   |
| Low                           | 2–8        | 29.6  | 28.9                    | 32.7               | 30.3             | ^             |                   |
| Moderate                      | 9–18       | 22.2  | 24.0                    | 16.3               | 11.1             | ^             |                   |
| High                          | 19–144     | 23.2  | 23.7                    | 23.1               | 12.3             | ^             |                   |
| Number of households          |            | 2,440 | 1,900                   | 471                | 57               | 12            |                   |

<sup>a</sup> Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

Note: Estimates are based on de jure household members.

Source: Feed the Future Nepal ZOI Survey 2019

## 5.2 Ability to recover from shocks and stresses index (ARSSI)

In cross-sectional surveys, it is challenging to collect information on “actual recovery;” therefore, the ZOI survey collected information on the ARSSI, a proxy indicator for “actual recovery” that captures a household's self-perceived ability to recover from the shocks and stresses that occur in the ZOI. The index comprises two components: (1) a base ability to recover component that captures how households are currently able to meet food needs relative to the past year and (2) a forward-looking component that captures how households expect to be able to manage shocks and stresses in the

future. The ARSSI corrects the ability to recover index for differences in shock exposure among households and is therefore comparable across households. Specifically, the ARSSI is made up of two individual indices: the SEI and the Ability-to-Recover Index (ATR).

### 5.2.1 Shock Exposure Index

The SEI methodology is described in detail in Section 5.1: Shock exposure and severity.

### 5.2.2 Ability to Recover

The ATR index is calculated using the following responses to two questions, after the respondent is asked about his or her household exposure to and severity of the 24 types of shocks:

1. Would you say your household's ability to meet your food needs is:
  - a. Better than before these difficult times? (Assigned a value of three)
  - b. The same as before these difficult times? (Assigned a value of two)
  - c. Or worse than before these difficult times? (Assigned a value of one)
2. Looking ahead over the next year, do you believe your household's ability to meet your food needs will be:
  - a. Better than before these difficult times? (Assigned a value of three)
  - b. The same as before these difficult times? (Assigned a value of two)
  - c. Or worse than before these difficult times? (Assigned a value of one)

The responses to these two questions are combined into one variable that ranges from 2.0 to 6.0, where a higher score represents a greater ability to recover.

### 5.2.3 Ability to Recover from Shocks and Stresses Index

The shock exposure-corrected ARSSI is a measure of ATR that corrects for any differences between households in their shock exposure and is therefore comparable across households. A linear regression of the base ATR index on the SEI yields the average difference in the ability to recover index given an increase of one in the SEI. As with the ATR index, a higher ARSSI score represents a greater ability to recover, controlling for differences in shock exposure. In the Nepal ZOI, ARSSI ranged from 2.0 to 7.0.

**Table 5.2.1** presents the mean ARSSI score and households' self-perceived ability to meet their food needs, at the time of the survey and over the next year, for all households and by household characteristics, including gendered household type, household educational attainment, wealth quintile, poverty status, and ecological zone. Note that the survey was conducted in the Nepal post-harvest season when food supplies were still adequate for the purposes of food security measurement, and the ARSSI may fluctuate slightly up or down for surveys closer or further from the harvest.

The average ARSSI score is 5.2. M&F households have a slightly above-average score of 5.3, while FNM households have a slightly below-average score of 5.0. These differences are statistically significant. Most households believe their ability to meet household food needs was worse than before exposure to a shock or stressor. 58.2 percent of M&F households and 52.2 percent of FNM households believe that their ability to meet food needs was worse than before shock exposure. The perceptions of the households' ability to meet food needs over the next year appears even worse: 68.3 percent of M&F

households and 62.8 percent of FNM households believe that their ability to meet food needs would be worse over the next year than before shock exposure.

Higher household educational attainment is associated with higher ARSSI scores. Households with no education score 4.9 on average; those with less than a primary education score 5.1 on average; those who completed primary and those who completed secondary score 5.2 on average, equal to the overall mean; and those with a higher education score 5.5 on average, 0.3 points above the overall mean. These differences are statistically significant at the five percent level. Of households with the highest levels of education, 68.1 percent perceive their ability to meet food needs at the time of the survey as worse than before shock exposure, while only 46.2 percent of those with no education perceive their ability to meet food needs as worse than before shock exposure. These differences are statistically significant. Similarly, 80.9 percent of households with the highest level of education perceive their ability to meet food needs over the next year as worse than before shock exposure, while only 56.0 percent of households with no education perceive their ability to meet food needs over the next year as worse than before shock exposure. These differences are statistically significant.

The wealth quintile of a household is not significantly associated with ARSSI scores. The mean score ranges from 5.2 in the lowest, second, middle, and fourth quintiles to 5.3 in the highest quintile. Of the wealthiest households, 64.2 percent report that their ability to meet food needs is worse than before shock exposure, while 46.7 percent of the poorest households report that their ability to meet food needs is worse than before shock exposure. These differences are statistically significant. Again, a higher percentage of households in the highest wealth quintile believe their ability to meet food needs will be worse the following year than those in the lowest wealth quintile.

Poverty status is significantly associated with household perception of ability to meet food needs at the time of the survey. While 58.0 percent of non-poor households report that their ability to meet food needs is worse than before shock exposure, 42.2 percent of poor households report that their ability to meet food needs is worse than before shock exposure. This difference is statistically significant.

Ecological zone is significantly associated with ARSSI scores. The mean ARSSI score in hill zones is 5.3, compared to 5.1 in terai zones and 4.9 in mountain zones. Some 58.4 percent of hill households report that their ability to meet food needs at the time of survey is worse than before shock exposure, compared to 55.9 percent in terai zones and 50.2 percent in mountain zones. Of hill households, 69.7 percent report that their ability to meet food needs over the next year will be worse than at the time of survey, compared to 65.6 percent in terai zones and 56.4 percent in mountain zones.

**Table 5.2.1: Mean ARSSI scores and households' self-perceived ability to meet their food needs, at the time of the survey and over the next year, compared to before shock exposure, in total and by selected household characteristics**

| Household characteristic | Mean ARSSI score | Sig. <sup>a</sup> | Percent of households able to meet household food needs |      |       |                   |                |      |       |                   | Number of households <sup>b,c</sup> |
|--------------------------|------------------|-------------------|---------------------------------------------------------|------|-------|-------------------|----------------|------|-------|-------------------|-------------------------------------|
|                          |                  |                   | At time of survey                                       |      |       |                   | Over next year |      |       |                   |                                     |
|                          |                  |                   | Better                                                  | Same | Worse | Sig. <sup>a</sup> | Better         | Same | Worse | Sig. <sup>a</sup> |                                     |
| All households           | 5.2              |                   | 5.3                                                     | 37.9 | 56.8  |                   | 6.8            | 26.1 | 67.1  |                   | 1,566                               |
| Gendered household type  |                  | ***               |                                                         |      |       | n/s               |                |      |       | n/s               | 1,566                               |
| Male and female adults   | 5.3              |                   | 4.7                                                     | 37.1 | 58.2  |                   | 6.0            | 25.7 | 68.3  |                   | 1,247                               |
| Female adults only       | 5.0              |                   | 7.1                                                     | 40.7 | 52.2  |                   | 10.5           | 26.7 | 62.8  |                   | 290                                 |
| Male adults only         | ^                |                   | ^                                                       | ^    | ^     |                   | ^              | ^    | ^     |                   | 25                                  |
| Children only, no adults | ^                |                   | ^                                                       | ^    | ^     |                   | ^              | ^    | ^     |                   | 4                                   |
| Household education      |                  | **                |                                                         |      |       | *                 |                |      |       | *                 | 1,566                               |
| No education             | 4.9              |                   | 8.0                                                     | 45.8 | 46.2  |                   | 9.3            | 34.7 | 56.0  |                   | 87                                  |
| Less than primary        | 5.1              |                   | 4.6                                                     | 40.9 | 54.5  |                   | 7.7            | 31.2 | 61.1  |                   | 349                                 |
| Completed primary        | 5.2              |                   | 6.3                                                     | 36.2 | 57.6  |                   | 6.2            | 25.5 | 68.4  |                   | 736                                 |
| Completed secondary      | 5.2              |                   | 3.0                                                     | 44.1 | 52.9  |                   | 8.3            | 26.4 | 65.3  |                   | 210                                 |
| Higher                   | 5.5              |                   | 3.9                                                     | 28.0 | 68.1  |                   | 4.7            | 14.4 | 80.9  |                   | 184                                 |
| Wealth quintile          |                  | n/s               |                                                         |      |       | *                 |                |      |       | n/s               | 1,566                               |
| Highest (wealthiest)     | 5.3              |                   | 5.1                                                     | 30.7 | 64.2  |                   | 4.5            | 24.8 | 70.8  |                   | 245                                 |
| Fourth                   | 5.2              |                   | 4.7                                                     | 37.5 | 57.8  |                   | 7.0            | 26.3 | 66.7  |                   | 314                                 |
| Middle                   | 5.2              |                   | 6.7                                                     | 35.0 | 58.3  |                   | 7.9            | 25.8 | 66.3  |                   | 329                                 |
| Second                   | 5.2              |                   | 4.7                                                     | 35.4 | 60.0  |                   | 9.3            | 24.0 | 66.7  |                   | 307                                 |
| Lowest (poorest)         | 5.2              |                   | 5.1                                                     | 48.2 | 46.7  |                   | 5.3            | 28.8 | 66.0  |                   | 371                                 |
| Poverty status           |                  | *                 |                                                         |      |       | ***               |                |      |       | n/s               | 1,537                               |
| Poor                     | 5.0              |                   | 4.6                                                     | 53.1 | 42.2  |                   | 9.2            | 34.0 | 56.9  |                   | 148                                 |
| Non-poor                 | 5.2              |                   | 5.5                                                     | 36.5 | 58.0  |                   | 6.6            | 25.3 | 68.1  |                   | 1,389                               |
| Ecological zone          |                  | *                 |                                                         |      |       | n/s               |                |      |       | n/s               | 1,566                               |
| Hill                     | 5.3              |                   | 4.0                                                     | 37.6 | 58.4  |                   | 6.6            | 23.7 | 69.7  |                   | 772                                 |
| Terai                    | 5.1              |                   | 6.7                                                     | 37.4 | 55.9  |                   | 6.7            | 27.8 | 65.6  |                   | 729                                 |
| Mountain                 | 4.9              |                   | 3.3                                                     | 46.5 | 50.2  |                   | 10.4           | 33.1 | 56.4  |                   | 65                                  |

^ Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Records missing information for the disaggregate variables have been excluded from the disaggregated estimates. The unweighted sample size reflects this loss in observations; therefore, the sum of disaggregate sample sizes may not equal the overall sample size.

<sup>c</sup> Estimates include only households that experienced at least one shock or stressor during the 12 months preceding the ZOI Survey.

Note: Estimates are based on de jure household members.

Source: Feed the Future Nepal ZOI Survey 2019

## 5.3 Resilience capacities

There are multiple sources of resilience that Feed the Future calls resilience capacities. The four elements of risk reduction strategies, prevention, mitigation, coping, and recovery, support the absorptive, adaptive, and transformative capacities that are essential to strengthen resilience. Many of these are captured in other parts of this report, such as input into decision-making, decision-making autonomy, and coping strategies during times of food shortages. This section presents three additional resilience capacities that research has shown to strengthen resilience and improve adaptation and recovery from shocks and stresses: local government response; participation in group-based savings, micro-finance, or lending programs; and social capital.

### 5.3.1 Proportion of households that believe local government will respond effectively to future shocks and stresses

Believing in the ability of one's local government to respond to shocks and stresses is a proxy for the trust, legitimacy, and effectiveness of local institutions and leadership. Such perceptions contribute to transformative resilience capacity, or the enabling environment that supports, or limits, people's ability to prevent or mitigate the impact of, deal with, and recover from shocks and stresses. This indicator reflects the proportion of households in the ZOI that believe their local government will help the community cope with difficult times in the future, illustrated by a shock known to the community, such as drought or flood. Local government responsiveness can refer to either local leaders or institutions.

**Table 5.3.1** presents the indicator results for all households and by household characteristics, including gendered household type, household educational attainment, wealth quintile, poverty status, severity of shock exposure, and ecological zone.

84.3 percent of respondents believe that local government will help the community cope with future shocks and stresses. Gendered household type, wealth quintile, and ecological zone are not significantly associated with the likelihood that a household believes that local government will respond effectively to future shocks and stresses. Household education is significantly associated with the proportion of households that believe local government will respond effectively to future shocks and stresses. 83.7 percent of households with no education believe the government would respond effectively, compared to 88.8 percent of households with a higher education. Poverty status and shock severity are significantly associated as well, with 76.3 percent of poor households believing the government would respond effectively to future shocks and stresses, compared to 84.9 percent of non-poor households. 93.0 percent of households that did not experience any shocks believe that the government would respond effectively, compared to 73.7 percent of households with high shock exposure, a difference of about 20 percentage points

**Table 5.3.1: Percent of households in the ZOI that believe local government will help the community cope with future shocks and stresses, in total and by selected household characteristics**

| Household characteristic       | Percent | Sig. <sup>a</sup> | Number of households <sup>b</sup> |
|--------------------------------|---------|-------------------|-----------------------------------|
| <b>All households</b>          | 84.3    |                   | 2,332                             |
| <b>Gendered household type</b> |         | n/s               | 2,332                             |
| Male and female adults         | 83.7    |                   | 1,825                             |
| Female adults only             | 85.3    |                   | 446                               |
| Male adults only               | 93.3    |                   | 52                                |
| Children only, no adults       | ^       |                   | 9                                 |
| <b>Household education</b>     |         | **                | 2,332                             |
| No education                   | 83.7    |                   | 147                               |
| Less than primary              | 82.1    |                   | 503                               |
| Completed primary              | 82.0    |                   | 1,062                             |
| Completed secondary            | 90.6    |                   | 321                               |
| Higher                         | 88.8    |                   | 299                               |
| <b>Wealth quintile</b>         |         | n/s               | 2,332                             |
| Highest (wealthiest)           | 84.8    |                   | 462                               |
| Fourth                         | 86.4    |                   | 478                               |
| Middle                         | 85.4    |                   | 457                               |
| Second                         | 87.6    |                   | 462                               |
| Lowest (poorest)               | 76.5    |                   | 473                               |
| <b>Poverty status</b>          |         | **                | 2,279                             |
| Poor                           | 76.3    |                   | 198                               |
| Non-poor                       | 84.9    |                   | 2,081                             |
| <b>Shock exposure index</b>    |         | ***               | 2,332                             |
| Did not experience any shocks  | 93.0    |                   | 535                               |
| Low                            | 87.8    |                   | 678                               |
| Moderate                       | 81.3    |                   | 542                               |
| High                           | 73.7    |                   | 577                               |
| <b>Ecological zone</b>         |         | n/s               | 2,332                             |
| Hill                           | 85.7    |                   | 1,261                             |
| Terai                          | 81.0    |                   | 984                               |
| Mountain                       | 100     |                   | 87                                |

<sup>a</sup> Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Records missing information for the disaggregate variables have been excluded from the disaggregated estimates. The unweighted sample size reflects this loss in observations; therefore, the sum of disaggregate sample sizes may not equal the overall sample size.

Note: Estimates are based on de jure household members.

Source: Feed the Future Nepal ZOI Survey 2019

### 5.3.2 Proportion of households participating in group-based savings, micro-finance, or lending programs

This indicator helps track the financial inclusion of households in the ZOI. Financial inclusion allows for lower day-to-day transaction costs (e.g., Mobile Money), the ability to grow savings to ease the burden of stressors and shocks, and access to credit to invest. Group-based savings programs are formal or informal community programs that serve as a mechanism for people in poor communities, with otherwise limited access to financial services, to pool their savings. The specific composition and function of the savings groups vary and can include rotating disbursement and accumulating savings models. According to the World Bank, microfinance can be defined as approaches to provide financial services to households and micro-enterprises that are excluded from traditional commercial banking services. Typically, participants are low-income, self-employed, or informally employed individuals, with no formalized ownership titles on their assets and with limited formal identification papers.<sup>61</sup>

**Table 5.3.2** presents the percentage of households participating in group-based savings, micro-finance, or lending programs. A household is participating if any member of the household saved money with, took a loan, or borrowed cash or in-kind from a group-based savings, micro-finance, or lending program in the 12 months preceding the survey. Findings are shown for all households and by household characteristics, including gendered household type, household educational attainment, wealth quintile, poverty status, and SEI score.

41.7 percent of households participate in group savings, micro-finance, or lending programs. Gendered household type is significantly associated with likelihood to participate in these finance programs. The proportion of M&F households is 44.5 percent, compared to 34.3 percent of FNM households and 11.0 percent of MNF households. Household education, wealth quintile, and poverty status are also all significantly associated with likelihood of participating in these programs. Households with no education or those with less than a primary school education are less likely to participate in such financial programs than those with higher levels of education. While the poorest households participate in financial programs at a much lower rate than all other wealth quintiles (28.4 percent), there are no substantial differences in participation among the remaining wealth quintiles. 42.6 percent of non-poor households participate in financial programs, compared to 28.1 percent of poor households. Neither SEI score nor ecological zone are significantly associated with the proportion of households participating in group-based savings, micro-finance, or lending programs.

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<sup>61</sup> Beck, 2015; World Bank FINDEX: <http://www.worldbank.org/en/programs/globalindex>; Cull, 2017.



**Table 5.3.2: Percent of households in the ZOI participating in group-based savings, micro-finance, or lending programs, in total and by selected household characteristics**

| Household characteristic       | Percent | Sig. <sup>a</sup> | Number of households <sup>b</sup> |
|--------------------------------|---------|-------------------|-----------------------------------|
| <b>All households</b>          | 41.7    |                   | 2,449                             |
| <b>Gendered household type</b> |         | ***               | 2,449                             |
| Male and female adults         | 44.5    |                   | 1,932                             |
| Female adults only             | 34.3    |                   | 462                               |
| Male adults only               | 11.0    |                   | 51                                |
| Children only, no adults       | ^       |                   | 4                                 |
| <b>Household education</b>     |         | ***               | 2,449                             |
| No education                   | 27.1    |                   | 153                               |
| Less than primary              | 33.4    |                   | 532                               |
| Completed primary              | 43.3    |                   | 1,116                             |
| Completed secondary            | 53.1    |                   | 338                               |
| Higher                         | 44.4    |                   | 310                               |
| <b>Wealth quintile</b>         |         | *                 | 2,449                             |
| Highest (wealthiest)           | 43.7    |                   | 489                               |
| Fourth                         | 45.5    |                   | 492                               |
| Middle                         | 48.9    |                   | 485                               |
| Second                         | 40.7    |                   | 490                               |
| Lowest (poorest)               | 28.4    |                   | 493                               |
| <b>Poverty status</b>          |         | ***               | 2,392                             |
| Poor                           | 28.1    |                   | 203                               |
| Non-poor                       | 42.6    |                   | 2,189                             |
| <b>Shock exposure index</b>    |         | n/s               | 2,419                             |
| Did not experience any shocks  | 42.1    |                   | 565                               |
| Low                            | 43.0    |                   | 705                               |
| Moderate                       | 41.8    |                   | 553                               |
| High                           | 39.5    |                   | 596                               |
| <b>Ecological zone</b>         |         | n/s               | 2,449                             |
| Hill                           | 41.5    |                   | 1,339                             |
| Terai                          | 42.5    |                   | 1,020                             |
| Mountain                       | 37.7    |                   | 90                                |

<sup>a</sup> Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Records missing information for the disaggregate variables have been excluded from the disaggregated estimates. The unweighted sample size reflects this loss in observations; therefore, the sum of disaggregate sample sizes may not equal the overall sample size.

Note: Estimates are based on de jure household members.

Source: Feed the Future Nepal ZOI Survey 2019

### 5.3.3 Index of social capital

Social capital has been shown to be an important source of resilience across different shocks and stresses, geographies, and populations. *Bonding social capital* relates to the ability of households to provide support to and receive support from other households in the same community, whereas *bridging social capital* relates to the ability of households to provide support to and receive support from other households living outside of their community. The stronger the reciprocal obligation networks, the more likely it is that a household will be able to successfully manage shocks and stresses.

The index of social capital measures the ability of households in the ZOI to draw on social networks to get support to reduce the impact of shocks and stresses on their households. The index measures both the degree of bonding among households in their own community and the degree of bridging between households in the area to households outside their own community. If household responses indicate that they have reciprocal, mutually reinforcing relationships through which household members can receive and provide support during times of need, they are considered to have social capital. The indicator is constructed by averaging two bonding and bridging sub-indices.

**Table 5.3.3** presents the index of social capital results overall and by sub-index for all households and by household characteristics, including gendered household type, household educational attainment, wealth quintile, poverty status, severity of shock exposure, and ecological zone.

On average, households score 0.71 on the social capital index, 0.81 on bonding, and 0.60 on bridging. Gendered household type is not significantly associated with social capital index scores.

Household education is not significantly associated with the total social capital index; however, household education is significantly associated with both the bonding and the bridging sub-indices. Households with no education have a mean bonding score of 0.77, compared to 0.89 among households with higher education. Households with no education have a mean bridging score of 0.58, compared to 0.70 among households with higher education.

Wealth quintiles are significantly associated with social capital index scores. The second wealth quintile has the highest social capital score (0.73), while the lowest wealth quintile had the lowest bridging score. Poverty status is not significantly associated with social capital.

SEI scores and ecological zone are both significantly associated with social capital. Households experiencing no shocks have a mean social capital index score of 0.77, compared to 0.63 among households with high shock severity. These differences are consistent across the bonding and bridging indices. Hill zone households have a mean social capital index score of 0.75, compared to 0.67 for terai households and 0.50 for mountain households.

**Table 5.3.3: Mean social capital index scores in the ZOI, in total and by selected household characteristics**

| Household characteristic       | Total |                   | Bonding |                   | Bridging |                   | Number of households <sup>b</sup> |
|--------------------------------|-------|-------------------|---------|-------------------|----------|-------------------|-----------------------------------|
|                                | Score | Sig. <sup>a</sup> | Score   | Sig. <sup>a</sup> | Score    | Sig. <sup>a</sup> |                                   |
| <b>All households</b>          | 0.71  |                   | 0.81    |                   | 0.60     |                   | 2,439                             |
| <b>Gendered household type</b> | n/s   |                   | n/s     |                   | n/s      |                   | 2,439                             |
| Male and female adults         | 0.71  |                   | 0.81    |                   | 0.60     |                   | 1,910                             |
| Female adults only             | 0.70  |                   | 0.81    |                   | 0.58     |                   | 467                               |
| Male adults only               | 0.75  |                   | 0.84    |                   | 0.65     |                   | 52                                |
| Children only, no adults       | ^     |                   | ^       |                   | ^        |                   | 10                                |
| <b>Household education</b>     | n/s   |                   | *       |                   | **       |                   | 2,439                             |
| No education                   | 0.67  |                   | 0.77    |                   | 0.58     |                   | 153                               |
| Less than primary              | 0.66  |                   | 0.77    |                   | 0.54     |                   | 527                               |
| Completed primary              | 0.70  |                   | 0.81    |                   | 0.59     |                   | 1,112                             |
| Completed secondary            | 0.74  |                   | 0.84    |                   | 0.63     |                   | 336                               |
| Higher                         | 0.79  |                   | 0.89    |                   | 0.70     |                   | 311                               |
| <b>Wealth quintile</b>         | ***   |                   | ***     |                   | *        |                   | 2,439                             |
| Highest (wealthiest)           | 0.70  |                   | 0.79    |                   | 0.61     |                   | 483                               |
| Fourth                         | 0.71  |                   | 0.80    |                   | 0.62     |                   | 492                               |
| Middle                         | 0.70  |                   | 0.79    |                   | 0.61     |                   | 479                               |
| Second                         | 0.73  |                   | 0.86    |                   | 0.61     |                   | 492                               |
| Lowest (poorest)               | 0.68  |                   | 0.83    |                   | 0.54     |                   | 493                               |
| <b>Poverty status</b>          | n/s   |                   | n/s     |                   | n/s      |                   | 2,384                             |
| Poor                           | 0.61  |                   | 0.73    |                   | 0.49     |                   | 204                               |
| Non-poor                       | 0.71  |                   | 0.82    |                   | 0.61     |                   | 2,180                             |
| <b>Shock exposure index</b>    | ***   |                   | ***     |                   | ***      |                   | 2,439                             |
| Did not experience any shocks  | 0.77  |                   | 0.87    |                   | 0.67     |                   | 570                               |
| Low                            | 0.73  |                   | 0.84    |                   | 0.62     |                   | 709                               |
| Moderate                       | 0.67  |                   | 0.79    |                   | 0.56     |                   | 561                               |
| High                           | 0.63  |                   | 0.74    |                   | 0.52     |                   | 599                               |
| <b>Ecological zone</b>         | ***   |                   | ***     |                   | ***      |                   | 2,439                             |
| Hill                           | 0.75  |                   | 0.87    |                   | 0.63     |                   | 1,333                             |
| Terai                          | 0.67  |                   | 0.77    |                   | 0.57     |                   | 1,019                             |
| Mountain                       | 0.50  |                   | 0.58    |                   | 0.42     |                   | 87                                |

^ Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Records missing information for the disaggregate variables have been excluded from the disaggregated estimates. The unweighted sample size reflects this loss in observations; therefore, the sum of disaggregate sample sizes may not equal the overall sample size.

Note: Estimates are based on de jure household members.

Source: Feed the Future Nepal ZOI Survey 2019

## 6. WOMEN'S EMPOWERMENT IN AGRICULTURE

This chapter presents findings related to the A-WEAI. Although women play a prominent role in agriculture, they face persistent economic and social constraints. Closing the gender gap in agriculture is critical to achieving Feed the Future's objectives of increasing agricultural productivity and efficiency, reducing hunger and malnutrition, and achieving food security.

### 6.1 Overview

The Women's Empowerment in Agriculture Index (WEAI) is the first-ever measure to directly capture women's empowerment and inclusion in the agriculture sector, and it was originally developed to track changes in women's empowerment that occur as a direct or indirect result of Feed the Future's programming.<sup>62</sup> Following its widespread uptake, the WEAI was improved and streamlined to make it less time-consuming and expensive to collect, resulting in the A-WEAI.<sup>63</sup> All five domains of the original WEAI are retained, but the ten indicators in the original WEAI are reduced to six in the A-WEAI.

The A-WEAI survey module is administered to the primary adult male decision-maker and the primary adult female decision-maker (18 years of age or older) in each household so that the relative empowerment of women and men in the same household can be compared. The primary adult male and female decision-makers self-identify as the man or woman who makes more social and economic decisions than other men or women, respectively, in the household.<sup>64</sup> This information is collected as part of the household roster information. Households are excluded from responding to questions in the A-WEAI modules if there is only a self-identified primary adult male decision-maker and no self-identified primary adult female decision-maker, or if there are no adults 18 years of age or older.

The A-WEAI comprises two sub-indices: the 5DE and the GPI. The A-WEAI applies the same weights to the 5DE and the GPI as the original WEAI. The 5DE is weighted at 90 percent, and the GPI is weighted at ten percent. The A-WEAI score is calculated as:  $A\text{-WEAI score} = 0.9(5DE) + 0.1(GPI)$

The 5DE score captures two elements: (1) the percentage of women who are empowered and (2) the average percentage of indicators that compose the 5DE in which disempowered women have adequate achievements.

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<sup>62</sup> Alkire, 2013.

<sup>63</sup> For more information, please refer to the [Instructional Guide for the Abbreviated Women's Empowerment in Agriculture Index](#).

<sup>64</sup> The only respondents to the A-WEAI survey module were primary adult decision-makers in the household and, therefore, are not representative of the entire female and male adult populations in the ZOI. It is thus essential to remember that the A-WEAI data reflect only the primary adult female and male decision-makers when interpreting the data. However, to streamline the text of this report, the generic terms "woman," "female," "man," and "male" will be used henceforth. When used, they refer to the primary adult female or male decision-makers from whom the data were collected.

The formula to calculate the 5DE score is as follows:<sup>65</sup>  $5DE\ score = H_e + H_n (A_d)$

Where:

$H_e$  = percentage of women who are empowered

$H_n$  = percentage of disempowered women

$A_d$  = average percentage of indicators in which disempowered women have adequate achievements

The 5DE score can be improved by increasing the percentage of empowered women or by increasing the percentage of women among the disempowered who achieve adequacy in the 5DE indicators.

The 5DE is composed of five domains: (1) decisions about agricultural production, (2) access to and decision-making power about productive resources, (3) control over use of income, (4) leadership in the community, and (5) time allocation. Each domain of the 5DE is equally weighted at one-fifth. The decisions about agricultural production, control over use of income, leadership in the community, and time allocation domains are composed of a single indicator, and so these domains and corresponding indicators all have a one-fifth weight. The access to and decision-making power about productive resources domain also has a weight of one-fifth but is composed of two indicators: ownership of assets, with a weight of two-fifteenths, and access to and decision made on credit, with a weight of one-fifteenth.

The indicators that compose the 5DE measure whether an individual reaches a certain threshold for that indicator, defined as achieving adequacy. An individual who has adequate achievements in 80 percent of the indicators that compose the 5DE is identified as empowered, equivalent to four of the five A-WEAI domains.<sup>66</sup> These indicators are also used to compute an inadequacy score for each individual, which is the weighted average of the indicators (0=adequate; 1=inadequate) and is used in the GPI calculation. **Table 6.1.1** presents the 5DE domains, indicators, and adequacy cut-offs. Appendix 2.3 presents more information, including the survey questions and criteria used to determine adequacy for each 5DE indicator.

**Table 6.1.1: A-WEAI domains, indicators, and definitions of adequacy**

| Domain            | Indicator                                    | Definition of indicator adequacy                                                                                                                                                                                                                                |
|-------------------|----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Production</b> | Input in productive decisions                | Adequate if, for at least one activity, an individual decides alone; OR participates and has input into some, or most or all decisions regarding the activity; OR someone else decides but feels they could decide to a medium or high extent if they wanted to |
| <b>Resources</b>  | Ownership of assets                          | Adequate if individual individually or jointly at least one large asset or at least two small asset types                                                                                                                                                       |
|                   | Access to and input into decisions on credit | Adequate if individual individually or jointly makes decisions about at least one source of credit accessed by her household <sup>a</sup>                                                                                                                       |

<sup>65</sup> The **Guide to Feed the Future Statistics** calculates the 5DE as:  $5DE\ score = 1 - (H_p \times A_p)$ , where  $H_p$  = the number of disempowered respondents in the ZOI (respondents whose disempowerment score is greater than 0.2) divided by the total population of respondents in the ZOI with complete 5DE indicator data; and  $A_p$  = the average inadequacy score of disempowered women (i.e., the average censored inadequacy score).

<sup>66</sup> In the original WEAI, an individual must achieve adequacy in four of the five WEAI domains or in 80 percent of the weighted WEAI indicators. The A-WEAI is composed of fewer indicators, and therefore an individual must achieve adequacy in four out of five domains to reach the 80 percent threshold for empowerment.

| Domain     | Indicator                  | Definition of indicator adequacy                                                                                                                                                                                                                                                                            |
|------------|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Income     | Control over use of income | Adequate if individual participates in and has input in some, most, or all decisions about income generated from an activity; OR they makes decisions, has input in decisions, or feels they could make decisions if desired about employment or major household expenditures, excluding minor expenditures |
| Leadership | Group membership           | Adequate if individual is an active member of at least one group <sup>b</sup>                                                                                                                                                                                                                               |
| Time       | Workload                   | Adequate if individual worked less than 10.5 hours during the previous day <sup>c</sup>                                                                                                                                                                                                                     |

<sup>a</sup> Respondents who live in households that did not access credit are considered inadequate on access to credit and decisions on credit.

<sup>b</sup> Respondents who report that no groups exist in their communities or who are not aware of any groups in their community are considered adequate in group membership.

<sup>c</sup> Respondents who reported the 24 hours preceding the survey as being an atypical workday are excluded.

Source: Adapted from Malapit et al., 2015.

The A-WEAI survey questions that are administered to the primary female decision-maker and used to determine empowerment status and calculate the inadequacy score are also administered to the primary male decision-maker in the same household and used to determine his empowerment status and inadequacy score. The GPI is the second sub-index of the A-WEAI and is calculated using these data for the primary female and male decision-makers in households that have both.

The GPI measures the extent of inequality in empowerment in a household between the primary male decision-maker and the primary female decision-maker. The GPI excludes households that lack both a primary male decision-maker and a primary female decision-maker. A household is considered to lack gender parity if the primary female decision-maker is disempowered and her inadequacy score is higher than that of the primary male decision-maker. The GPI comprises two components: (1) proportion of gender parity-inadequate households; and (2) the average empowerment gap, which is the average normalized percentage gap in the censored inadequacy score of women and men in households that do not have gender parity.

The average normalized empowerment gap ( $I_{GPI}$ ) is calculated as:

$$I_{GPI} = (\text{inadequacy score}_{\text{woman}} - \text{inadequacy score}_{\text{man}}) / (1 - \text{inadequacy score}_{\text{man}})$$

Note the empowerment gap is normalized because each household has a different threshold for gender parity that is based on the man's inadequacy score in each household. The average empowerment gap is normalized by dividing each difference in inadequacy scores by the maximum possible gap for women, which is one (complete inadequacy), minus the male's inadequacy score.

The GPI score is calculated as:  $GPI = 1 - (H_{GPI} \times I_{GPI})$

Where:

$H_{GPI}$  = percentage of women without gender parity

$I_{GPI}$  = average normalized empowerment gap

The GPI score can be improved by increasing the percentage of women who have gender parity or, for those women who are less empowered than men, by reducing the empowerment gap between the primary male and female decision-makers in the same household.

This chapter presents findings on the A-WEAI and the indices and indicators that compose the index. For additional details on calculating the A-WEAI, please refer to the *Feed the Future Guide to Statistics*.<sup>67</sup>

## 6.2 Summary of A-WEAI results

This section presents the following A-WEAI results for women and men: (1) A-WEAI scores, disaggregated by age group and province; (2) 5DE scores, representing the percentage of individuals achieving empowerment; (3) GPI scores, including the percentage of women achieving gender parity; and (4) average empowerment gap.

**Table 6.2.1** presents an overview of the A-WEAI, 5DE, and GPI scores, disaggregated by age group, gender, and province. **Figure 6.1** illustrates the percentage that each of the six A-WEAI indicators contributes to empowerment. **Table 6.2.2** presents the percentage of females and males achieving empowerment disaggregated by age, education, poverty status, whether a woman's child is being fed according to recommendations, and province.<sup>68</sup>

At baseline, men and women experienced comparable levels of empowerment. On average, women's A-WEAI score was 0.86. Women aged 18 to 29 had a slightly lower A-WEAI score on average (0.84) than women aged 30 and above (0.86). Women in Lumbini and Karnali provinces also had slightly lower A-WEAI scores on average (0.84) than women in Bagmati (0.88) and Sudurpashchim provinces (0.89).

Women had a 5DE score of 0.85, while men had a 5DE score of 0.86; this difference was not statistically significant. Men and women achieved empowerment at roughly equal rates, 61.6 percent and 58.9 percent, respectively. Women's GPI score was 0.95. The percentage of women achieving gender parity was 73.5, with slightly more women aged 18 to 29 (75.8 percent) achieving gender parity than women aged 30 and above (73.1 percent). Similar to the A-WEAI scores, fewer women in Lumbini and Karnali provinces achieved empowerment (68.9 and 67.9 percent, respectively) than women in Bagmati (78.8 percent) and Sudurpashchim provinces (79.8 percent). Finally, the average empowerment gap for women was 0.21.

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<sup>67</sup> K. Zalisk et al., 2019.

<sup>68</sup> The education and maternal behavior disaggregates were selected because they were positively associated with women's empowerment scores when data were analyzed under Feed the Future Phase I. Additional details can be found in the [WEAI Baseline Report](#). No clear relationship with poverty was found at baseline; however, it is important to understand how empowerment status varies for individuals in households living above or below the \$1.90 poverty line. Further analysis should be considered based on these results. All disaggregates align with the indicator definitions presented in the Feed the Future Indicator Handbook.

**Table 6.2.1: A-WEAI, 5DE, and GPI scores, and average empowerment gap**

| Statistic                                                                                                                  | Female       | Male         | Sig. <sup>a</sup> |
|----------------------------------------------------------------------------------------------------------------------------|--------------|--------------|-------------------|
| <b>A-WEAI score</b>                                                                                                        | 0.86         |              |                   |
| <b>Age category</b>                                                                                                        |              |              |                   |
| 18–29                                                                                                                      | 0.84         |              |                   |
| 30+                                                                                                                        | 0.86         |              |                   |
| <b>Province</b>                                                                                                            |              |              |                   |
| Bagmati Province                                                                                                           | 0.88         |              |                   |
| Lumbini Province                                                                                                           | 0.84         |              |                   |
| Karnali Province                                                                                                           | 0.84         |              |                   |
| Sudurpashchim Province                                                                                                     | 0.89         |              |                   |
| <b>Number of individuals</b>                                                                                               | <b>918</b>   |              |                   |
| <b>5DE score</b>                                                                                                           | 0.85         | 0.86         | n/s               |
| Percent of individuals achieving empowerment                                                                               | 58.9         | 61.6         | n/s               |
| Percent of weighted indicators in which disempowered individuals have adequate achievements (i.e., average adequacy score) | 63.8         | 64.2         | n/s               |
| <b>Number of individuals</b>                                                                                               | <b>1,358</b> | <b>1,107</b> |                   |
| <b>GPI score</b>                                                                                                           | 0.95         |              |                   |
| Percent achieving gender parity                                                                                            | 73.5         |              |                   |
| <b>Age category</b>                                                                                                        |              |              |                   |
| 18–29                                                                                                                      | 75.8         |              |                   |
| 30+                                                                                                                        | 73.1         |              |                   |
| <b>Province</b>                                                                                                            |              |              |                   |
| Bagmati Province                                                                                                           | 78.8         |              |                   |
| Lumbini Province                                                                                                           | 68.9         |              |                   |
| Karnali Province                                                                                                           | 67.9         |              |                   |
| Sudurpashchim Province                                                                                                     | 79.8         |              |                   |
| Average empowerment gap                                                                                                    | 0.21         |              |                   |
| <b>Number of dual-adult households</b>                                                                                     | <b>918</b>   |              |                   |

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and primary adult decision-makers' sex. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

Note: Estimates are based on primary adult decision-makers who are de jure household members.

Source: Feed the Future Nepal ZOI Survey 2019

**Table 6.2.2** below again illustrates that men and women experienced comparable levels of empowerment at baseline. 58.9 percent of women and 61.6 of men were empowered.

A higher level of education was significantly associated with a greater likelihood of empowerment. Only 55.1 percent and 49.8 percent of women and men with no education achieved empowerment, compared to 65.3 and 61.8 percent of women and men who completed secondary education. Though the number of women with higher education was too low to report, the proportion of men with higher education achieving empowerment was 78.9 percent.

Poverty status was a statistically significant determinant of empowerment, with poverty associated with a lower likelihood of achieving empowerment. Only 42.1 and 52.4 percent of poor women and men, respectively, achieved empowerment. However, 60.4 and 62.4 percent of non-poor women and men achieved empowerment. In three out of four provinces, a similar share of women and men achieve empowerment, but there is a notable difference in Lumbini province, where 53.6 percent of women and



61.9 percent of men achieved empowerment.

**Table 6.2.2: Empowerment by age, education, sex, poverty status, and child feeding behavior**

| Characteristic                                     | Female  |       | Male    |       | Sig. <sup>a</sup> |
|----------------------------------------------------|---------|-------|---------|-------|-------------------|
|                                                    | Percent | n     | Percent | n     |                   |
| <b>All individuals</b>                             | 58.9    | 1,358 | 61.6    | 1,107 |                   |
| <b>Age category</b>                                |         |       |         |       | n/s               |
| 18–29                                              | 56.7    | 220   | 52.1    | 122   |                   |
| 30+                                                | 59.3    | 1,138 | 62.8    | 985   |                   |
| <b>Education</b>                                   |         |       |         |       | **                |
| No education                                       | 55.1    | 879   | 49.8    | 337   |                   |
| Less than primary                                  | 69.5    | 249   | 62.1    | 393   |                   |
| Completed primary                                  | 62.2    | 175   | 72.0    | 301   |                   |
| Completed secondary                                | 65.3    | 31    | 61.8    | 39    |                   |
| Higher                                             | ^       | 23    | 78.9    | 37    |                   |
| <b>Poverty status</b>                              |         |       |         |       | ***               |
| Poor                                               | 42.1    | 112   | 52.4    | 83    |                   |
| Non-poor                                           | 60.4    | 1,225 | 62.4    | 999   |                   |
| <b>Province</b>                                    |         |       |         |       | n/s               |
| Bagmati Province                                   | 64.6    | 267   | 63.5    | 237   |                   |
| Lumbini Province                                   | 53.6    | 560   | 61.9    | 448   |                   |
| Karnali Province                                   | 55.2    | 206   | 54.4    | 166   |                   |
| Sudurpashchim Province                             | 65.6    | 325   | 64.0    | 256   |                   |
| <b>0–5-month-old exclusively breastfed</b>         |         |       |         |       | -                 |
| Yes                                                | ^       | 14    |         |       |                   |
| No                                                 | ^       | 7     |         |       |                   |
| <b>6–23-month-old with minimum acceptable diet</b> |         |       |         |       | -                 |
| Yes                                                | ^       | 28    |         |       |                   |
| No                                                 | 57.7    | 40    |         |       |                   |

^ Results not statistically reliable, n<30

<sup>a</sup>Significance tests were performed to determine whether an association exists between the outcome indicator and primary adult decision-makers' sex. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

Note: Estimates are based on primary adult decision-makers who are de jure household members.

Source: Feed the Future Nepal ZOI Survey 2019

### 6.3. A-WEAI domain and indicator results

Empowerment is a complex and multidimensional concept. Aggregating the different dimensions of empowerment into a single index to generate the A-WEAI score provides a simple way to communicate the status of women's empowerment in agriculture, compare those scores across countries and over time, and analyze the relationship of women's empowerment in agriculture to other outcomes of interest, such as hunger and malnutrition. A-WEAI scores also provide incentives for decision-makers to reduce the prevalence and intensity of disempowerment.

Based on the A-WEAI methodology, empowerment in agriculture occurs when a woman has adequate achievements across the five domains that compose the index. Therefore, decomposing the A-WEAI and examining the individual indicators in each domain is critical for identifying the greatest constraints

to empowerment, designing policies and programs to reduce those constraints, and understanding how and why those constraints change over time.

This section presents A-WEAI results disaggregated by age and decomposed by: (1) average percentage of individuals who are disempowered and achieving adequacy across the six A-WEAI indicators; (2) contribution of each indicator to empowerment; and (3) percentage of individuals who are disempowered and have adequate achievements in each A-WEAI indicator, using censored headcount ratios. Examining censored headcount ratios helps focus attention on those indicators that are the biggest constraints to empowerment *among the disempowered*. Uncensored headcount ratios present indicator results *regardless of empowerment status* by identifying those indicators that report the lowest percentages achieving adequacy.<sup>69</sup>

**Table 6.3.1** presents the average percentage of women and men who are disempowered and achieving adequacy across the six A-WEAI indicators. The purpose of reporting on the average percentage of women who are disempowered and achieving adequacy across the six A-WEAI indicators overall, which is a Feed the Future context indicator, and for the individual indicators is two-fold: to bring greater attention to the composition of empowerment and disempowerment and to identify the individual indicators that present the greatest constraints to empowerment for women and men.

At baseline, 25.4 percent of female decision-makers were disempowered and achieved adequacy and 24.3 percent of male decision-makers were disempowered and achieved adequacy across the six A-WEAI indicators. Gender and age were not statistically significant determinants of adequacy achievement.

**Table 6.3.1: Average percent of primary adult decision-makers who are disempowered and achieving adequacy across the six A-WEAI indicators, by sex and age**

| A-WEAI indicator                              | Female  |       | Male    |       | Sig. <sup>a</sup> |
|-----------------------------------------------|---------|-------|---------|-------|-------------------|
|                                               | Percent | n     | Percent | n     |                   |
| Average percentage (censored headcount ratio) | 25.4    | 1,358 | 24.3    | 1,107 | n/s               |
| <b>Age category</b>                           |         |       |         |       | n/s               |
| 18–29                                         | 26.3    | 220   | 30.5    | 122   |                   |
| 30+                                           | 25.2    | 1,138 | 23.5    | 985   |                   |

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and primary adult decision-makers' sex. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant. Notes: Estimates are based on primary adult decision-makers who are de jure household members. The Feed the Future ZOI context indicator, "Average percent of women achieving adequacy across the six indicators of the A-WEAI," is calculated as the sum of the censored headcount ratios for primary adult female decision-makers for each of the six A-WEAI indicators, divided by six (the number of indicators). It shows the average across the six indicators of the proportion of primary adult female decision-makers in the ZOI population who are disempowered but still achieved adequacy in an individual A-WEAI indicator. Source: Feed the Future Nepal ZOI Survey 2019

The 5DE has two components: (1) the percentage of empowered individuals and (2) the percentage of disempowered individuals multiplied by the mean adequacy score of the disempowered (i.e., the average percentage of indicators that compose the 5DE in which disempowered women have adequate

<sup>69</sup> The censored headcount ratios present results from respondents who are disempowered and have adequate achievements in each indicator, divided by the total number of respondents. Uncensored headcount ratios present results from all individuals achieving adequacy in each indicator, regardless of empowerment status, divided by the total number of respondents. Indicator results using uncensored headcount ratios can be found in Appendix I.2.

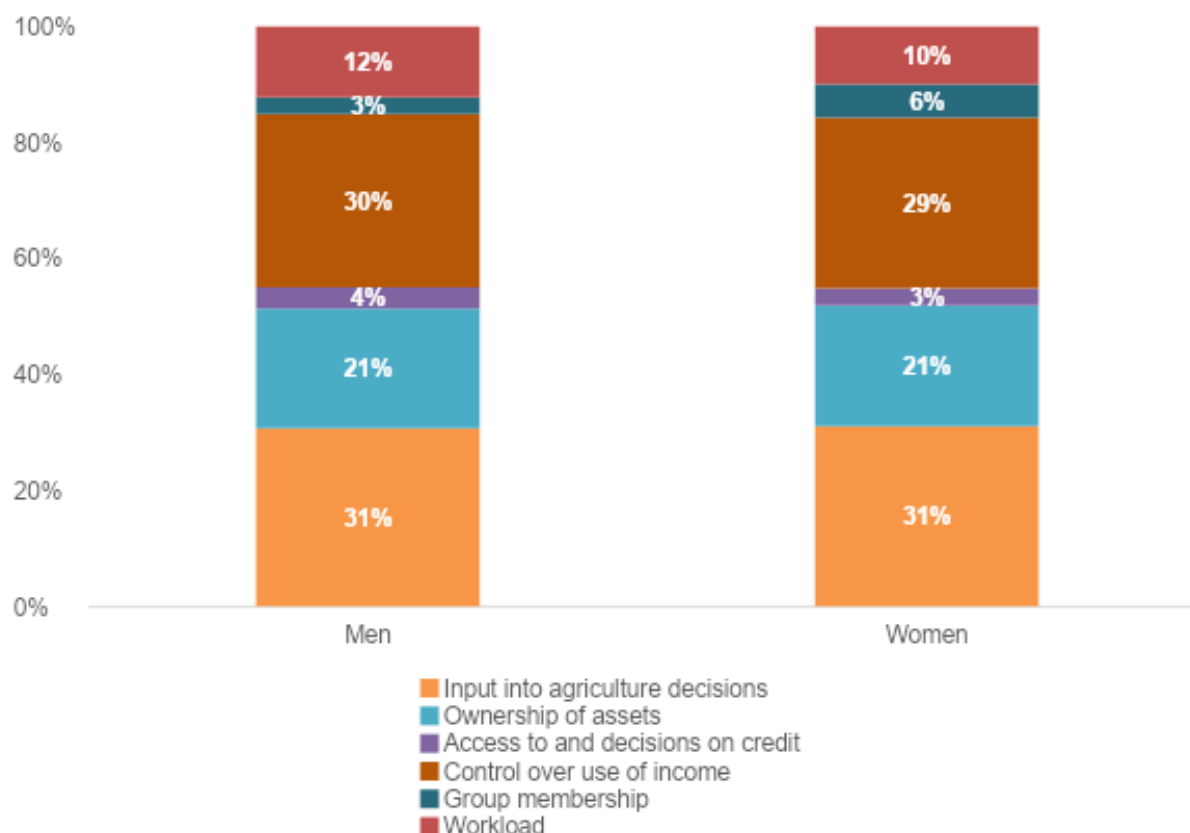
achievements). **Figure 6.1** presents the comparison of each indicator's contribution by sex to the second component of the 5DE, disempowered but adequate, to illustrate which indicators present the greatest constraints to empowerment among men and women identified as disempowered.

The decisions about agricultural production, control over use of income, leadership in the community, and time allocation domains are composed of a single indicator, and thus these domains and the corresponding indicator carry the same weight: one-fifth. The access to and decision-making power about productive resources domain also has a weight of one-fifth but is composed of two indicators: ownership of assets, with a weight of two-fifteenths, and access to and decisions on credit, with a weight of one-fifteenth.

The indicator weights are important to consider in calculating the 5DE and the overall A-WEAI, which is an aggregated, standardized index score that allows for cross-country comparability. However, the purpose of decomposing the “disempowered but adequate” component of the 5DE is to draw attention to the indicators for which low percentages of individuals are disempowered but still achieve adequacy (censored adequacy headcounts) or contribute proportionally less than the indicator's weight to the “disempowered but adequate” component of the 5DE. Increasing the percentage of disempowered individuals who achieve adequacy in these indicators will increase the 5DE.

Men and women experienced similar trends regarding the contribution of each A-WEAI indicator to empowerment. Productive decisions contributed most to the empowerment of both disempowered men and women, at 31 percent for both, followed closely by control over use of income at 30 percent for men and 29 percent for women. For both disempowered men and women, ownership of assets accounted for 21 percent of empowerment. Workload, group membership, and access to and decisions on credit contributed the least for both men and women.

**Figure 6.1: Percent contribution of the six A-WEAI indicators to empowerment, by sex (Censored Headcount Ratio)**



Source: Feed the Future Nepal ZOI Survey 2019

**Table 6.3.2** presents the censored headcount ratios of individuals who are disempowered and achieving adequacy in each indicator, disaggregated by sex and age.

Among the surveyed women in the Nepal ZOI at baseline, the leading constraints to empowerment were group membership (7.5 percent), access to and decisions on credit (11.7 percent), and workload (13.0 percent). These were also the top three constraints for men, with group membership at 3.5, access to and decisions on credit at 14.2 percent, and workload at 14.4 percent.

There were statistically significant differences between men and women regarding group membership as a whole and group membership among those 30 and older. Additionally, there was a large significant difference in workload between men and women in the 18–29 age range: among 18–29-year-olds, only 9.6 percent of primary female decision-makers were disempowered and had adequate achievement in workload, compared to 21.1 percent of primary male decision-makers.

**Table 6.3.2: Percent of primary adult decision-makers who are disempowered and have adequate achievement in each A-WEAI indicator using censored headcount ratios, by sex and age**

| A-WEAI indicator                         | Female  |       | Male    |       | Sig. <sup>a</sup> |
|------------------------------------------|---------|-------|---------|-------|-------------------|
|                                          | Percent | n     | Percent | n     |                   |
| <b>Input in productive decisions</b>     | 40.7    | 1,358 | 38.0    | 1,107 | n/s               |
| 18–29                                    | 42.7    | 220   | 46.1    | 122   | n/s               |
| 30+                                      | 40.3    | 1,138 | 37.0    | 985   | n/s               |
| <b>Ownership of assets</b>               | 41.0    | 1,358 | 38.3    | 1,107 | n/s               |
| 18–29                                    | 42.9    | 220   | 47.9    | 122   | n/s               |
| 30+                                      | 40.6    | 1,138 | 37.1    | 985   | n/s               |
| <b>Access to and decisions on credit</b> | 11.7    | 1,358 | 14.2    | 1,107 | n/s               |
| 18–29                                    | 15.4    | 220   | 18.3    | 122   | n/s               |
| 30+                                      | 10.9    | 1,138 | 13.7    | 985   | n/s               |
| <b>Control over income</b>               | 38.6    | 1,358 | 37.0    | 1,107 | n/s               |
| 18–29                                    | 39.6    | 220   | 47.1    | 122   | n/s               |
| 30+                                      | 38.4    | 1,138 | 35.7    | 985   | n/s               |
| <b>Group membership</b>                  | 7.5     | 1,358 | 3.5     | 1,107 | ***               |
| 18–29                                    | 7.5     | 220   | 2.5     | 122   | n/s               |
| 30+                                      | 7.5     | 1,138 | 3.7     | 985   | **                |
| <b>Workload</b>                          | 13.0    | 1,358 | 14.4    | 1,107 | n/s               |
| 18–29                                    | 9.6     | 220   | 21.1    | 122   | **                |
| 30+                                      | 13.7    | 1,138 | 13.6    | 985   | n/s               |

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and primary adult decision-makers' sex. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

Note: Estimates are based on primary adult decision makers who are de jure household members.

Source: Feed the Future Nepal ZOI Survey 2019

## 6.4 Descriptive statistics for A-WEAI domains and indicators

The following section presents more granular information on data collected in the A-WEAI module. The sub-sections are organized by A-WEAI domain.

### 6.4.1 Production

Adequacy in *production* is measured by input into decisions about agricultural activities in which an individual participates. Respondents are considered adequate in production if they make decisions alone, have input into most or all decisions, or feel that they could make decisions if they wanted to for at least one agricultural activity.

**Table 6.4.1** presents the percentages of women and men who are involved in agriculture-related activities (i.e., food crop farming, cash crop farming, livestock raising, or fishing), non-farm economic activities, and wage or salaried employment to capture the breadth of economic activities in which individuals are engaged. The table also presents the percentages of women and men who have input into the decisions made about specific activities.

At baseline, all men and women participated in some form of economic activity and virtually all men and women had input into decisions regarding one or more economic activities. The most prevalent economic activities for women were food crop farming (82.7 percent), livestock raising (80.3 percent),

and cash crop farming (38.4 percent). For men, the most prevalent economic activities were food crop farming (79.3 percent), livestock raising (73.6 percent), and wage or salaried employment (58.2 percent). The least common activities for both genders were fishing or fishpond culture (7.6 percent for women and 7.2 percent for men) and non-farm economic activities (18.4 percent for women and 24.5 percent for men).

Several trends regarding economic participation and decision-making varied significantly by gender. Females were significantly more likely to participate in food crop farming, cash crop farming, and livestock raising than men, while men were significantly more likely than women to participate in non-farm economic activities and wage or salaried employment. Wage or salaried employment had the largest gender gap, as men were more than twice as likely as women to participate. A very high proportion of both females and males had input into decisions about these economic activities. Significantly more males than females had input into decisions about food crop farming, though both proportions were high (96.4 percent for females and 98.1 percent for males). Significantly more females than males had input into decisions about fishing or fishpond culture, though proportions were also high (100.0 percent for females and 97.7 percent for males).

**Table 6.4.1: Participation in economic activities and input in decision-making on production, by sex**

| Economic activity            | Participates in activity   |                          |                   | Has input into decisions about activity <sup>a</sup> |       |                     |       |                   |
|------------------------------|----------------------------|--------------------------|-------------------|------------------------------------------------------|-------|---------------------|-------|-------------------|
|                              | Female <sup>b</sup><br>(%) | Male <sup>c</sup><br>(%) | Sig. <sup>d</sup> | Female <sup>b,d</sup>                                |       | Male <sup>c,d</sup> |       | Sig. <sup>e</sup> |
|                              |                            |                          |                   | %                                                    | n     | %                   | n     |                   |
| <b>Any economic activity</b> | 100.0                      | 100.0                    | -                 | 97.6                                                 | 1,645 | 99.7                | 1,360 | -                 |
| Food crop farming            | 82.7                       | 79.3                     | **                | 96.4                                                 | 1,380 | 98.1                | 1,096 | *                 |
| Cash crop farming            | 38.4                       | 30.8                     | *                 | 97.8                                                 | 643   | 97.2                | 407   | n/s               |
| Livestock raising            | 80.3                       | 73.6                     | ***               | 97.8                                                 | 1,350 | 96.4                | 1,017 | n/s               |
| Fishing or fishpond culture  | 7.6                        | 7.2                      | n/s               | 100.0                                                | 119   | 97.7                | 101   | ***               |
| Non-farm economic activities | 18.4                       | 24.5                     | **                | 98.6                                                 | 342   | 99.7                | 300   | n/s               |
| Wage or salaried employment  | 25.3                       | 58.2                     | ***               | 99.3                                                 | 797   | 99.7                | 387   | n/s               |
| <b>Number of individuals</b> | <b>1,646</b>               | <b>1,361</b>             |                   |                                                      |       |                     |       |                   |

<sup>a</sup> Having input means that the individual reported having input into most or all decisions regarding the activity.

<sup>b</sup> Estimates exclude households that do not have a primary adult female decision-maker or that have missing or incomplete indicator data.

<sup>c</sup> Estimates exclude households that do not have a primary adult male decision-maker or that have missing or incomplete indicator data.

<sup>d</sup> Estimates exclude individuals who do not participate in an activity or report that no decision was made.

<sup>e</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and primary adult decision-makers' sex. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

Note: Estimates are based on primary adult decision-makers who are de jure household members.

Source: Feed the Future Nepal ZOI Survey 2019

## 6.4.2 Resources

Adequacy in *resources* is measured by two indicators: (1) ownership of assets and (2) access to and decisions related to credit. Respondents are considered adequate in asset ownership if they own, alone or jointly, at least two small asset types or one large asset. Respondents are considered adequate to access credit if they decide alone or jointly whether to borrow cash or in-kind or what to do with the money or item borrowed. **Table 6.4.2** presents the findings for ownership of assets.

Results demonstrate that certain household items were much more frequently owned than others. The most commonly owned items in the household were a cell phone (95.9 percent), agricultural land (86.3 percent), and small consumer durables (84.2 percent). The least commonly owned items were mechanized farm equipment (11.6 percent) and fishpond or fishing equipment (12.9 percent).

Ownership of specific items also varied significantly by gender. Men were significantly more likely than women to own a variety of items either solely or jointly, including agricultural land, non-mechanized farm equipment, a house or other structures, non-agricultural land, and means of transport. However, women were significantly more likely to own small livestock and chickens, ducks, turkeys, and pigeons. Although all these differences are statistically significant, the percentage point differences between genders for items owned more commonly by men are substantially larger than the percentage point differences between genders for the items owned more commonly by women. For example, 80.4 percent of men owned agricultural land, compared to just 48.8 percent of women. However, while 98.7 percent of women owned chickens, ducks, turkeys, or pigeons, so did 95.8 percent of men.

**Table 6.4.2: Ownership of productive resources, any household member and by sex of primary adult decision-maker**

| Productive resource                   | Someone in the household owns item <sup>a</sup> (%) | Female owns solely or jointly <sup>a,b</sup> (%) | Male owns solely or jointly <sup>a,c</sup> (%) | Sig. <sup>d</sup> |
|---------------------------------------|-----------------------------------------------------|--------------------------------------------------|------------------------------------------------|-------------------|
| Agricultural land                     | 86.3                                                | 48.8                                             | 80.4                                           | ***               |
| Large livestock                       | 64.2                                                | 98.2                                             | 98.9                                           | n/s               |
| Small livestock                       | 64.8                                                | 99.0                                             | 96.9                                           | *                 |
| Chickens, ducks, turkeys, and pigeons | 47.6                                                | 98.7                                             | 95.8                                           | *                 |
| Fishpond or fishing equipment         | 12.9                                                | 90.4                                             | 85.8                                           | n/s               |
| Non-mechanized farm equipment         | 44.6                                                | 90.2                                             | 99.4                                           | ***               |
| Mechanized farm equipment             | 11.6                                                | 94.4                                             | 100.0                                          | -                 |
| Non-farm business equipment           | 37.7                                                | 90.6                                             | 92.7                                           | n/s               |
| House or other structures             | 76.8                                                | 85.2                                             | 93.0                                           | ***               |
| Large consumer durables               | 43.6                                                | 98.1                                             | 98.1                                           | n/s               |
| Small consumer durables               | 84.2                                                | 99.1                                             | 98.8                                           | n/s               |
| Cell phone                            | 95.9                                                | 94.1                                             | 92.1                                           | n/s               |
| Non-agricultural land                 | 55.4                                                | 41.9                                             | 74.2                                           | ***               |
| Means of transportation               | 40.0                                                | 79.2                                             | 93.4                                           | ***               |
| <b>Number of households</b>           | <b>3,061</b>                                        |                                                  |                                                |                   |

<sup>a</sup> Estimates exclude households that have no primary adult decision-maker or that have missing or incomplete indicator data. Respondents who indicated "not applicable" are also excluded.

<sup>b</sup> Estimates exclude households that do not have a primary adult female decision-maker or that have missing or incomplete indicator data.

<sup>c</sup> Estimates exclude households that do not have a primary adult male decision-maker or that have missing or incomplete indicator data.

<sup>d</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and primary adult decision-makers' sex. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

Note: Estimates are based on primary adult decision-makers who are de jure household members.

Source: Feed the Future Nepal ZOI Survey 2019

**Table 6.4.3** and **Table 6.4.4** show the second indicator of the *resources* domain: access to and decision-making on credit. **Table 6.4.3** presents the percentage of women who report that a member of their household received any loan in the 12 months preceding the survey, overall and disaggregated by source. The percentages of households with primary adult female decision-makers who received an in-kind loan or credit (e.g., food items or raw materials) or a cash loan are also presented. The in-kind

and cash loan categories are not mutually exclusive; a household could have received both types of loans. For women living in households that received a loan, the table also presents the percentages who reported having contributed to deciding to take the loan or how to use the loan. **Table 6.4.4** presents the same information for men.

At baseline, the percentage of households with primary adult females receiving a loan was 63.1 percent. 63.0 percent took out a cash loan and only 0.6 percent took out an in-kind loan. The most common sources to borrow from was friends and relatives (30.5 percent), followed closely by group-based micro-finance organizations (29.2 percent). The most infrequently used source of credit was non-governmental organizations (NGOs), at 3.0 percent.

At baseline, 90.5 percent of women contributed to any decision on credit. Women's contributions to decisions on whether to borrow and how to use the loan was similar across all loan types. Women were the most likely to contribute to a credit decision related to a loan from an informal credit or savings group (95.0 percent) and the least likely to contribute to a credit decision related to a loan from an informal lender (79.4 percent).

**Table 6.4.3: Credit access among women, by source**

| Characteristic                                               | Credit source <sup>a</sup> |         |                     |                   |                          |                               |                                    |                      |
|--------------------------------------------------------------|----------------------------|---------|---------------------|-------------------|--------------------------|-------------------------------|------------------------------------|----------------------|
|                                                              | Any source (%)             | NGO (%) | Informal lender (%) | Formal lender (%) | Friends or relatives (%) | Group-based micro-finance (%) | Informal credit/savings groups (%) | No credit needed (%) |
| <b>Household received a loan</b>                             |                            |         |                     |                   |                          |                               |                                    |                      |
| Any loan                                                     | 63.1                       | 3.0     | 9.7                 | 10.9              | 30.5                     | 29.2                          | 12.3                               | -                    |
| In-kind loan                                                 | 0.6                        | 0.1     | 0.2                 | 0.1               | 0.2                      | 0.1                           | 0.0                                | -                    |
| Cash loan                                                    | 63.0                       | 2.9     | 9.6                 | 10.8              | 30.5                     | 29.0                          | 12.3                               | -                    |
| <b>Number of households<sup>b</sup></b>                      | <b>1,680</b>               | 1,680   | 1,680               | 1,678             | 1,679                    | 1,676                         | 1,679                              | -                    |
| <b>Woman contributed to credit decision</b>                  |                            |         |                     |                   |                          |                               |                                    |                      |
| Any decision                                                 | 90.5                       | 87.5    | 79.4                | 91.9              | 84.0                     | 92.8                          | 95.0                               | -                    |
| On whether to borrow                                         | 87.7                       | 86.3    | 74.4                | 87.5              | 79.6                     | 90.6                          | 94.1                               | -                    |
| On how to use loan                                           | 87.8                       | 85.7    | 73.4                | 86.8              | 80.4                     | 91.0                          | 93.5                               | -                    |
| <b>Number of households that received a loan<sup>c</sup></b> | <b>1,048</b>               | 55      | 162                 | 174               | 522                      | 463                           | 217                                | -                    |

<sup>a</sup> Percentages sum to more than 100 percent because loans may have been received from more than one source.

<sup>b</sup> Estimates exclude households that do not have a primary adult female decision-maker or that have missing or incomplete indicator data.

<sup>c</sup> Estimates exclude households that do not have a primary adult female decision-maker, that did not receive a loan, or that have missing or incomplete indicator data.

Note: Estimates are based on primary adult female decision-makers who are de jure household members.

Source: Feed the Future Nepal ZOI Survey 2019

The percentage of households with primary male adult decision-makers receiving loans was 63.8 percent. 63.6 percent of households with primary male adult decision-maker took out a cash loan and only 2.4 percent took out an in-kind loan. The most common source to borrow from was friends or relatives (44.7 percent), followed by group-based microfinance institutions (39.2 percent). The most



infrequently used source of credit for households with primary male adult decision-maker was NGOs (6.0 percent).

95.9 percent of men contributed to any decision on credit. Men's contribution to credit decisions was similar across most loan types but differed more substantially with informal credit and savings groups: while only 70.9 percent of men contributed to a decision to borrow, 88.4 percent contributed to a decision on how to use the loan. Men were most likely to contribute to a credit decision related to a formal lender (96.1 percent) and least likely to contribute to a credit decision related to a loan from an NGO (79.6 percent).

**Table 6.4.4: Credit access among men, by source**

| Characteristic                                               | Credit source <sup>a</sup> |            |                     |                   |                          |                               |                                    |                      |
|--------------------------------------------------------------|----------------------------|------------|---------------------|-------------------|--------------------------|-------------------------------|------------------------------------|----------------------|
|                                                              | Any source (%)             | NGO (%)    | Informal lender (%) | Formal lender (%) | Friends or relatives (%) | Group-based micro-finance (%) | Informal credit/savings groups (%) | No credit needed (%) |
| <b>Household received a loan</b>                             |                            |            |                     |                   |                          |                               |                                    |                      |
| Any loan                                                     | 63.8                       | 6.0        | 25.0                | 18.3              | 44.7                     | 39.2                          | 16.5                               | -                    |
| In-kind loan                                                 | 2.4                        | 0.1        | 1.9                 | 0.1               | 0.4                      | 0.0                           | 0.0                                | -                    |
| Cash loan                                                    | 63.6                       | 4.0        | 16.1                | 12.5              | 30.3                     | 26.7                          | 11.3                               | -                    |
| <b>Number of households<sup>b</sup></b>                      | <b>1,425</b>               | <b>975</b> | <b>974</b>          | <b>975</b>        | <b>974</b>               | <b>973</b>                    | <b>973</b>                         |                      |
| <b>Man contributed to credit decision</b>                    |                            |            |                     |                   |                          |                               |                                    |                      |
| Any decision                                                 | 95.9                       | 79.6       | 92.7                | 96.1              | 95.7                     | 93.4                          | 89.6                               | -                    |
| On whether to borrow                                         | 93.6                       | 76.4       | 91.2                | 94.6              | 94.5                     | 89.7                          | 70.9                               | -                    |
| On how to use loan                                           | 94.9                       | 79.6       | 91.7                | 94.7              | 94.3                     | 93.4                          | 88.4                               | -                    |
| <b>Number of households that received a loan<sup>c</sup></b> | <b>903</b>                 | <b>58</b>  | <b>245</b>          | <b>174</b>        | <b>437</b>               | <b>366</b>                    | <b>165</b>                         |                      |

<sup>a</sup> Percentages sum to more than 100 percent because loans may have been received from more than one source.

<sup>b</sup> Estimates exclude households that do not have a primary adult male decision-maker or that have missing or incomplete indicator data.

<sup>c</sup> Estimates exclude households that do not have a primary adult male decision-maker, that did not receive a loan, or that have missing or incomplete indicator data.

Note: Estimates are based on primary adult male decision-makers who are de jure household members.

Source: Feed the Future Nepal ZOI Survey 2019

### 6.4.3 Income

Adequacy in *income* is measured by input into decisions related to income and expenditures. Respondents are considered adequate if they have substantial input into most or all decisions or feel that they can decide for at least one economic activity or major household expenditures. **Table 6.4.5** shows the percentages of women and men who have input into the decisions made regarding the use of income derived from an activity.

At baseline, both men and women expressed a very high level of input into decision-making on economic activities. There were no statistically significant differences across gender on input into decision-making for economic activities.

**Table 6.4.5: Input into decision-making on use of income and major household expenditures, by sex**

| Economic activity            | Female <sup>a</sup> |       | Male <sup>b</sup> |       | Sig. <sup>c</sup> |
|------------------------------|---------------------|-------|-------------------|-------|-------------------|
|                              | Percent             | n     | Percent           | n     |                   |
| <b>Any economic activity</b> |                     |       |                   |       |                   |
| Food crop farming            | 98.5                | 1,343 | 97.4              | 1,087 | n/s               |
| Cash crop farming            | 98.6                | 631   | 97.1              | 407   | n/s               |
| Livestock raising            | 98.8                | 1,326 | 97.8              | 1,014 | n/s               |
| Fishing or fishpond culture  | 100.0               | 119   | 100.0             | 96    | -                 |
| Non-farm economic activities | 98.7                | 299   | 100.0             | 341   | -                 |
| Wage or salaried employment  | 99.5                | 384   | 99.7              | 797   | n/s               |

<sup>a</sup> Estimates exclude households that do not have a primary adult female decision-maker or that have missing or incomplete data. Estimates also exclude respondents who do not participate in the activity or who report that no decision was made regarding the activity.

<sup>b</sup> Estimates exclude households that do not have a primary adult male decision-maker or that have missing or incomplete data. Estimates also exclude respondents who do not participate in the activity or who report that no decision was made regarding the activity.

<sup>c</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and primary adult decision-makers' sex. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

Notes: Estimates are based on primary adult decision-makers who are de jure household members. Having input means that the individual reported having input into most or all decisions regarding the use of income generated from the activity.

Source: Feed the Future Nepal ZOI Survey 2019

#### 6.4.4 Leadership

Adequacy in *leadership* is measured through an individual's active involvement with community groups. Respondents are considered adequate if they are active members of at least one community group.

**Table 6.4.6** shows the percentages of women and men who are active members of groups in their community.

At baseline, 50.4 percent of women were a member of any group, compared to 38.3 percent of men; this difference is statistically significant. Within types of groups, women were significantly more likely than men to be a member of an agricultural producer's group or a credit or micro-finance group. Men were significantly more likely than women to be a member of a water user's group, a civic or charitable group, local government, or a religious group.

**Table 6.4.6: Group membership, by sex**

| Type of group                  | Is an active group member |                         | Sig. <sup>d</sup> |
|--------------------------------|---------------------------|-------------------------|-------------------|
|                                | Female <sup>a,b</sup> (%) | Male <sup>a,c</sup> (%) |                   |
| <b>Any group</b>               | <b>50.4</b>               | <b>38.3</b>             | <b>***</b>        |
| Agricultural producer's group  | 10.0                      | 7.2                     | *                 |
| Water users' group             | 6.8                       | 12.9                    | ***               |
| Forest users' group            | 13.7                      | 17.0                    | n/s               |
| Credit or micro-finance group  | 28.4                      | 12.2                    | ***               |
| Mutual help or insurance group | 4.5                       | 4.9                     | n/s               |
| Trade and business association | 0.1                       | 1.3                     | n/s               |
| Civic or charitable group      | 5.0                       | 7.7                     | *                 |
| Local government               | 2.0                       | 4.4                     | **                |
| Religious group                | 3.5                       | 5.6                     | *                 |
| Other women's group            | 24.8                      |                         |                   |
| <b>Number of individuals</b>   | <b>1,680</b>              | <b>1,425</b>            |                   |

<sup>a</sup> The denominator for these percentages includes all interviewed individuals, even those who reported that no group exists or that they were unaware of the existence of a group in their community. These individuals who report that none of the groups exist or who are unaware of any groups are counted as having inadequate achievement of this empowerment indicator.

<sup>b</sup> Estimates exclude households that do not have a primary adult female decision-maker or that have missing or incomplete data.  
<sup>c</sup> Estimates exclude households that do not have a primary adult male decision-maker or that have missing or incomplete data.  
<sup>d</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ ; n/s=not significant.  
 Note: Estimates are based on primary adult decision-makers who are de jure household members.  
 Source: Feed the Future Nepal ZOI Survey 2019

### 6.4.5 Time

Adequacy in the last domain, *time*, assesses the workloads of women and men as measured using a time allocation log. Respondents are considered adequate if they spend 10.5 hours or less performing work activities in a 24-hour period. **Table 6.4.7** shows the percentages of women and men who performed the listed activities the day before the survey and the average number of hours they spent performing each activity. The percentages indicate those individuals who reported performing the activity, irrespective of the length of time that they spent performing the activity. The average hours spent performing an activity is the average across all individuals, assigning zero hours to individuals who did not perform an activity. Note that individuals who reported that the hours worked during the day before the ZOI Survey were not normal are excluded from the results.

At baseline, time allocation varied considerably by sex. Men spent significantly more time than women engaging in a variety of activities, including working as employed, in own business work, traveling and commuting, watching TV, listening to the radio and reading, exercising, and in social activities and hobbies. Conversely, women spent significantly more time than men on activities that include cooking, domestic work, and caring for children and adults. The largest disparities in time allocation between women and men were cooking and domestic work: on average, men spent 0.2 hours cooking in the previous 24 hours, compared to 1.6 for women (a 1.4-hour difference), and 0.7 hours on domestic work, compared to 2.0 for women (a 1.3-hour difference). These results suggest that men were more likely to spend time on work and social activities outside the home while women were more likely to spend time on home-based activities.

**Table 6.4.7: Time allocation, by sex**

| Activity                                 | Female       |                    | Male         |                    | Sig. <sup>a</sup> |
|------------------------------------------|--------------|--------------------|--------------|--------------------|-------------------|
|                                          | Percent      | Mean hours devoted | Percent      | Mean hours devoted |                   |
| Sleeping and resting                     | 98.0         | 10.2               | 95.5         | 9.9                | n/s               |
| Eating and drinking                      | 97.8         | 1.3                | 95.4         | 1.3                | n/s               |
| Personal care                            | 91.6         | 0.7                | 91.8         | 0.7                | n/s               |
| School and homework                      | 1.6          | 0.03               | 1.6          | 0.03               | n/s               |
| Work as employed                         | 5.8          | 0.4                | 16.1         | 1.3                | ***               |
| Own business work                        | 6.7          | 0.4                | 15.5         | 1.1                | ***               |
| Farming, livestock, fishing              | 72.9         | 3.8                | 63.2         | 4.0                | n/s               |
| Shopping, getting services               | 9.0          | 0.3                | 11.4         | 0.3                | n/s               |
| Weaving, sewing, textile care            | 3.0          | 0.05               | 1.3          | 0.04               | n/s               |
| Cooking                                  | 81.9         | 1.6                | 14.6         | 0.2                | ***               |
| Domestic work (fetching food and water)  | 88.9         | 2.0                | 33.5         | 0.7                | ***               |
| Care for children, adults, elderly       | 27.8         | 0.7                | 11.2         | 0.3                | ***               |
| Travel and commuting                     | 11.5         | 0.3                | 26.6         | 0.6                | ***               |
| Watching TV, listening to radio, reading | 18.0         | 0.3                | 25.0         | 0.5                | ***               |
| Exercising                               | 0.7          | 0.01               | 3.2          | 0.05               | **                |
| Social activities and hobbies            | 45.7         | 1.2                | 52.2         | 1.7                | ***               |
| Religious activities                     | 12.4         | 0.2                | 8.1          | 0.1                | n/s               |
| Other                                    | 2.6          | 0.1                | 3.5          | 0.2                | **                |
| <b>Number of individuals</b>             | <b>1,680</b> |                    | <b>1,425</b> |                    |                   |

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

Note: Estimates are based on primary adult decision-makers who are de jure household members.

Source: Feed the Future Nepal ZOI Survey 2019

## 7. TARGETED AGRICULTURE VALUE CHAINS

This chapter presents the results for the targeted value chains—maize, rice, cauliflower, and tomatoes—included in the Feed the Future Nepal ZOI Survey, including background information about each value chain and its farmers, the use of agriculture technologies and management practices, and the yield. Individuals responsible for making management decisions about one or more maize, rice, cauliflower, or tomato plots during the year preceding the ZOI Survey were eligible to respond to the corresponding survey modules. Throughout this chapter, these interviewed individuals are referred to as farmers. There may be more than one farmer of a specific value chain in the same household if the farmers were responsible for different plots of maize, rice, cauliflower, or tomatoes. Therefore, multiple farmers in the same household may have been interviewed about the same value chains. Additionally, the same farmer may have been responsible for more than one targeted value chain; in which case, the same farmer may have been interviewed about multiple value chains.

Results for each targeted value chain are presented across all farmers of that value chain and disaggregated by sex and age (15–29 years and 30 years or older). Group-wise tests of differences were run to compare the use of practices and technologies between male and female farmers and youth and non-youth farmers. Statistically significant results are indicated in the tables and discussed in the narrative.

Knowing what management practices and technologies farmers use to cultivate their crops and raise their fish or livestock fosters a better understanding of what farmers are already doing well and what they could do better to increase their productivity. Collecting information about management practices and technologies that farmers use through the ZOI Survey enables an examination of practices and technologies beyond those who have directly participated in Feed the Future programming. Feed the Future promotes improved management practices or technologies to increase agriculture productivity or support stronger and better-functioning systems. In all tables in this chapter, improved technologies promoted by Feed the Future in Nepal are indicated with a superscript (‡).

Yields of products from targeted agricultural value chains are a key driver of agricultural productivity. Yield can serve as a proxy for the productivity of these value chains and the impacts of interventions when the trend is evaluated over time. Improving smallholders' yield of agricultural commodities contributes to increasing agricultural GDP, can increase income when other components of agricultural productivity (e.g., post-harvest storage, value addition and processing, markets) are in place, and can therefore contribute to increasing sustainable productivity and reducing poverty.<sup>70</sup> Collecting information about yield through the ZOI Survey enables an examination of outcomes that have scaled beyond those who have directly participated in Feed the Future programming to have an effect at the ZOI level.

Not only did the ZOI Survey enable the collection of information about management practices, technologies, and yields in the ZOI, it also enabled the collection of information about the land that farmers used to cultivate targeted value chain crops in the ZOI. Assessing the soil in agricultural plots can provide information about the land's potential. Land potential is the long-term potential of the land

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<sup>70</sup> A smallholder holds 5 hectares or less of arable land.

to sustainably generate ecosystem services, which fall into four general categories: (1) provisioning, such as the production of food and water; (2) regulating, such as the control of climate and disease; (3) supporting, such as nutrient cycles and crop pollination; and (4) cultural, such as spiritual and recreational benefits. Soil characteristics, along with topography and climate, feed into land potential. Understanding land potential is important for human uses, such as agriculture and livestock keeping; for conserving biodiversity and natural resources; and for land-use planning as it can help farming households decide what activities are best suited for a piece of land. For example, a farmer can choose to plant one part of the farm with drought-tolerant crops and leave another plot with lower-potential soil fallow for livestock grazing.

Farmers' understanding of their land's potential can increase the household's resilience by providing information about which land is at risk of irreversible degradation and where crop failure risk due to drought is high. A household's economic well-being can be better managed by matching the household's land use with the sustainable potential of that land. In the ZOI Survey, survey field teams collected information to identify the soil type and soil characteristics of all agricultural plots where farmers in surveyed households cultivated targeted value chain crops during the year preceding the survey. This information is important because map-based soil prediction varies widely and soil maps are often not very accurate at predicting the soil type at a specific point.

## **7.1 Maize cultivation**

### **7.1.1 Cultivation of maize in Nepal**

Feed the Future targets the maize value chain in Nepal. Maize is the second most important crop produced in Nepal, after rice, in terms of area of cultivation and quantity of production.<sup>71</sup> In 2017-2018, Nepal produced 2.5 million metric tons of maize and the productivity yield was 2.7 mt/ha.<sup>72</sup> Nepal also has the highest per capita maize consumption in South Asia.<sup>73</sup> Maize is the hilly farmers' principal food crop and an animal feed source for different feed industries in the terai region. In recent years, the demand for maize has grown. As such, the Agriculture Development Strategy and other agricultural policies have prioritized maize cultivation and enhancing the maize value chain. However, despite these efforts, average maize yields remain well below regional and global averages. The unavailability of seeds and fertilizers, inadequate nutrient management, and high dependence on monsoon rainfall due to a lack of irrigation are among the main reasons for low agricultural productivity.<sup>74</sup>

Feed the Future engages with the maize value chain because of the crop's high potential for increased production and its significant role in local diets.<sup>75</sup> Feed the Future expands farmers' access to strengthened markets. Feed the Future also introduces and magnifies access to improved seed varieties.<sup>76</sup> Nepal's Global Food Security Strategy Country Plan (2018) details how Feed the Future

<sup>71</sup> MoALD, 2015. *Selected Indicators of Nepalese Agriculture and Population*. GoN, Agri-Business Promotion and Statistics Division, Kathmandu, Nepal.

<sup>72</sup> MoALD, 2019. *Fact Sheet of Agricultural Data*.

<sup>73</sup> P. Ranum, et. al., 2014. *Global maize production, utilization and consumption*. Annals of the New York Academy of Sciences 1: 1312.

<sup>74</sup> CIAT, 2017. *Climate Smart Agriculture in Nepal*.

<sup>75</sup> Feed the Future, 2018. *The Global Food Security Strategy (GFSS) Nepal Country Plan*, 10.

<sup>76</sup> Ibid., 13.

works with the feed industry in Nepal to foster private sector investment in supply chains. Feed the Future worked with industry stakeholders to promote high-quality local production of Quality Protein Maize hybrid varieties and increase the adoption of postharvest technologies designed to reduce insect infestations and fungal infections.<sup>77</sup> Additionally, through the Nepal Seed and Fertilizer (NSAF) Activity, Feed the Future works to promote aflatoxin yellow maize hybrids, polymer-coated urea, urea deep placement briquettes, and split fertilizer application technologies, all of which have high potential to increase farmer productivity.<sup>78</sup>

### 7.1.2 Farmers' background

**Table 7.1.1** presents the age and education characteristics of maize farmers in the ZOI. The largest proportion of maize farmers (18.6 percent) is aged 60 and above, and the smallest proportion (0.5 percent) is aged 15 to 19. There are statistically significant differences in the age of maize farmers by sex. Female farmers tend to be younger than male farmers. The largest proportion of maize farmers has no education (46.5 percent) and the smallest proportion has completed higher education (2.4 percent). There is a statistically significant difference in education level of maize farmers by sex. Female farmers tend to have lower levels of education than male maize farmers.

**Table 7.1.1: Age and education of maize farmers in the ZOI, in total and by farmers' sex**

| Background characteristic      | Total (%)    | Sex        |            | Sig. <sup>a</sup> | Number of maize farmers |
|--------------------------------|--------------|------------|------------|-------------------|-------------------------|
|                                |              | Male (%)   | Female (%) |                   |                         |
| Total                          | 100.0        | 50.7       | 49.3       |                   | 1,276                   |
| <b>Age</b>                     |              |            |            | ***               |                         |
| 15–19                          | 0.5          | 0.3        | 0.7        |                   | 7                       |
| 20–24                          | 3.9          | 0.8        | 7.0        |                   | 47                      |
| 25–29                          | 8.8          | 5.6        | 12.1       |                   | 112                     |
| 30–34                          | 11.3         | 9.6        | 13.1       |                   | 142                     |
| 35–39                          | 12.7         | 8.9        | 16.6       |                   | 162                     |
| 40–44                          | 11.5         | 9.4        | 13.6       |                   | 148                     |
| 45–49                          | 10.5         | 11.1       | 9.8        |                   | 131                     |
| 50–54                          | 12.5         | 14.3       | 10.6       |                   | 164                     |
| 55–59                          | 9.9          | 13.9       | 5.8        |                   | 126                     |
| 60+                            | 18.6         | 26.2       | 10.7       |                   | 237                     |
| <b>Education<sup>b</sup></b>   |              |            |            | ***               |                         |
| No education                   | 46.5         | 34.3       | 59.0       |                   | 596                     |
| Less than primary              | 28.9         | 36.9       | 20.7       |                   | 373                     |
| Completed primary              | 18.5         | 21.2       | 15.8       |                   | 236                     |
| Completed secondary            | 3.6          | 4.1        | 3.2        |                   | 41                      |
| Higher                         | 2.4          | 3.3        | 1.5        |                   | 29                      |
| <b>Number of maize farmers</b> | <b>1,276</b> | <b>643</b> | <b>633</b> |                   | <b>1,276</b>            |

<sup>a</sup>Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Estimates do not include “other” responses for this category.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating maize.

Source: Feed the Future Nepal ZOI Survey 2019

<sup>77</sup> Ibid., 14.

<sup>78</sup> CAMRIS International, Inc., 2019. Nepal Seed and Fertilizer Mid-Term Performance Evaluation. USAID Mission Nepal, 2.

**Table 7.1.2** presents information about why farmers cultivate maize, specifically for consumption, market, or both. A majority of maize farmers (86.8 percent) cultivate maize for consumption only. 13.2 percent of farmers cultivate maize both for consumption and for market sale. No maize farmers reported cultivating the crop purely for market sale. Female farmers are significantly more likely than male farmers to grow maize for consumption only, while male farmers are significantly more likely to grow maize both for consumption and for market sale.

**Table 7.1.2: Reasons for cultivating maize in the ZOI, in total and by farmers' sex and age**

| Reason for maize cultivation   | Total (%)    | Sex        |            | Sig. <sup>a</sup> | Age (years) |              | Sig. <sup>a</sup> |
|--------------------------------|--------------|------------|------------|-------------------|-------------|--------------|-------------------|
|                                |              | Female (%) | Male (%)   |                   | 15–29 (%)   | 30+ (%)      |                   |
| <b>Reason</b>                  |              |            |            | *                 |             |              | n/s               |
| Consumption only               | 86.8         | 88.8       | 84.9       |                   | 91.5        | 86.1         |                   |
| Market only                    | 0.0          | 0.0        | 0.0        |                   | 0.0         | 0.0          |                   |
| Consumption and market         | 13.2         | 11.2       | 15.1       |                   | 8.5         | 13.9         |                   |
| <b>Number of maize farmers</b> | <b>1,276</b> | <b>633</b> | <b>643</b> |                   | <b>166</b>  | <b>1,110</b> |                   |

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables.

Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating maize.

Source: Feed the Future Nepal ZOI Survey 2019

### 7.1.3 Application of management practices and technologies by maize farmers

This section examines the management practices and technologies that farmers used to grow maize. In all tables, Feed the Future-promoted improved management practices and technologies are indicated with a double dagger (‡).

#### Land preparation and management practices

Proper land preparation practices are important to provide the necessary conditions for improved soil health and successful crop growth. Land preparation includes the approaches that farmers take to prepare their plots for planting, including plowing or zero tillage practices. Improved land management practices increase soil fertility and enhance water-use efficiency to improve overall plot productivity. Land management includes crop rotation practices and approaches farmers take to soil and water management and irrigation of their plots. Globally, water-use efficiency in irrigation of crop plots is low. Raised-bed planting with trench irrigation, as well as bunding or terracing, can significantly increase water-use efficiency.<sup>79</sup> Using appropriate irrigation techniques, minimizing soil disturbances, using surface mulch, and rotating crops help boost crop yields.<sup>80</sup> Maize farmers may choose to grow complementary crops, such as legumes, alongside maize. Such intercropping enhances soil nutrition and fertility by adding much-needed nitrogen to the soil, increases resource-use efficiency, and discourages weeds, pests, and other crop diseases.<sup>81</sup>

**Table 7.1.3** shows the land preparation practices, planting practices, and cropping practices that maize farmers used in the ZOI. 41.4 percent of farmers practiced hand weeding. Female farmers were

<sup>79</sup> Solh, Braun, & Tadesse, 2014; Djagba, Rodenburg, Zwart, Houndagba, & Kiepe, 2014.

<sup>80</sup> Reeves, et al., 2016.

<sup>81</sup> Wilkins, 2008.



significantly more likely than male farmers to practice hand weeding, although differences did not vary significantly by age. Meanwhile, almost all farmers (98.7 percent) practiced plowing. Animal traction was the most common type of plowing, practiced by 82.1 percent of farmers. Hand tillage was the second most common form of plowing, practiced by 24.9 percent of farmers. These values did not differ significantly by sex or age category. Only 0.3 percent of farmers practiced zero tillage; individuals aged 15 to 29 were significantly more likely to do so than individuals aged 30 and above.

91.8 percent of farmers practiced crop rotation, while 7.8 percent of farmers left their plots fallow. Only 0.4 percent of farmers did not rotate their crops. These differences did not significantly vary by sex or age category.

A majority of farmers (63.0 percent) did not practice any form of soil or water management. The most commonly used form of management was terracing, practiced by 33.4 percent of farmers, distantly followed by soil bands and trenches (4.6 percent), mulching (3.4 percent), and adding lime to soil (0.8 percent). Farmers aged 15 to 29 were significantly less likely than older farmers to use soil bands and trenches. Otherwise, no management practices varied by sex or age.

The majority of farmers (86.2 percent) used no irrigation other than rainwater for their maize crops. Canals were the most commonly used (7.3 percent), followed by a pump system (7.1 percent). Age was significantly associated with the use of canals with farmers aged 30 and above more likely to use them than younger farmers. Sex was significantly associated with use of irrigation. Male farmers were more likely to use canals and pump systems than male farmers, while female farmers were more likely not to use irrigation.

**Table 7.1.3: Land preparation, planting practices, and management practices used by maize farmers in the ZOI, in total and by farmers' sex and age**

| Practice                               | Total (%) | Sex        |          |                   | Age (years) |         |                   |
|----------------------------------------|-----------|------------|----------|-------------------|-------------|---------|-------------------|
|                                        |           | Female (%) | Male (%) | Sig. <sup>a</sup> | 15–29 (%)   | 30+ (%) | Sig. <sup>a</sup> |
| Land preparation <sup>b</sup>          |           |            |          |                   |             |         |                   |
| Hand weeding                           | 41.4      | 47.2       | 35.7     | ***               | 44.5        | 40.9    | n/s               |
| Plowing <sup>b</sup>                   | 98.7      | 97.7       | 99.6     | **                | 98.4        | 98.7    | n/s               |
| Hand tillage                           | 24.9      | 24.9       | 24.9     | n/s               | 24.6        | 25.0    | n/s               |
| Animal traction                        | 82.1      | 80.3       | 83.9     | n/s               | 87.3        | 81.3    | n/s               |
| Motorized tiller                       | 0.3       | 0.2        | 0.4      | n/s               | 0.5         | 0.3     | n/s               |
| Tractor                                | 15.1      | 14.3       | 15.8     | n/s               | 9.6         | 15.9    | n/s               |
| Zero tillage <sup>b</sup>              | 0.3       | 0.4        | 0.2      | n/s               | 1.2         | 0.1     | *                 |
| Slash and plant                        | 0.3       | 0.4        | 0.2      | n/s               | 1.2         | 0.1     | *                 |
| Burn and plant                         | 0.0       | 0.0        | 0.0      | n/s               | 0.0         | 0.0     | n/s               |
| Herbicide and plant‡                   | 0.0       | 0.0        | 0.0      | n/s               | 0.0         | 0.0     | n/s               |
| None                                   | 0.1       | 0.2        | 0.0      | n/s               | 0.0         | 0.1     | n/s               |
| Crop rotated                           |           |            |          | n/s               |             |         | n/s               |
| Yes, rotated                           | 91.8      | 89.5       | 94.0     |                   | 94.1        | 91.5    |                   |
| No, did not rotate                     | 0.4       | 0.7        | 0.2      |                   | 0.0         | 0.5     |                   |
| No, left plot fallow                   | 7.8       | 9.7        | 5.9      |                   | 6.0         | 8.0     |                   |
| Soil and water management <sup>b</sup> |           |            |          |                   |             |         |                   |
| Terracing                              | 33.4      | 36.6       | 30.3     | n/s               | 31.3        | 33.7    | n/s               |

| Practice                                   | Total (%)    | Sex        |            | Sig. <sup>a</sup> | Age (years) |              | Sig. <sup>a</sup> |
|--------------------------------------------|--------------|------------|------------|-------------------|-------------|--------------|-------------------|
|                                            |              | Female (%) | Male (%)   |                   | 15–29 (%)   | 30+ (%)      |                   |
| Mulching <sup>‡</sup>                      | 3.4          | 2.5        | 4.3        | n/s               | 3.4         | 3.4          | n/s               |
| Soil bands, trenches                       | 4.6          | 4.0        | 5.2        | n/s               | 0.6         | 5.2          | **                |
| Adding lime to soil                        | 0.8          | 0.8        | 0.8        | n/s               | 0.0         | 0.9          | n/s               |
| None                                       | 63.0         | 60.8       | 65.1       | n/s               | 65.2        | 62.6         | n/s               |
| <b>Irrigation<sup>b</sup></b>              |              |            |            |                   |             |              |                   |
| Hand (watering can, hose)                  | 0.0          | 0.0        | 0.0        | n/s               | 0.0         | 0.0          | n/s               |
| Canals                                     | 7.3          | 5.5        | 9.0        | *                 | 2.9         | 7.9          | *                 |
| Permanent hose                             | 0.2          | 0.0        | 0.4        | n/s               | 0.0         | 0.3          | n/s               |
| Pump system                                | 7.1          | 5.3        | 8.9        | *                 | 3.9         | 7.6          | n/s               |
| Flood (basin, furrow, border) <sup>‡</sup> | 0.0          | 0.0        | 0.0        | n/s               | 0.0         | 0.0          | n/s               |
| Drip                                       | 0.0          | 0.0        | 0.0        | n/s               | 0.0         | 0.0          | n/s               |
| Traveling gun/moving sprinkler             | 0.0          | 0.0        | 0.0        | n/s               | 0.0         | 0.0          | n/s               |
| Sprinkler                                  | 0.0          | 0.0        | 0.0        | n/s               | 0.0         | 0.0          | n/s               |
| Center pivot                               | 0.0          | 0.0        | 0.0        | n/s               | 0.0         | 0.0          | n/s               |
| Forest                                     | 0.0          | 0.0        | 0.0        | n/s               | 0.0         | 0.0          | n/s               |
| None                                       | 86.2         | 88.7       | 83.7       | *                 | 91.0        | 85.2         | n/s               |
| <b>Number of maize farmers</b>             | <b>1,276</b> | <b>633</b> | <b>643</b> |                   | <b>166</b>  | <b>1,110</b> |                   |

<sup>a</sup> Results not statistically reliable, n<30

<sup>‡</sup> Promoted improved technology or management practice

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Farmers were allowed to give more than one response, so the percentages may not add up to 100 percent.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating maize.

Source: Feed the Future Nepal ZOI Survey 2019

## Use of inputs

This section presents information on maize farmers' inputs, including seed, fertilizer, manure, training, information, and decision-making for growing maize.

Certain hybrids of maize seed are more drought- and heat-tolerant than traditional maize and will produce greater yields when grown in very warm or drought-prone climates.<sup>82</sup> **Table 7.1.4** shows where farmers obtained their maize seeds and the types of maize seeds used. Most farmers (69.2 percent) used traditional varieties of seeds. Modern seeds were the second-most common seed variety (20.2 percent). Hybrid seeds were used by 10.7 percent of farmers. Farmers aged 30 and above were significantly more likely than younger farmers to use hybrid seeds.

A majority of farmers (71.9 percent) used seeds that they had saved themselves or received seeds from relatives for free. The two second-most common sources of seeds were an agricultural dealer (15.4 percent) and purchased from a friend or relative (5.5 percent). The primary source of farmers' seeds varied significantly by sex and age. The largest percentage point differences were regarding purchases from an agricultural dealer, where men were significantly more likely than women to purchase seeds, as were farmers aged 30 and above, relative to younger farmers.

<sup>82</sup> Edmeades, 2015

**Table 7.1.4: Seed types and seed sources used by maize farmers in the ZOI, in total and by farmers' sex and age**

| Characteristic or practice                                  | Total (%) | Sex        |          | Sig. <sup>a</sup> | Age (years) |         | Sig. <sup>a</sup> |
|-------------------------------------------------------------|-----------|------------|----------|-------------------|-------------|---------|-------------------|
|                                                             |           | Female (%) | Male (%) |                   | 15–29 (%)   | 30+ (%) |                   |
| Seed type <sup>b</sup>                                      |           |            |          |                   |             |         |                   |
| Unimproved or local open-pollinated varieties (traditional) | 69.2      | 68.0       | 70.4     | n/s               | 74.3        | 68.4    | n/s               |
| Improved open-pollinated varieties (modern) ‡               | 20.2      | 22.3       | 18.1     | n/s               | 19.9        | 20.2    | n/s               |
| Hybrid‡                                                     | 10.7      | 9.0        | 12.4     | n/s               | 3.8         | 11.8    | **                |
| Main seed source                                            |           |            |          | **                | *           |         |                   |
| Own saved/friend or relative (not purchased)                | 71.9      | 71.1       | 72.7     |                   | 76.0        | 71.3    |                   |
| Friend or relative (purchased)                              | 5.5       | 6.3        | 4.7      |                   | 9.1         | 4.9     |                   |
| Agriculture dealer (cash)                                   | 15.4      | 12.8       | 17.9     |                   | 9.0         | 16.4    |                   |
| Market or non-agriculture dealer                            | 2.9       | 4.4        | 1.5      |                   | 3.0         | 2.9     |                   |
| Aid distribution                                            | 2.6       | 4.0        | 1.2      |                   | 2.8         | 2.5     |                   |
| Number of maize farmers                                     | 1,276     | 633        | 643      |                   | 166         | 1,110   |                   |

‡ Promoted improved technology or management practice

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Farmers were allowed to give more than one response, so the percentages may not add up to 100 percent.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating maize.

Source: Feed the Future Nepal ZOI Survey 2019

Application of inorganic or organic fertilizers, such as manure and crop residues, plays an important role in soil health. Fertilizers help correct soil macro- and micro-nutrient deficiencies in many regions and promote crop growth.<sup>83</sup> Inorganic or mineral fertilizers are often too expensive for smallholder farmers and are frequently locally unavailable. Organic inputs can be used in place of or alongside mineral fertilizers, through improved waste recycling, crop residue composting, animal manure, and intercropping or crop rotation with legumes, trees, and shrubs.<sup>84</sup> **Table 7.1.5** presents information related to maize farmers' fertilizer practices.

Overall, 92.8 percent of maize farmers applied fertilizer to their crops. These values did not significantly differ by sex or age. Of those that did apply fertilizer, the largest proportion of farmers (95.9 percent) used a soil-based organic fertilizer, and soil-based inorganic fertilizers were the second-most commonly used (43.8 percent). Fewer than one percent of farmers used organic or inorganic foliar seeds. Farmers above the age of 30 were significantly more likely to use soil-based inorganic fertilizers than younger farmers. Otherwise, the type of fertilizer used did not vary significantly by sex or age. Most farmers (92.7 percent) applied this fertilizer at the planting stage. Farmers aged 15 to 29 were significantly more likely to apply fertilizer at this time than older farmers. 28.1 percent and 14.9 percent of farmers applied fertilizer at the early growth stage and mid-crop stage, respectively.

<sup>83</sup> Lal, 2010.

<sup>84</sup> Reeves, et al., 2016; Snapp, Mafongoya, and Waddington, 1998.

**Table 7.1.5: Maize farmers' fertilizer use, types of fertilizer, and timing of application in the ZOI, in total and by farmers' sex and age**

| Characteristic or practice                            | Total (%)    | Sex        |            | Sig. <sup>a</sup> | Age (years) |              | Sig. <sup>a</sup> |
|-------------------------------------------------------|--------------|------------|------------|-------------------|-------------|--------------|-------------------|
|                                                       |              | Female (%) | Male (%)   |                   | 15–29 (%)   | 30+ (%)      |                   |
| <b>Applied fertilizer</b>                             | 92.8         | 91.9       | 93.8       | n/s               | 90.9        | 93.1         | n/s               |
| <b>Number of maize farmers</b>                        | <b>1,276</b> | <b>633</b> | <b>643</b> |                   | <b>166</b>  | <b>1,110</b> |                   |
| <b>Type<sup>b</sup></b>                               |              |            |            |                   |             |              |                   |
| Soil-based organic                                    | 95.9         | 96.0       | 95.9       | n/s               | 97.0        | 95.8         | n/s               |
| Soil-based inorganic                                  | 43.8         | 42.7       | 44.9       | n/s               | 33.1        | 45.4         | *                 |
| Organic foliar feeds                                  | 0.2          | 0.4        | 0.0        | n/s               | 0.0         | 0.2          | n/s               |
| Inorganic foliar feeds                                | 0.3          | 0.7        | 0.0        | n/s               | 0.0         | 0.4          | n/s               |
| <b>Timing of application<sup>b</sup></b>              |              |            |            |                   |             |              |                   |
| Planting                                              | 92.7         | 93.4       | 92.1       | n/s               | 97.1        | 92.1         | *                 |
| Early growth stage                                    | 28.1         | 26.8       | 29.3       | n/s               | 20.0        | 29.3         | n/s               |
| Mid-crop                                              | 14.9         | 14.7       | 15.1       | n/s               | 11.7        | 15.3         | n/s               |
| <b>Number of maize farmers who applied fertilizer</b> | <b>1,168</b> | <b>568</b> | <b>600</b> |                   | <b>147</b>  | <b>1,021</b> |                   |

<sup>a</sup>Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables.

Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Farmers were allowed to give more than one response, so the percentages may not add up to 100 percent.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating maize.

Source: Feed the Future Nepal ZOI Survey 2019

Animal manure supplies beneficial nutrients to growing maize plants and improves soil fertility. In many countries, adequate quantities of animal manure for agricultural use may not be locally available and must be purchased elsewhere. **Table 7.1.6** presents information related to maize farmers' use of manure, including the percentage who use animal manure, how the manure was applied to fields, and the manure's source. 95.6 percent of maize farmers applied animal manure to their fields with no significant differences by sex or age. Of those who applied manure, almost all maize farmers applied manure by hand, and 95.8 percent of these farmers acquired the manure from their own animals. Again, these differences did not vary significantly by sex or age.

**Table 7.1.6: Manure sources and application practices used by maize farmers in the ZOI, in total and by farmers' sex and age**

| Characteristic or practice     | Total (%)    | Sex        |            | Sig. <sup>a</sup> | Age (years) |              | Sig. <sup>a</sup> |
|--------------------------------|--------------|------------|------------|-------------------|-------------|--------------|-------------------|
|                                |              | Female (%) | Male (%)   |                   | 15–29 (%)   | 30+ (%)      |                   |
| <b>Applied animal manure</b>   | 95.6         | 96.0       | 95.3       | n/s               | 94.         | 95.8         | n/s               |
| <b>Number of maize farmers</b> | <b>1,276</b> | <b>633</b> | <b>643</b> |                   | <b>166</b>  | <b>1,110</b> |                   |
| <b>Method of application</b>   |              |            |            | n/s               |             |              |                   |
| Other                          | 0.1          | 0.0        | 0.1        |                   | 0.0         | 0.1          |                   |
| By hand                        | 99.9         | 100        | 99.8       |                   | 100         | 99.9         |                   |
| By machine                     | 0.1          | 0.0        | 0.2        |                   | 0.0         | 0.1          |                   |
| <b>Source</b>                  |              |            |            | n/s               |             |              |                   |
| Own animals                    | 95.8         | 94.8       | 96.8       |                   | 95.3        | 95.9         |                   |
| Given, did not purchase        | 2.9          | 3.5        | 2.3        |                   | 2.8         | 2.9          |                   |
| Purchased                      | 1.3          | 1.7        | 0.9        |                   | 1.9         | 1.2          |                   |

| Characteristic or practice                        | Total (%)    | Sex        |            | Sig. <sup>a</sup> | Age (years) |              | Sig. <sup>a</sup> |
|---------------------------------------------------|--------------|------------|------------|-------------------|-------------|--------------|-------------------|
|                                                   |              | Female (%) | Male (%)   |                   | 15–29 (%)   | 30+ (%)      |                   |
| <b>Number of maize farmers who applied manure</b> | <b>1,214</b> | <b>600</b> | <b>614</b> |                   | <b>154</b>  | <b>1,060</b> |                   |

<sup>a</sup>Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables.

Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating maize.

Source: Feed the Future Nepal ZOI Survey 2019

Crop loss due to pests, weeds, and diseases can be substantial for smallholder farmers, with an estimated 31–50 percent loss of maize crops worldwide from these factors.<sup>85</sup> Maize is affected by fungal, bacterial, and viral diseases. Common fungal diseases include foliar, smut, cob/ear rot, stalk rot, and downy mildew. Common bacterial diseases include bacterial stalk rot, bacterial leaf strip, and stewart wilt. Common viruses include leaf fleck and mosaic.<sup>86</sup> Maize is also plagued by common pests, including army worms, blister beetles, cut worms, field crickets, moths, red ants, stem borers, termites, weevils, and white grubs.<sup>87</sup> Lastly, common weeds include commelina, digitaria, cyperus, cynodon, and ageratum.<sup>88</sup>

Adequate prevention and management measures may prevent or minimize crop losses. Herbicides and manual removal can control weeds, and pesticides, insecticides, and fungicides can help manage pests and crop diseases. There are also several favorable and effective non-chemical approaches to maize pest control.<sup>89</sup> Integrated pest management is an encouraged “problem-avoiding” approach to pest management that seeks to minimize pesticide use and control pests through cultural, manual, and biological means.<sup>90</sup> Intercropping and crop rotation is a particularly effective non-chemical measure for pest and weed management in Nepalese maize fields.<sup>91</sup> **Table 7.1.7** presents maize farmers’ pest and weed management practices.

Most maize farmers (91.1 percent) used no form of chemical pest management. Only 8.2 percent of maize farmers used chemicals in response to a pest attack. However, a majority of maize farmers (97.6 percent) used some form of weed control. The most commonly used practice was weeding with a hoe (93.6 percent), distantly followed by pulling weeds by hand (42.7 percent). Women were significantly more likely than men to use slashing and to pull weeds by hand. None of the practices varied significantly by age.

<sup>85</sup> Oerke, 2005.

<sup>86</sup> S. Subedi, 2015. *A Review on Important Maize Diseases and Their Management in Nepal*, Journal of Maize Research and Development.

<sup>87</sup> K.R. Paudel n.d. *Maize in Nepal: Production Systems, Constraints and Priorities for Research*. NARC & CIMMYT.

<sup>88</sup> DADO, 2016. *Maize Farming Technique Manual*. DADO Sindhupalchok & Gorkha and JICA.

<sup>89</sup> Reeves et. al., 2016.

<sup>90</sup> FAO, 2011.

<sup>91</sup> PQPMC, MoALD, 2019. *Annual Program and Statistics Book*.

**Table 7.1.7: Pest and weed management practices used by maize farmers in the ZOI, in total and by farmers' sex and age**

| Management practice                | Total (%)    | Sex        |            | Sig. <sup>a</sup> | Age (years) |              | Sig. <sup>a</sup> |
|------------------------------------|--------------|------------|------------|-------------------|-------------|--------------|-------------------|
|                                    |              | Female (%) | Male (%)   |                   | 15–29 (%)   | 30+ (%)      |                   |
| <b>Chemical pest management</b>    |              |            |            | n/s               |             |              | n/s               |
| Preventative (routine) ‡           | 0.8          | 1.1        | 0.5        |                   | 0.6         | 0.8          |                   |
| Response to attack‡                | 8.2          | 7.0        | 9.3        |                   | 7.5         | 8.3          |                   |
| None                               | 91.1         | 91.9       | 90.3       |                   | 92.0        | 91.0         |                   |
| <b>Weed management<sup>b</sup></b> |              |            |            |                   |             |              |                   |
| Herbicide applied‡                 | 0.1          | 0.2        | 0.0        | n/s               | 0.0         | 0.1          | n/s               |
| Weeding with hoe                   | 93.6         | 93.7       | 93.5       | n/s               | 93.6        | 93.6         | n/s               |
| Intercropping                      | 0.1          | 0.2        | 0.0        | n/s               | 0.0         | 0.1          | n/s               |
| Mulching‡                          | 0.0          | 0.0        | 0.0        | -                 | 0.0         | 0.0          | -                 |
| Slashing                           | 18.8         | 22.3       | 15.4       | **                | 24.0        | 18.0         | n/s               |
| Pull by hand                       | 42.7         | 48.8       | 36.9       | ***               | 46.3        | 42.2         | n/s               |
| None                               | 2.4          | 1.7        | 3.1        | n/s               | 2.2         | 2.5          | n/s               |
| <b>Number of maize farmers</b>     | <b>1,276</b> | <b>633</b> | <b>643</b> |                   | <b>166</b>  | <b>1,110</b> |                   |

‡ Promoted improved technology or management practice

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ ; n/s=not significant.

<sup>b</sup> Farmers were allowed to give more than one response, so the percentages may not add up to 100 percent.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating maize.

Source: Feed the Future Nepal ZOI Survey 2019

## Harvesting and waste reuse practices

This section presents information on the harvesting, drying, and shucking techniques used by maize farmers. Waste reuse practices, which are how farmers use the leftover maize husks, stalks, and cobs after harvesting, are also presented.

Harvesting is done when the maize has reached maturity and can be accomplished mechanically or manually by hand. Maize cobs may be shucked or left in the husk before transport and drying. After harvest, maize must be dried to reduce moisture content, prevent deterioration of the grain, and allow for safe storage.<sup>92</sup> Proper drying techniques are important to protect the maize from rodents and pests, prevent uneven drying, and prevent slow rates of drying, which may result in mold growth.<sup>93</sup> **Table 7.1.8** presents the harvesting techniques used by maize farmers in the ZOI.

The vast majority (99.4 percent) of maize farmers harvested their crops by hand, and only 0.1 percent harvested their crops by machine. These practices did not vary significantly by sex or age. A majority of maize farmers (77.4 percent) dried their crops on tarpaulins. No drying methods varied significantly by sex, although older farmers were significantly more likely than younger farmers to lay crops on the bare ground, and younger farmers significantly more likely than older farmers to leave crops to dry on the plants in the field. Finally, 92.0 percent of farmers shucked their crops by hand, and 40.6 percent

<sup>92</sup> FAO, 2003.

<sup>93</sup> Shepherd, 1999.

shucked their crops using sticks. Women were significantly more likely to shuck their crops by hand than men. Otherwise, shucking practices did not significantly vary by sex or age.

**Table 7.1.8: Harvesting, drying, and shucking methods used by maize farmers in the ZOI, in total and by farmers' sex and age**

| Method                                | Total (%)    | Sex        |            | Sig. <sup>a</sup> | Age (years) |              | Sig. <sup>a</sup> |
|---------------------------------------|--------------|------------|------------|-------------------|-------------|--------------|-------------------|
|                                       |              | Female (%) | Male (%)   |                   | 15–29 (%)   | 30+ (%)      |                   |
| <b>Harvesting method</b>              |              |            |            | n/s               |             |              | n/s               |
| By hand                               | 99.4         | 99.1       | 99.6       |                   | 99.3        | 99.4         |                   |
| By machine                            | 0.1          | 0.1        | 0.0        |                   | 0.0         | 0.1          |                   |
| Not yet harvested                     | 0.6          | 0.7        | 0.4        |                   | 0.8         | 0.6          |                   |
| <b>Drying method<sup>b</sup></b>      |              |            |            |                   |             |              |                   |
| Laid on bare ground                   | 4.8          | 3.4        | 6.1        | n/s               | 0.8         | 5.4          | *                 |
| Laid on ground covered with cow dung  | 13.1         | 13.9       | 12.4       | n/s               | 15.5        | 12.8         | n/s               |
| Laid on ground covered with straw     | 1.3          | 1.8        | 0.8        | n/s               | 0.0         | 1.5          | n/s               |
| Left to dry on plant                  | 3.4          | 4.2        | 2.6        | n/s               | 8.4         | 2.7          | ***               |
| Laid on tarpaulins                    | 77.4         | 77.0       | 77.8       | n/s               | 75.8        | 77.6         | n/s               |
| Used drying yard with cemented ground | 2.3          | 1.7        | 2.9        | n/s               | 0.0         | 2.7          | n/s               |
| Used drying racks                     | 0.2          | 0.2        | 0.3        | n/s               | 0.0         | 0.3          | n/s               |
| Other                                 | 30.0         | 30.9       | 29.3       | n/s               | 23.8        | 30.9         | n/s               |
| <b>Shucking method<sup>b</sup></b>    |              |            |            |                   |             |              |                   |
| By hand                               | 92.0         | 94.4       | 89.6       | ***               | 92.7        | 91.8         | n/s               |
| With sticks                           | 40.6         | 38.3       | 42.8       | n/s               | 45.0        | 40.0         | n/s               |
| With a machine                        | 2.6          | 2.5        | 2.6        | n/s               | 0.7         | 2.8          | n/s               |
| Did not shuck                         | 0.1          | 0.0        | 0.2        | n/s               | 0.0         | 0.1          | n/s               |
| <b>Number of maize farmers</b>        | <b>1,276</b> | <b>633</b> | <b>643</b> |                   | <b>166</b>  | <b>1,110</b> |                   |

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables.

Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Farmers were allowed to give more than one response, so the percentages may not add up to 100 percent.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating maize.

Source: Feed the Future Nepal ZOI Survey 2019

Maize residues have many valuable uses. Stalks, husks, and cobs that cannot be sold or consumed can be used directly in the field as organic fertilizer or mulch, in food preparation, as animal feed, and as a source of energy or fuel.<sup>94</sup> **Table 7.1.9** presents information on how maize crop residues are used by maize farmers in the ZOI.

A majority of maize farmers (89.6 percent) harvested and fed their maize stalks to their animals. 14.1 percent of farmers burned their maize stalks in the field, and 6.8 incorporated the stalks back into their soil. Female farmers were significantly more likely than male farmers to burn their maize stalks in their fields or leave the stalks in the field for grazing animals. However, age was not a significant determinant of how maize stalks were used.

<sup>94</sup> El-Mashad, Loon, Zeeman, Bot, & Lettinga, 2003.

A majority of maize farmers (91.4 percent) fed their maize husks to their animals. Only 4.5 percent of farmers sold or traded their maize husks with others as animal feed, and only 3.7 percent used maize husks as fuel for fire. Women were significantly more likely than men to use maize husks for their food preparation. However, age was not a significant determinant of how maize husks were used. Finally, most maize farmers (97.8 percent) used their maize cobs as fuel for fire, while only 3.3 percent of farmers used maize cobs to feed their animals. Sex and age were not significant determinants of cob use.

**Table 7.1.9: Use of crop residues by maize farmers in the ZOI, in total and by farmers' sex and age**

| Waste reuse practice                      | Total<br>(%) | Sex           |             |                   | Age (years)  |            |                   |
|-------------------------------------------|--------------|---------------|-------------|-------------------|--------------|------------|-------------------|
|                                           |              | Female<br>(%) | Male<br>(%) | Sig. <sup>a</sup> | 15–29<br>(%) | 30+<br>(%) | Sig. <sup>a</sup> |
| Maize stalks use <sup>b</sup>             |              |               |             |                   |              |            |                   |
| Burned in the field                       | 14.1         | 16.7          | 11.6        | *                 | 19.0         | 13.3       | n/s               |
| Incorporated back into soil               | 6.8          | 8.0           | 5.6         | n/s               | 9.2          | 6.4        | n/s               |
| Used as bedding for own livestock         | 6.3          | 7.9           | 4.8         | n/s               | 7.7          | 6.1        | n/s               |
| Used as fuel for fire                     | 5.1          | 3.9           | 6.3         | n/s               | 2.6          | 5.5        | n/s               |
| Left in field for grazing animals         | 0.9          | 1.5           | 0.4         | *                 | 2.3          | 0.7        | n/s               |
| Harvested and fed to own animals          | 89.6         | 88.4          | 90.9        | n/s               | 86.7         | 90.1       | n/s               |
| Harvested and sold to others              | 3.5          | 3.7           | 3.3         | n/s               | 2.3          | 3.7        | n/s               |
| Maize husks use <sup>b</sup>              |              |               |             |                   |              |            |                   |
| Used for own food preparation             | 0.6          | 1.1           | 0.2         | ***               | 0.6          | 0.6        | n/s               |
| Sold or traded for food preparation       | 0.0          | 0.0           | 0.0         | -                 | 0.0          | 0.0        | -                 |
| Used as fuel for fire                     | 3.7          | 3.6           | 3.8         | n/s               | 1.2          | 4.1        | n/s               |
| Fed to own animals                        | 91.4         | 91.6          | 91.1        | n/s               | 94.0         | 91.0       | n/s               |
| Sold or traded with others as animal feed | 4.5          | 4.6           | 4.4         | n/s               | 3.2          | 4.7        | n/s               |
| Did not use                               | 2.4          | 2.5           | 2.2         | n/s               | 4.0          | 2.1        | n/s               |
| Maize cobs use <sup>b</sup>               |              |               |             |                   |              |            |                   |
| Used as fuel for fire                     | 97.8         | 97.8          | 97.9        | n/s               | 98.1         | 97.8       | n/s               |
| Fed to own animals                        | 3.3          | 2.9           | 3.8         | n/s               | 3.3          | 3.3        | n/s               |
| Sold                                      | 0.0          | 0.0           | 0.0         | -                 | 0.0          | 0.0        | -                 |
| Number of maize farmers                   | 1,276        | 633           | 643         |                   | 166          | 1,110      |                   |

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables.

Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Farmers were allowed to give more than one response, so the percentages may not add up to 100 percent.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating maize.

Source: Feed the Future Nepal ZOI Survey 2019

## Storage practices

This section presents information on maize storage practices, including the use of various containers and storage locations. Storage serves several purposes in the maize post-harvest process. It protects against excessive heat, ground and rainwater, insects, rodents, birds, and harmful micro-organisms, and helps ensure that the maize retains its nutritional value.<sup>95</sup> **Table 7.1.10** presents information on how farmers store and transport their harvested maize in the ZOI.

<sup>95</sup> Shepherd, 1999.



89.9 percent of farmers stored their maize in bags, 1.2 percent of farmers used buckets and 1.2 percent used drums, and 7.8 percent of farmers did not store their maize in containers at all. The most commonly used bags were single-layer woven bags. Practices did not vary significantly by sex or age.

A majority of farmers (97.7 percent) stored their maize in residential houses, while 20.0 percent of maize farmers used cribs and 18.8 percent used granaries. Women were significantly more likely than men to store their maize in residential houses, while men were significantly more likely to store their maize in granaries or warehouses. Practices did not vary significantly by age.

**Table 7.1.10: Methods of storing and transporting maize in the ZOI, in total and by farmers' sex and age**

| Storage or transport method            | Total (%)    | Sex        |            | Sig. <sup>a</sup> | Age (years) |              | Sig. <sup>a</sup> |
|----------------------------------------|--------------|------------|------------|-------------------|-------------|--------------|-------------------|
|                                        |              | Female (%) | Male (%)   |                   | 15–29 (%)   | 30+ (%)      |                   |
| <b>Storage or transport containers</b> |              |            |            | n/s               |             |              | n/s               |
| Buckets                                | 1.2          | 1.5        | 0.9        |                   | 2.8         | 0.9          |                   |
| Drums                                  | 1.2          | 1.2        | 1.1        |                   | 0.8         | 1.2          |                   |
| Bags <sup>b</sup>                      | 89.9         | 91.1       | 88.6       |                   | 91.0        | 89.7         |                   |
| Single-layer woven bags                | 88.3         | 90.3       | 86.5       |                   | 91.4        | 10.5         |                   |
| Two- or three-layer woven bags         | 1.5          | 0.7        | 2.2        |                   | 0.0         | 1.7          |                   |
| Hermetic bags <sup>‡</sup>             | 0.0          | 0.2        | 0.0        |                   | 0.0         | 0.1          |                   |
| Did not put in containers              | 7.8          | 6.2        | 9.5        |                   | 5.4         | 8.2          |                   |
| <b>Storage location<sup>b</sup></b>    |              |            |            |                   |             |              |                   |
| Residential house                      | 97.7         | 98.6       | 96.8       | *                 | 96.9        | 97.8         | n/s               |
| Cribs                                  | 20.0         | 17.7       | 22.2       | n/s               | 17.8        | 20.3         | n/s               |
| Granaries                              | 18.8         | 14.5       | 22.9       | **                | 19.6        | 18.7         | n/s               |
| Warehouses                             | 0.5          | 0.2        | 0.8        | **                | 0.8         | 0.5          | n/s               |
| Storage silos                          | 0.2          | 0.2        | 0.2        | n/s               | 0.0         | 0.2          | n/s               |
| Other constructed stores               | 2.9          | 2.3        | 3.6        | n/s               | 1.8         | 3.1          | n/s               |
| Other locations                        | 11.4         | 12.2       | 10.7       | n/s               | 11.1        | 11.5         | n/s               |
| <b>Number of maize farmers</b>         | <b>1,276</b> | <b>633</b> | <b>643</b> |                   | <b>166</b>  | <b>1,110</b> |                   |

<sup>‡</sup> Promoted improved technology or management practice

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables.

Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Farmers were allowed to give more than one response, so the percentages may not add up to 100 percent.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating maize.

Source: Feed the Future Nepal ZOI Survey 2019

### Training, record keeping, information sources, and decision-making

Farmers may receive training on agricultural production, markets, and inputs, the use of fertilizers, pesticides, and herbicides, and integrated pest management. Farmers may also receive agricultural information from many sources both within and outside their communities. **Table 7.1.11** presents the percentages of maize farmers who received training on the use of inorganic fertilizers, pesticides, and herbicides, and farmers' main sources of information for how to grow their crops well.

Very few farmers in the ZOI received agricultural training. 3.6 percent of farmers received training on the use and application of inorganic fertilizer, 1.7 percent received training on the use and application of pesticides, and 0.7 percent received training on the application of herbicides. Farmers aged 30 and above

were more likely to have received training on the use and application of inorganic fertilizer. Otherwise, differences did not significantly vary by sex or age.

Most farmers (82.8 percent) received information on crop success from a friend or neighbor, distantly followed by other information sources (7.2 percent), and agro-input dealers (5.1 percent). Only 0.1 percent of farmers received information on crop success from television and 0.1 percent from mobile phone messaging; of those that did, all were men over the age of 30. Differences regarding information sources did not vary significantly by sex or age.

**Table 7.1.11: Training received and main information sources among maize farmers in the ZOI, in total and by farmers' sex and age**

| Topic or source                             | Total<br>(%) | Sex           |             |                   | Age (years)  |            |                   |
|---------------------------------------------|--------------|---------------|-------------|-------------------|--------------|------------|-------------------|
|                                             |              | Female<br>(%) | Male<br>(%) | Sig. <sup>a</sup> | 15–29<br>(%) | 30+<br>(%) | Sig. <sup>a</sup> |
| Training <sup>b</sup>                       |              |               |             |                   |              |            |                   |
| Use and application of inorganic fertilizer | 3.6          | 3.2           | 4.0         | n/s               | 0.7          | 4.0        | *                 |
| Use and application of pesticides‡          | 1.7          | 0.9           | 2.6         | n/s               | 0.7          | 1.9        | n/s               |
| Use and application of herbicides‡          | 0.7          | 0.6           | 0.8         | n/s               | 0.7          | 0.7        | n/s               |
| Main information source: crop success       |              |               |             | n/s               |              |            | n/s               |
| Friend or neighbor                          | 82.8         | 83.4          | 82.2        |                   | 82.3         | 82.9       |                   |
| Agro-input dealer                           | 5.1          | 3.4           | 6.7         |                   | 1.2          | 5.7        |                   |
| Agriculture extension worker                | 4.6          | 4.3           | 4.9         |                   | 6.7          | 4.3        |                   |
| Radio program                               | 0.2          | 0.2           | 0.2         |                   | 0.8          | 0.1        |                   |
| Television                                  | 0.1          | 0.0           | 0.2         |                   | 0.0          | 0.1        |                   |
| Mobile phone messaging                      | 0.1          | 0.0           | 0.1         |                   | 0.0          | 0.1        |                   |
| Other                                       | 7.2          | 8.8           | 5.8         |                   | 9.0          | 7.0        |                   |
| Number of maize famers                      | 1,276        | 633           | 643         |                   | 166          | 1,110      |                   |

<sup>‡</sup> Promoted improved technology or management practice

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Farmers were allowed to give more than one response, so the percentages may not add up to 100 percent.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating maize.

Source: Feed the Future Nepal ZOI Survey 2019

In households with multiple household members, farming decisions may be made by one person or two or more individuals jointly. **Table 7.1.12** presents the percent distribution of maize farmers by who made key production decisions, such as the type of seed to plant, whether to use fertilizer, and whether to irrigate.

More than 71 percent of female maize farmers made key production decisions alone. Slightly more women made independent decisions about whether to use fertilizer or whether to irrigate than about what type of seed to plant. The second most common pattern of decision-making for female farmers was making joint decisions with a partner. Female farmers were least likely to report that decisions were made by their partner alone. For all three types of decisions surveyed, patterns of decision-making varied significantly by sex.

Patterns of decision-making were similar for men, albeit slightly more collaborative. More than half of male maize farmers made decisions alone. Men were more likely to make independent decisions about

irrigation than about seeds and fertilizer. Male maize farmers were also approximately twice as likely to make decisions together with a partner than were female farmers. Male farmers were also the least likely to report that decisions were made by their partner alone.

**Table 7.1.12: Percent distribution of who made key maize production decisions in the ZOI, by farmers' sex**

| Decision-makers                             | Type of seed to plant |                   | Whether to use fertilizer |                   | Whether to irrigate |                   |
|---------------------------------------------|-----------------------|-------------------|---------------------------|-------------------|---------------------|-------------------|
|                                             | Percent               | Sig. <sup>a</sup> | Percent                   | Sig. <sup>a</sup> | Percent             | Sig. <sup>a</sup> |
| <b>Female farmers</b>                       |                       | ***               |                           | ***               |                     | ***               |
| Self alone                                  | 71.2                  |                   | 76.2                      |                   | 76.0                |                   |
| Partner/spouse alone                        | 0.6                   |                   | 0.5                       |                   | 0.2                 |                   |
| Self and partner together                   | 18.0                  |                   | 15.8                      |                   | 16.5                |                   |
| Self and other (could also include partner) | 9.9                   |                   | 7.5                       |                   | 7.4                 |                   |
| Other                                       | 0.3                   |                   | 0.0                       |                   | 0.0                 |                   |
| <b>Number of female maize farmers</b>       | <b>633</b>            |                   | <b>633</b>                |                   | <b>633</b>          |                   |
| <b>Male farmers</b>                         |                       | ***               |                           | ***               |                     | ***               |
| Self alone                                  | 55.6                  |                   | 53.8                      |                   | 62.6                |                   |
| Partner/spouse alone                        | 1.7                   |                   | 1.5                       |                   | 0.6                 |                   |
| Self and partner together                   | 32.5                  |                   | 34.0                      |                   | 29.0                |                   |
| Self and other (could also include partner) | 9.7                   |                   | 10.5                      |                   | 7.6                 |                   |
| Other                                       | 0.6                   |                   | 0.2                       |                   | 0.3                 |                   |
| <b>Number of male maize farmers</b>         | <b>643</b>            |                   | <b>643</b>                |                   | <b>643</b>          |                   |

<sup>a</sup>Significance tests were performed to determine whether an association exists between the outcome indicator and farmers' sex. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating maize.

Source: Feed the Future Nepal ZOI Survey 2019

#### 7.1.4 Use of improved management practices and technologies

This section examines maize farmers' use of improved management practices and technologies promoted by Feed the Future in the Nepal ZOI. Feed the Future has promoted a number of improved management practices for maize in recent years through the NSAF and Knowledge-based Integrated Sustainable Agriculture and Nutrition (KISAN) II projects. These efforts have included improved irrigation, post-harvest handling, and climate adaptation strategies. In particular, KISAN II has promoted the use of integrated pest management practices, such as biopesticides, traps and lures, the adoption of furrow irrigation technologies, and the post-harvest use of hermetic bags for seed storage. NSAF and KISAN II jointly promoted technologies such as pollinated maize varieties, crop genetics and hybrid seeds, and climate adaptation varieties.

**Table 7.1.13** shows the percentage of maize farmers in the ZOI who applied one or more improved management practices or technologies promoted by the Nepal mission during the 12 months preceding the ZOI Survey. The table also includes the percentage of maize farmers in the ZOI who used promoted improved management practices and technologies by category.

Overall, 38.9 percent of maize farmers in the ZOI applied at least one promoted improved management practice or technology. 33.9 percent of farmer applied promoted climate adaptation practices. 30.6

percent of farmers applied improved crop genetics, and 8.8 percent applied improved pest and disease management. No maize farmers reported that they used the promoted improved irrigation practices. Age and sex were not significantly associated with the application of any practice.

**Table 7.1.13: Percentage of maize farmers in the ZOI who applied one or more promoted improved management practices and technologies by category, in total and by farmers' sex and age**

| Category                                                   | Total (%)    | Sex         |             | Sig. <sup>a</sup> | Age (years) |              | Sig. <sup>a</sup> |
|------------------------------------------------------------|--------------|-------------|-------------|-------------------|-------------|--------------|-------------------|
|                                                            |              | Female (%)  | Male (%)    |                   | 15–29 (%)   | 30+ (%)      |                   |
| <b>Across all categories</b>                               | <b>38.9</b>  | <b>38.2</b> | <b>39.9</b> | n/s               | <b>33.3</b> | <b>39.9</b>  | n/s               |
| Crop genetics <sup>b</sup>                                 | 30.6         | 31.4        | 30.1        | n/s               | 23.7        | 31.8         | n/s               |
| Pest and disease management <sup>c</sup>                   | 8.8          | 8.1         | 9.7         | n/s               | 8.0         | 9.1          | n/s               |
| Improved climate adaptations <sup>d</sup>                  | 33.9         | 33.8        | 34.3        | n/s               | 25.9        | 35.3         | n/s               |
| Improved post-harvesting handling and storage <sup>e</sup> | 0.1          | 0.2         | 0.0         | n/s               | 0.0         | 0.1          | n/s               |
| Irrigation <sup>f</sup>                                    | 0.0          | 0.0         | 0.0         | -                 | 0.0         | 0.0          | -                 |
| <b>Number of maize farmers</b>                             | <b>1,276</b> | <b>633</b>  | <b>643</b>  |                   | <b>166</b>  | <b>1,110</b> |                   |

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Crop genetics refers to a farmer's use of hybrid and/or improved open pollinated varieties of seeds.

<sup>c</sup> Pest and disease management refers to farmer's use of chemicals, herbicides, or mulching.

<sup>d</sup> Climate adaptations included improved open pollinated or hybrid seed, permanent hose/drip irrigation and pump irrigation.

<sup>e</sup> Improved post-harvesting handling and storage included hermetic bags.

<sup>f</sup> Irrigation refers to a farmer's use of flood irrigation systems (basin, furrow or border).

Note: Estimates are based on de jure household members who are farmers responsible for cultivating maize.

Source: Feed the Future Nepal ZOI Survey 2019

**Table 7.1.14** shows the percent distribution of maize farmers in the ZOI who used promoted improved management practices and technologies, by the number used. Most farmers (61.2 percent) did not use any of the promoted improved management practices or technologies. 8.1 percent of farmers applied one practice or technology category, 27.0 percent applied two, and 3.8 percent applied three practice or technology categories. These differences did not vary significantly by sex or age.

**Table 7.1.14: Percent distribution of maize farmers by number of promoted improved management practices and technologies used in the ZOI, in total and by farmers' sex and age**

| Promoted improved practice or technology | Total (%)    | Sex        |            | Sig. <sup>a</sup> | Age (years) |              | Sig. <sup>a</sup> |
|------------------------------------------|--------------|------------|------------|-------------------|-------------|--------------|-------------------|
|                                          |              | Female (%) | Male (%)   |                   | 15–29 (%)   | 30+ (%)      |                   |
| <b>Number used</b>                       |              |            |            | n/s               |             |              | n/s               |
| 0                                        | 61.2         | 62.3       | 60.1       |                   | 66.7        | 60.1         |                   |
| 1                                        | 8.1          | 6.4        | 9.7        |                   | 9.6         | 7.8          |                   |
| 2                                        | 27.0         | 27.6       | 26.4       |                   | 23.1        | 27.6         |                   |
| 3                                        | 3.8          | 3.8        | 3.9        |                   | 0.6         | 4.3          |                   |
| <b>Number of maize farmers</b>           | <b>1,276</b> | <b>633</b> | <b>643</b> |                   | <b>166</b>  | <b>1,110</b> |                   |

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating maize.

Source: Feed the Future Nepal ZOI Survey 2019

### 7.1.5 Maize yields

Yield is a measure of total production per unit of area planted. For maize, yield at the farmer level is the weight of maize, in metric tons, harvested in the season preceding the survey divided by the area, in hectares, planted in the season preceding the survey. Total production is the amount produced, regardless of how it was ultimately used. It also includes any post-harvest loss (i.e., post-harvest loss is not subtracted from total production.) To compute average farmer yield in the ZOI, maize yield is calculated for each farmer and then averaged across farmers. Dividing the estimated total production of farmers in the ZOI by the estimated total area planted by farmers in the ZOI gives the area-weighted average yield of maize in the ZOI. **Table 7.1.15** presents the total production in metric tons (mt), total production units in hectares (ha), and the average area-weighted and average farmer yields of maize in metric tons per hectare (mt/ha) for the season preceding the ZOI Survey. The table also presents the average production (mt), average units of production (ha), and average yield of maize per farmer for the same time period. The results are disaggregated by farm size (smallholder and non-smallholder) and further by sex and age. All data on total production and total units of production are self-reported, thus yields are calculated using self-reported data.<sup>96</sup>

Overall, maize farmers in the ZOI produced an estimated total of 343,731 mt of maize in the season preceding the survey. An estimated total of 119,072 ha was cultivated, for an average area-weighted yield of 2.9 mt/ha. Average farmer yield was 2.7 mt/ha. Average farmer yield was greater for male farmers relative to female farmers, and for farmers 30 years and older relative to younger farmers. Sex and age were statistically significant determinants of yield for farmers overall and for smallholder farmers. Due to the small sample size, estimates were not available for non-smallholder farms.

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<sup>96</sup> Due to low response rates for land measurements combined with issues merging measurement data between CSPro and the area measurement software, the sample size for plot measurements was significantly reduced. Accordingly, all yield estimates are based on self-reported areas. Field teams collected self-reported area for all plots farmed (up to 8) for each of the farmers interviewed in the household (not only plots that were sampled for direct area measurement).

**Table 7.1.15: Maize yield in the ZOI during the season preceding the survey, by farm size and farmers' sex and age**

| Background characteristic | Area-weighted   |                          |               | Average per farmer |                          |               | Sig. <sup>a</sup> | Number of maize farmers (n) |
|---------------------------|-----------------|--------------------------|---------------|--------------------|--------------------------|---------------|-------------------|-----------------------------|
|                           | Production (mt) | Units of production (ha) | Yield (mt/ha) | Production (mt)    | Units of production (ha) | Yield (mt/ha) |                   |                             |
| <b>Total</b>              | 343,730.5       | 119,072.1                | 2.9           | 0.5                | 0.1                      | 2.7           |                   | <b>838</b>                  |
| <b>Sex</b>                |                 |                          |               |                    |                          |               | **                |                             |
| Female                    | 146,171.5       | 53,682.2                 | 2.7           | 0.4                | 0.2                      | 2.4           |                   | 396                         |
| Male                      | 197,553.3       | 65,389.8                 | 3.0           | 0.5                | 0.2                      | 3.0           |                   | 442                         |
| <b>Age</b>                |                 |                          |               |                    |                          |               | **                |                             |
| 15-29 years               | 31,975.13       | 21,241.3                 | 1.5           | 0.3                | 0.3                      | 2.0           |                   | 108                         |
| 30+ years                 | 311,749.7       | 97,830.8                 | 3.2           | 0.5                | 0.2                      | 2.8           |                   | 730                         |
| <b>Farm size</b>          |                 |                          |               |                    |                          |               |                   |                             |
| <b>Smallholder</b>        | 338,333.2       | 117,071.0                | 2.9           | 0.9                | 0.2                      | 2.7           |                   | 830                         |
| <b>Sex</b>                |                 |                          |               |                    |                          |               | **                |                             |
| Female                    | 142,442.2       | 52,060.5                 | 2.7           | 0.4                | 0.2                      | 2.4           |                   | 391                         |
| Male                      | 195,885.4       | 65,010.5                 | 3.0           | 0.5                | 0.2                      | 3.0           |                   | 439                         |
| <b>Age</b>                |                 |                          |               |                    |                          |               | **                |                             |
| 15-29 years               | 30,461.1        | 20,010.57                | 1.5           | 0.4                | 0.2                      | 2.1           |                   | 106                         |
| 30+ years                 | 307,866.4       | 97,060.43                | 3.2           | 0.5                | 0.2                      | 2.8           |                   | 724                         |
| <b>Non-smallholder</b>    | ^               | ^                        | ^             | ^                  | ^                        | ^             | -                 | <b>8</b>                    |
| <b>Sex</b>                |                 |                          |               |                    |                          |               | -                 |                             |
| Female                    | ^               | ^                        | ^             | ^                  | ^                        | ^             |                   | 5                           |
| Male                      | ^               | ^                        | ^             | ^                  | ^                        | ^             |                   | 3                           |
| <b>Age</b>                |                 |                          |               |                    |                          |               | -                 |                             |
| 15-29 years               | ^               | ^                        | ^             | ^                  | ^                        | ^             |                   | 2                           |
| 30+ years                 | ^               | ^                        | ^             | ^                  | ^                        | ^             |                   | 6                           |

^ Results not statistically reliable, n<30

<sup>a</sup>Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating maize.

Source: Feed the Future Nepal ZOI Survey 2019

**Table 7.1.16** presents the average amount of harvested maize, in kilograms (kg), consumed by farmers' own households, among all households, and the average amount of harvested maize also sold by farmers, among households that sold their maize. For maize farms of all sizes, the maize farmer's household consumed an average of 315.2 kg of maize. Among farmers who sold maize, the average amount harvested was 758.4 kg and the average amount sold was 265.0 kg. In households where the maize farmer was male, the household consumed an additional 101.4 kg of maize relative to households where the farmer was female. These differences were statistically significant. In households where the maize farmer was aged 30 years or older, the household consumed an additional 76.0 kg of maize relative to households where the farmer was younger than 30. These differences were also statistically significant. Sex was significantly associated with the amount of maize that a farmer sold when they sold maize. Male farmers sold 323.4 kg of maize on average, compared to 184.1 kg sold by female farmers. Age was not significantly associated with the amount of maize sold.

Among smallholder farmers, the maize farmer's household consumed an average of 316.1 kg of maize. Among smallholder farmers who sold maize, the average amount harvested was 760.0 kg and the average amount sold was 265.1 kg. Again, in households where the maize farmer was male, the household consumed and, when they sold maize, sold more maize than in households where the maize farmer was female. Sex was significantly associated with both consumption and sales of maize among smallholder farmers, but age was only associated with consumption. Due to the small sample size, estimates for amount consumed, harvested, and sold are unavailable for non-smallholder farmers; estimates for amount harvested and sold are unavailable for farmers between 15 and 29 years of age.

**Table 7.1.16: Average amount of maize in kilograms consumed by farmers' own households and sold by farmers in the ZOI by farm size, in total and by farmers' sex and age**

| Use of maize           | Average amount consumed (kg) | Sig. <sup>a</sup> | Number of maize farmers | Average amount harvested (kg) | Average amount sold (kg) | Sig. | Number of maize farmers who sold maize |
|------------------------|------------------------------|-------------------|-------------------------|-------------------------------|--------------------------|------|----------------------------------------|
| <b>Total</b>           | 315.2                        |                   | <b>1,238</b>            | 758.4                         | 265.0                    |      | <b>162</b>                             |
| <b>Sex</b>             |                              | ***               |                         |                               |                          | ***  |                                        |
| Female                 | 263.7                        |                   | 610                     | 467.1                         | 184.1                    |      | 67                                     |
| Male                   | 365.1                        |                   | 628                     | 1,002.3                       | 323.4                    |      | 95                                     |
| <b>Age</b>             |                              | **                |                         |                               |                          | n/s  |                                        |
| 15–29 years            | 249.4                        |                   | 161                     | ^                             | ^                        |      | 13                                     |
| 30+ years              | 325.4                        |                   | 1,077                   | 780.2                         | 263.4                    |      | 149                                    |
| <b>Farm size</b>       |                              |                   |                         |                               |                          |      |                                        |
| <b>Smallholder</b>     | 316.1                        |                   | <b>1,213</b>            | 760.0                         | 265.1                    |      | <b>159</b>                             |
| <b>Sex</b>             |                              | ***               |                         |                               |                          | ***  |                                        |
| Female                 | 264.2                        |                   | 592                     | 461.7                         | 185.0                    |      | 65                                     |
| Male                   | 365.5                        |                   | 621                     | 1,002.3                       | 321.7                    |      | 94                                     |
| <b>Age</b>             |                              | *                 |                         |                               |                          | n/s  |                                        |
| 15–29 years            | 251.6                        |                   | 1,060                   | ^                             | ^                        |      | 11                                     |
| 30+ years              | 325.8                        |                   | 153                     | 780.2                         | 262.0                    |      | 148                                    |
| <b>Non-smallholder</b> | ^                            |                   | <b>25</b>               | ^                             | ^                        |      | <b>3</b>                               |

| Use of maize | Average amount consumed (kg) | Sig. <sup>a</sup> | Number of maize farmers | Average amount harvested (kg) | Average amount sold (kg) | Sig. | Number of maize farmers who sold maize |
|--------------|------------------------------|-------------------|-------------------------|-------------------------------|--------------------------|------|----------------------------------------|
| <b>Sex</b>   |                              | -                 |                         |                               |                          | -    |                                        |
| Female       | ^                            |                   | 18                      | ^                             | ^                        |      | 2                                      |
| Male         | ^                            |                   | 7                       | ^                             | ^                        |      | 1                                      |
| <b>Age</b>   |                              | -                 |                         |                               |                          | -    |                                        |
| 15–29 years  | ^                            |                   | 8                       | ^                             | ^                        |      | 2                                      |
| 30+ years    | ^                            |                   | 17                      | ^                             | ^                        |      | 1                                      |

<sup>a</sup> Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level:

\* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating maize.

Source: Feed the Future Nepal ZOI Survey 2019

**Table 7.1.17** presents the main buyers of harvested maize in the ZOI Survey. Maize farmers' most frequent buyers, irrespective of the size of their farm, were relatives or friends at 44.0 percent. For smallholder farmers, 43.4 percent of buyers were friends or relatives. Neither sex nor age were significantly associated with the main buyer of maize. Due to the small sample size, estimates for non-smallholder farmers are not statistically reliable.

**Table 7.1.17: Main buyers of maize produced in the ZOI by farm size, in total and by farmers' sex and age**

| Main buyer of maize                                        | Total (%)  | Sex        |           | Sig. <sup>a</sup> | Age (years) |            | Sig. <sup>a</sup> |
|------------------------------------------------------------|------------|------------|-----------|-------------------|-------------|------------|-------------------|
|                                                            |            | Female (%) | Male (%)  |                   | 15–29 (%)   | 30+ (%)    |                   |
| <b>Total</b>                                               |            |            |           | n/s               |             |            | -                 |
| Relative or friend                                         | 44.0       | 53.2       | 36.5      |                   | ^           | 41.4       |                   |
| Local market                                               | 35.2       | 24.5       | 43.8      |                   | ^           | 35.8       |                   |
| Private trader                                             | 14.1       | 12.6       | 15.4      |                   | ^           | 15.4       |                   |
| Other                                                      | 6.7        | 9.8        | 4.3       |                   | ^           | 7.3        |                   |
| <b>Total number of maize farmers that sold maize</b>       | <b>134</b> | <b>64</b>  | <b>70</b> |                   | <b>11</b>   | <b>123</b> |                   |
| <b>Farm size</b>                                           |            |            |           |                   |             |            |                   |
| <b>Smallholder</b>                                         |            |            |           | n/s               |             |            | -                 |
| Relative or friend                                         | 43.4       | 52.0       | 36.5      |                   | ^           | 41.4       |                   |
| Local market                                               | 35.5       | 24.1       | 43.8      |                   | ^           | 35.8       |                   |
| Private trader                                             | 14.3       | 12.9       | 15.4      |                   | ^           | 15.4       |                   |
| Other                                                      | 6.8        | 10.0       | 4.3       |                   | ^           | 7.3        |                   |
| <b>Number of smallholder maize farmers that sold maize</b> | <b>132</b> | <b>62</b>  | <b>70</b> |                   | <b>9</b>    | <b>123</b> |                   |
| <b>Non-smallholder</b>                                     |            |            |           | -                 |             |            | -                 |
| Relative or friend                                         | ^          | ^          | ^         |                   | ^           | ^          |                   |
| Local market                                               | ^          | ^          | ^         |                   | ^           | ^          |                   |
| Private trader                                             | ^          | ^          | ^         |                   | ^           | ^          |                   |
| Other                                                      | ^          | ^          | ^         |                   | ^           | ^          |                   |



| Main buyer of maize                                            | Total (%) | Sex        |          | Sig. <sup>a</sup> | Age (years) |          | Sig. <sup>a</sup> |
|----------------------------------------------------------------|-----------|------------|----------|-------------------|-------------|----------|-------------------|
|                                                                |           | Female (%) | Male (%) |                   | 15–29 (%)   | 30+ (%)  |                   |
| <b>Number of non-smallholder maize farmers that sold maize</b> | <b>2</b>  | <b>2</b>   | <b>0</b> |                   | <b>2</b>    | <b>0</b> |                   |

<sup>a</sup> Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables.

Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating maize.

Source: Feed the Future Nepal ZOI Survey 2019

### 7.1.6 Soil characteristics

This section presents soil characteristics, including texture, rock fragment percentage, land capability classification (LCC), and soil limitations of plots used to grow maize in the ZOI. Texture is an important soil property that affects crop production, land use, and land management. A soil's ability to retain nutrients and also drain is directly related to its texture.<sup>97</sup> Soil can be classified into one of 12 textural classes, as shown in **Table 7.1.18**, depending on the percentages of sand, silt, and clay that it contains.<sup>98</sup>

**Table 7.1.18** also presents the percent distribution of soil textures in maize plots in the ZOI by depth, or soil horizon. For maize soil samples of depths of zero centimeters up to 20 centimeters, the largest proportion of soil consisted of sandy clay loam (27.7 percent), followed by sandy loam and silty clay loam. For soil samples of measurements 20 to 70 centimeters deep, the largest proportion contained sandy loam, followed by sandy clay loam and silty clay loam. Sand, clay and silty loam were the least common soil consistencies found in maize plots at this depth.

**Table 7.1.18: Soil texture by soil horizon in maize plots in the ZOI**

| Depth (cm) | Soil texture (%) |           |            |      |            |                 |            |            |            |                 | Number of plots |
|------------|------------------|-----------|------------|------|------------|-----------------|------------|------------|------------|-----------------|-----------------|
|            | Clay             | Clay loam | Loamy sand | Sand | Sandy clay | Sandy clay loam | Sandy loam | Silty loam | Silty clay | Silty clay loam |                 |
| 0 to <1    | 1.8              | 12.3      | 6.1        | 5.8  | 0.7        | 1.9             | 27.7       | 22.9       | 3.3        | 3.3             | 1,177           |
| 1 to <10   | 2.1              | 14.4      | 4.7        | 6.0  | 0.8        | 2.6             | 23.8       | 20.6       | 2.3        | 4.4             | 1,177           |
| 10 to <20  | 1.9              | 12.1      | 4.4        | 8.2  | 1.2        | 3.0             | 23.1       | 20.5       | 2.1        | 7.6             | 1,170           |
| 20 to <50  | 2.6              | 6.8       | 4.7        | 10.3 | 2.0        | 3.5             | 20.6       | 25.0       | 1.8        | 8.8             | 1,123           |
| 50 to <70  | 1.9              | 6.0       | 4.2        | 12.1 | 2.2        | 3.9             | 18.2       | 22.7       | 1.5        | 11.8            | 806             |

Note: Estimates are based on de jure household members who are farmers responsible for cultivating maize.

Source: Feed the Future Nepal ZOI Survey 2019

Rock fragments are unattached pieces of rock two millimeters in diameter or larger. Rock fragments are characterized by their size and shape and, in some cases, the type of rock. Rock fragments classes include pebbles, cobbles, channers, flagstones, stones, and boulders.<sup>99</sup> **Table 7.1.19** presents the percent distribution of rock fragments in maize plots in the ZOI by soil horizon.

For maize soil samples of less than one centimeter and greater than 50 centimeters in depth, the greatest proportion of samples consisted of zero to one percent rock fragments, followed by one to 15

<sup>97</sup> Jaja, 2016.

<sup>98</sup> USDA-NRCS, 1999.

<sup>99</sup> A Guide for Preparing Soil Profile Descriptions. Soils Properties and Processes. NRE 430/ EEB 489.

percent rock fragments. Maize soil samples of between one to 50 centimeters in depth most frequently consisted of one to 15 percent rock fragments, followed by zero to one percent. Irrespective of the depth of the soil sample, plots that consisted of 60 percent rock fragments or greater were the least common.

**Table 7.1.19: Rock fragment percentage by soil horizon in maize plots in the ZOI**

| Depth (cm) | Rock fragment percentage (%) |             |            |            |      | Number of plots |
|------------|------------------------------|-------------|------------|------------|------|-----------------|
|            | 0 to <1%                     | 1 to <15%   | 15 to <35% | 35 to <60% | ≥60% |                 |
| 0 to <1    | <b>38.7</b>                  | 36.6        | 19.7       | 4.8        | 0.3  | <b>1,177</b>    |
| 1 to <10   | 38.2                         | <b>38.4</b> | 19.3       | 3.9        | 0.1  | <b>1,177</b>    |
| 10 to <20  | 37.1                         | <b>37.2</b> | 19.9       | 5.8        | 0.1  | <b>1,170</b>    |
| 20 to <50  | 33.6                         | <b>34.2</b> | 23.3       | 8.3        | 0.7  | <b>1,126</b>    |
| 50 to <70  | <b>38.8</b>                  | 30.9        | 19.7       | 9.6        | 1.0  | <b>810</b>      |

Note: Estimates are based on de jure household members who are farmers responsible for cultivating maize.

Source: Feed the Future Nepal ZOI Survey 2019

LCC is a system of grouping soils based on their capability to produce crops without deteriorating over time.<sup>100</sup> The eight capability classes, which indicate to farmers how limited their soil is for producing crops, are described in **Table 7.1.20**. This table also presents the percentage of maize plots and average maize yield by LCC.

The largest proportion of maize plots (33.6 percent) fell into the third-best category of the LCC system, categorized as plots with soil with severe limitations that reduce the choice of plants, require special conservation practices, or both. The second-largest proportion of plots (17.0 percent) fell into the fourth-best category, described as plots with very severe limitations that restrict the choice of plants, require very careful management, or both. The smallest proportion of plots (0.2 percent) fell into the best category, described as plots with slight limitations that restrict soil use.

**Table 7.1.20: Percentage of maize plots and average maize yield in the ZOI by LCC**

| LCC      | Description                                                                                                                                                      | Percent of maize plots (%) | Average maize yield (mt/ha) | Number of maize farmers <sup>a</sup> |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-----------------------------|--------------------------------------|
| I (best) | Slight limitations that restrict soil use                                                                                                                        | 0.2                        | ^                           | 0                                    |
| II       | Moderate limitations that reduce the choice of plants or require moderate conservation practices                                                                 | 3.4                        | 2.7                         | 35                                   |
| III      | Severe limitations that reduce the choice of plants or require special conservation practices, or both                                                           | 33.6                       | 3.2                         | 218                                  |
| IV       | Very severe limitations that restrict the choice of plants or require very careful management, or both                                                           | 17.0                       | 2.5                         | 97                                   |
| V        | Little or no hazard of erosion, but with other limitations; impractical to remove; limits soil use to mainly pasture, rangeland, forestland, or wildlife habitat | 8.9                        | 2.7                         | 55                                   |

<sup>100</sup> USDA, n.d.

| LCC                    | Description                                                                                                                                                   | Percent of maize plots (%) | Average maize yield (mt/ha) | Number of maize farmers <sup>a</sup> |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-----------------------------|--------------------------------------|
| VI                     | Severe limitations that make soils generally unsuited to cultivation and limit their use mainly to pasture, rangeland, forestland, or wildlife habitat        | 16.0                       | 2.5                         | 107                                  |
| VII                    | Very severe limitations that make the soils unsuited to cultivation and that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat | 14.4                       | 2.8                         | 77                                   |
| VIII (worst)           | Limitations that prevent use for commercial plant production and limit use mainly to recreation, wildlife habitat, water supply, or esthetic purposes         | 6.5                        | 1.8                         | 33                                   |
| Unclassified           |                                                                                                                                                               | 0.0                        | ^                           | 0                                    |
| <b>Number of plots</b> |                                                                                                                                                               | <b>904</b>                 |                             |                                      |

<sup>a</sup> Estimates include only maize farmers who cultivated maize on one plot or who cultivated maize on multiple plots that all had the same LCC score. Farmers who cultivated maize on multiple plots that did not all have the same LCC score or without a value for maize yield were excluded.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating maize.

Sources: Feed the Future Nepal ZOI Survey 2019, United States Department of Agriculture. 2018. National Soil Survey Handbook, Part 622

The LCC designation is accompanied by a sub-class designation. The sub-class designation indicates to farmers the main limitation of their plot's soil, such as erosion risk and low soil depth. A plot can have multiple sub-class designations if it has more than one notable limitation. The ten sub-classes, which are indicated by letters, are described in **Table 7.1.21**. This table also presents the percentages of maize farmers in the ZOI who have plots with soil in each LCC sub-class.

For the largest proportion of maize farmers (44.9 percent), soil depth was the main limitation of their plot's soil. The second most common soil limitation was erosion risk (33.1 percent), followed by soil water storage capacity (30.6 percent). Interestingly, flooding during the growing season was not the main soil limitation for any maize farmers.

**Table 7.1.21: Percentage of maize farmers in the ZOI with one or more plots that meet each LCC criteria**

| LCC criteria               | Description                                                                                          | Reason for assessment                                                                                                                         | Classification                     | Percent |
|----------------------------|------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|---------|
| Erosion risk (e)           | Risk of surface soil wearing away due to moving water, depending on the soil texture and land slope. | Erosion is a major factor limiting future agricultural production. If the productive soil erodes away, the yields will significantly decline. | Plot is at risk of soil erosion.   | 33.1    |
| Soil depth (s-d)           | Depth of soil to bedrock or other root-limiting layer.                                               | Soil depth can limit crop root growth if not deep enough.                                                                                     | Plot soil depth is low.            | 44.9    |
| Surface soil texture (s-t) | Soil texture near the surface is important for seedling establishment.                               | Poor surface soil texture can prevent seedling establishment.                                                                                 | Plot surface soil texture is poor. | 1.3     |

| LCC criteria                         | Description                                                                                                | Reason for assessment                                                                                                                | Classification                                  | Percent    |
|--------------------------------------|------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|------------|
| Salinity (s-k)                       | Salt on the soil surface is an indicator of high soil salinity.                                            | High soil salinity can limit crop growth.                                                                                            | Plot soil has high salinity.                    | 0.6        |
| Surface stoniness (s-r)              | Percentage of soil covered by stones and boulders (larger than 25 cm).                                     | Soil covered by stones and boulders can impede the use of tractors and animal-pulled plows.                                          | Plot surface too stony.                         | 20.5       |
| Soil water storage capacity (s-a)    | The amount of water that the soil can store that is usable by plants.                                      | A lower ability to store water means there is less water available for plants to grow. Farmers should plant drought-resistant crops. | Plot soil has poor ability to store water.      | 30.6       |
| Lime requirement (s-l)               | Soil with a low soil pH (high acidity) requires lime to raise the pH to the ideal range for growing crops. | Soil with a low pH (high acidity) can limit crop production.                                                                         | Plot soil has high acidity.                     | 2.0        |
| Flooding during growing season (w-f) | Frequency of flooding during the growing season.                                                           | Flooding can damage crops and influence crop selection.                                                                              | Plot subject to flooding during growing season. | 0.0        |
| Water table depth (w-d)              | Typical water table depth during the growing season.                                                       | A water table that is too high can create an environment not conducive to root growth.                                               | Plot water table depth is too high.             | 0.5        |
| Permeability (w-p)                   | The ability of water to move through the soil.                                                             | Low permeability can limit root growth during wet periods due to waterlogging.                                                       | Plot soil permeability is low.                  | 7.5        |
| <b>Number of maize farmers</b>       |                                                                                                            |                                                                                                                                      |                                                 | <b>904</b> |

Note: Estimates are based on de jure household members who are farmers responsible for cultivating maize.

Sources: Feed the Future Nepal ZOI Survey 2019, United States Department of Agriculture. 2018. National Soil Survey Handbook, Part 622

## 7.2 Rice

### 7.2.1 Cultivation of rice in Nepal

Feed the Future targets the paddy rice value chain in Nepal. Paddy rice is the principal and most important food grain crop in Nepal. Paddy rice is grown on 80 percent of all cultivated land in Nepal. In 2017–2018, Nepal produced 5.15 million mt of rice; the productivity yield was 3.5 mt/ha.<sup>101</sup> Paddy rice constitutes 53 percent of Nepal's total cereal food production and contributes to approximately one-fourth of agricultural GDP. Moreover, more than 75 percent of the agricultural working population is engaged in rice farming for at least six months of the year. Rice is also critical for nutrition in Nepal: paddy rice provides nearly 50 percent of the calorie requirements supplied by cereals. However, the paddy rice yield in Nepal is the lowest in South Asia and below the global average. As such, domestic rice production is not enough to meet domestic consumption because of the combined effects of slow growth in yield and rapid population growth.<sup>102</sup> Finally, agricultural policies and development strategies have also emphasized the production and value chain of paddy rice.

Because of the centrality of rice in Nepali diets, rice's substantial contribution to GDP, and the targeting of rice by government agricultural policies, Feed the Future works to sustain and improve the value chain of paddy rice in Nepal. The Global Food Security Strategy Nepal Country Plan details how Feed the Future will work with the private sector to provide access to “high-quality agriculture inputs and technologies” in a sustainable manner.<sup>103</sup> By using existing private sector linkages with smallholders, farmers will be enabled to intensify production of staple crops, such as rice, in a climate-smart manner. Through the NSAF Activity, Feed the Future further supports seed companies while they perform seed trials and demonstrations, increasing both availability of and access to high-quality seeds in farming communities.<sup>104</sup> Through the KISAN I (2013–2017) and KISAN II (2017–2022) projects, Feed the Future works with rice mills to modernize equipment and drive direct connections with farmers.<sup>105</sup> KISAN II supports mills by providing expertise and resources to farmers, enabling them to grow rice varieties that drive higher incomes.<sup>106</sup>

### 7.2.2 Farmers' background

**Table 7.2.1** presents the age and education characteristics of rice farmers in the ZOI.

Overall, there were more male (57.1 percent) rice farmers at baseline than female (42.9 percent). The largest proportion (15.8 percent) of rice farmers were aged 60 and above, and the smallest proportion were aged 15 to 19 (0.9 percent). There are statistically significant differences in the age of rice farmers by sex. Female rice farmers tend to be younger than male rice farmers. The greatest proportion of rice farmers had no education (44.6 percent), although these proportions significantly varied by sex: 60.0

<sup>101</sup> MoALD, 2019. Fact Sheet of Agricultural Data.

<sup>102</sup> B.P. Tripathi, et. al., 2019. *Rice Strategy in Nepal*. ACTA Scientific Agriculture 3 (2), February 2019.

<sup>103</sup> Feed the Future, 2018. *The Global Food Security Strategy (GFSS) Nepal Country Plan*, 13.

<sup>104</sup> CAMRIS International, Inc., 2019. Nepal Seed and Fertilizer Mid-Term Performance Evaluation. USAID Mission Nepal, 2.

<sup>105</sup> Winrock International, 2018. In *Asia: A Project that Puts Market Systems First*. <https://www.winrock.org/a-project-that-puts-market-systems-first/>.

<sup>106</sup> Ibid.

percent of female rice farmers had no education compared to 33.0 percent of male rice farmers. The smallest proportion of rice farmers had completed higher education (2.4 percent) and a larger proportion of male rice farmers had completed higher education than female rice farmers.

**Table 7.2.1: Age and education of rice farmers in the ZOI, in total and by farmers' sex**

| Background characteristic     | Total (%)    | Sex        |            | Sig. <sup>a</sup> | Number of rice farmers |
|-------------------------------|--------------|------------|------------|-------------------|------------------------|
|                               |              | Male (%)   | Female (%) |                   |                        |
| <b>Total</b>                  | 100          | 57.1       | 42.9       |                   | 1,347                  |
| <b>Age</b>                    |              |            |            | ***               |                        |
| 15–19                         | 0.9          | 0.9        | 1.0        |                   | 13                     |
| 20–24                         | 3.5          | 1.9        | 5.6        |                   | 46                     |
| 25–29                         | 8.3          | 5.5        | 12.1       |                   | 111                    |
| 30–34                         | 10.9         | 8.3        | 14.3       |                   | 143                    |
| 35–39                         | 12.9         | 11.5       | 14.8       |                   | 177                    |
| 40–44                         | 13.0         | 10.9       | 15.9       |                   | 179                    |
| 45–49                         | 12.4         | 13.4       | 11.1       |                   | 164                    |
| 50–54                         | 12.6         | 14.5       | 10.1       |                   | 167                    |
| 55–59                         | 9.7          | 12.3       | 6.3        |                   | 132                    |
| 60+                           | 15.8         | 20.9       | 8.9        |                   | 215                    |
| <b>Education</b>              |              |            |            | ***               |                        |
| No education                  | 44.6         | 33.0       | 60.0       |                   | 607                    |
| Less than primary             | 29.1         | 35.9       | 20.0       |                   | 392                    |
| Completed primary             | 20.6         | 24.6       | 15.4       |                   | 275                    |
| Completed secondary           | 3.2          | 3.1        | 3.4        |                   | 40                     |
| Higher                        | 2.4          | 3.3        | 1.2        |                   | 32                     |
| <b>Number of rice farmers</b> | <b>1,347</b> | <b>773</b> | <b>574</b> |                   | <b>1,347</b>           |

<sup>a</sup>Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables.

Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating rice.

Source: Feed the Future Nepal ZOI Survey 2019

**Table 7.2.2** presents information about why farmers cultivated rice, specifically for consumption, market, or both. A majority of rice farmers (79.6 percent) cultivated rice for consumption. 20.4 percent of farmers cultivated rice both for consumption and for sale at the market. No rice farmers reported cultivating the crop purely to sell at the market. Female farmers were significantly more likely than male farmers to grow rice for consumption only, while male farmers were significantly more likely to grow rice for both consumption and market sale. Additionally, farmers aged 15 to 29 were significantly more likely than older farmers to grow rice for consumption alone, while farmers aged 30 and above were significantly more likely than younger farmers to grow rice for both consumption and market sale.

**Table 7.2.2: Reasons for cultivating rice in the ZOI, in total and by farmers' sex and age**

| Reason for rice cultivation   | Total (%)    | Sex        |            | Sig. <sup>a</sup> | Age (years) |              | Sig. <sup>a</sup> |
|-------------------------------|--------------|------------|------------|-------------------|-------------|--------------|-------------------|
|                               |              | Female (%) | Male (%)   |                   | 15–29 (%)   | 30+ (%)      |                   |
| <b>Reason</b>                 |              |            |            | ***               |             |              | **                |
| Consumption only              | 79.6         | 88.8       | 72.8       |                   | 88.4        | 78.3         |                   |
| Market only                   | 0.0          | 0.0        | 0.0        |                   | 0.0         | 0.0          |                   |
| Consumption and market        | 20.4         | 11.2       | 27.3       |                   | 11.6        | 21.7         |                   |
| <b>Number of rice farmers</b> | <b>1,347</b> | <b>574</b> | <b>773</b> |                   | <b>170</b>  | <b>1,177</b> |                   |

<sup>a</sup>Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables.

Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating rice.

Source: Feed the Future Nepal ZOI Survey 2019

### 7.2.3 Application of management practices and technologies by rice farmers

This section examines the management practices and technologies that farmers used to grow rice. In all tables, Feed the Future-promoted improved management practices and technologies are indicated with a double dagger (‡).

#### Land preparation and management practices

Proper land preparation practices are important to provide the necessary conditions for improved soil health and successful crop growth. Land preparation includes the approaches that farmers take to prepare their plots for planting, including plowing or zero tillage practices. Improved land management practices increase soil fertility and enhance water-use efficiency to improve overall plot productivity. Land management includes crop rotation practices and approaches farmers take to soil and water management and irrigation of their plots. Globally, water-use efficiency in irrigation of crop plots is low. Raised-bed planting with trench irrigation, as well as bunding or terracing, can significantly increase water-use efficiency.<sup>107</sup> Using appropriate irrigation techniques, minimizing soil disturbances, using surface mulch, and rotating crops help boost crop yields.<sup>108</sup> Rice farmers may choose to grow complementary crops, such as legumes (peas, lentils, black gram, and beans), alongside rice or on the ridge of the rice field. Such intercropping enhances soil nutrition and fertility by adding much-needed nitrogen to the soil, increases resource-use efficiency, and discourages weeds, pests, and other crop diseases.<sup>109</sup>

**Table 7.2.3** shows the land preparation practices, planting practices, and cropping practices that rice farmers used in the ZOI. 87.6 percent of rice farmers practiced hand weeding and almost all rice farmers (97.9 percent) practiced plowing. Sex was significantly associated with plowing: 95.9 percent of females practiced plowing compared to 99.4 percent of male rice farmers. Animal traction was the most common type of plowing, practiced by 53.7 percent of farmers. Tractor was the second most common type of plowing, practiced by 35.0 percent of farmers, followed by hand tillage practiced by 22.3 percent of farmers. Significantly more males (33.0 percent) practiced hand tillage relative to females (12.7 percent), and significantly more males (67.0 percent) practiced animal traction relative to females (41.6

<sup>107</sup> Solh, Braun, and Tadesse, 2014; Djagba, Rodenburg, Zwart, Houndagba, and Kiepe, 2014.

<sup>108</sup> Reeves, et al., 2016.

<sup>109</sup> Wilkins, 2008.

percent). Older farmers (56.4 percent) were also significantly more likely to practice animal traction than younger farmers (35.9 percent). Only 0.2 percent of farmers practiced zero tillage.

The most common planting practice among rice farmers was planting seedlings (90.8 percent). Only 8.0 percent of farmers planted seeds randomly broadcast, 6.3 percent sowed seeds, and 0.3 percent planted seeds in rows. Significantly more females (9.6 percent) than males (3.8 percent) sowed seeds. Younger farmers were significantly more likely than older farmers to plant seeds randomly broadcast and to sow seeds, while older farmers were significantly more likely to plant seedlings.

89.5 percent of farmers practiced crop rotation, while 10.5 percent of farmers did not rotate their crops. No farmers left their plots fallow. Sex was significantly associated with crop rotation: 86.9 percent of female farmers rotated their crops compared to 91.5 percent of males.

A vast majority of farmers (86.7 percent) practiced terracing. Sex was significantly associated with terracing, with 91.3 percent of female farmers practicing terracing compared to 83.3 percent of males. The second most common type of soil and water management practiced by rice farmers was soil bands or trenches (19.9 percent). Age group was significantly associated with using soil bands or trenches. 21.0 percent of farmers aged 30 years or older used soil bands or trenches compared to just 12.6 percent of farmers aged 15-29. Very few farmers added lime to soil (0.3 percent) and 5.0 farmers practiced no soil and water management techniques.

About one-fourth farmers used no irrigation (24.5 percent). Canals were the most commonly used form of irrigation (55.4 percent), followed by pump systems (22.6 percent). Sex was significantly associated only with pump system use, with 18.9 percent of female farmers using pumps compared to 25.4 percent of male farmers. Age was significantly associated only with canal use, with 42.8 percent of farmers aged 15-29 using canals compared to 57.2 percent of farmers aged 30 and older using canals for irrigation.

**Table 7.2.3: Land preparation, planting practices, and management practices used by rice farmers in the ZOI, in total and by farmers' sex and age**

| Practice                        | Total (%) | Sex        |          |                   | Age (years) |         |                   |
|---------------------------------|-----------|------------|----------|-------------------|-------------|---------|-------------------|
|                                 |           | Female (%) | Male (%) | Sig. <sup>a</sup> | 15–29 (%)   | 30+ (%) | Sig. <sup>a</sup> |
| Land preparation <sup>b</sup>   |           |            |          |                   |             |         |                   |
| Hand weeding                    | 87.6      | 87.7       | 87.6     | n/s               | 87.8        | 86.4    | n/s               |
| Plowing <sup>b</sup>            | 97.9      | 95.9       | 99.4     | ***               | 96.4        | 98.2    | n/s               |
| Hand tillage                    | 22.3      | 12.7       | 33.0     | *                 | 9.2         | 24.3    | n/s               |
| Animal traction                 | 53.7      | 41.6       | 67.0     | **                | 35.9        | 56.4    | *                 |
| Motorized tiller                | 2.3       | 2.9        | 1.7      | n/s               | 0.0         | 2.7     | n/s               |
| Tractor                         | 35.0      | 31.1       | 39.3     | n/s               | 42.6        | 33.9    | n/s               |
| Zero tillage <sup>b</sup>       | 0.2       | 0.4        | 0.0      | n/s               | 0.6         | 0.0     | ***               |
| Slash and plant                 | 0.2       | 0.4        | 0.0      | n/s               | 0.6         | 0.1     | ***               |
| Burn and plant                  | 0.0       | 0.0        | 0.0      | n/s               | 0.0         | 0.0     | n/s               |
| Herbicide and plant‡            | 0.0       | 0.0        | 0.0      | n/s               | 0.0         | 0.0     | n/s               |
| None                            | 0.2       | 0.2        | 0.2      | n/s               | 0.0         | 0.2     | n/s               |
| Planting practices <sup>b</sup> |           |            |          |                   |             |         |                   |
| Planted seeds in rows ±         | 0.3       | 0.0        | 0.5      | n/s               | 0.4         | 0.3     | n/s               |



| Practice                                     | Total (%)    | Sex        |            | Sig. <sup>a</sup> | Age (years) |              | Sig. <sup>a</sup> |
|----------------------------------------------|--------------|------------|------------|-------------------|-------------|--------------|-------------------|
|                                              |              | Female (%) | Male (%)   |                   | 15–29 (%)   | 30+ (%)      |                   |
| Planted seeds randomly broadcast             | 8.0          | 10.3       | 6.2        | n/s               | 13.3        | 7.2          | **                |
| Planted seedlings ‡                          | 90.8         | 87.2       | 93.5       | n/s               | 83.7        | 91.8         | ***               |
| Seed sown                                    | 6.3          | 9.6        | 3.8        | *                 | 11.6        | 5.5          | ***               |
| <b>Crop rotated</b>                          |              |            |            | *                 |             |              | n/s               |
| Yes, rotated                                 | 89.5         | 86.9       | 91.5       |                   | 88.5        | 89.7         |                   |
| No, did not rotate                           | 10.5         | 13.1       | 8.5        |                   | 11.5        | 10.3         |                   |
| No, left plot fallow                         | 0.0          | 0.0        | 0.0        |                   | 0.0         | 0.0          |                   |
| <b>Soil and water management<sup>b</sup></b> |              |            |            |                   |             |              |                   |
| Terracing                                    | 86.7         | 91.3       | 83.3       | ***               | 86.4        | 86.8         | n/s               |
| Soil bands, trenches                         | 19.9         | 18.2       | 21.1       | n/s               | 12.6        | 21.0         | *                 |
| Adding lime to soil                          | 0.3          | 0.4        | 0.3        | n/s               | 0.0         | 0.4          | n/s               |
| None                                         | 5.0          | 4.3        | 5.6        | n/s               | 5.1         | 5.0          | n/s               |
| <b>Irrigation<sup>b</sup></b>                |              |            |            |                   |             |              |                   |
| Hand (watering can, hose)                    | 0.2          | 0.2        | 0.1        | n/s               | 0.0         | 0.2          | n/s               |
| Canals                                       | 55.4         | 53.5       | 56.9       | n/s               | 42.8        | 57.2         | **                |
| Permanent hose                               | 1.2          | 0.7        | 1.5        | n/s               | 1.1         | 1.2          | n/s               |
| Pump system                                  | 22.6         | 18.9       | 25.4       | *                 | 23.9        | 22.4         | n/s               |
| Flood (basin, furrow, border)                | 0.0          | 0.0        | 0.0        | n/s               | 0.0         | 0.0          | n/s               |
| Drip                                         | 0.0          | 0.0        | 0.0        | n/s               | 0.0         | 0.0          | n/s               |
| Traveling gun/moving sprinkler               | 0.0          | 0.0        | 0.0        | n/s               | 0.0         | 0.0          | n/s               |
| Sprinkler                                    | 0.0          | 0.0        | 0.0        | n/s               | 0.0         | 0.0          | n/s               |
| Center pivot                                 | 0.0          | 0.0        | 0.0        | n/s               | 0.0         | 0.0          | n/s               |
| Forest                                       | 0.1          | 0.3        | 0.0        | n/s               | 0.0         | 0.2          | n/s               |
| None                                         | 24.5         | 27.6       | 22.1       | n/s               | 29.2        | 23.8         | n/s               |
| <b>Number of rice farmers</b>                | <b>1,347</b> | <b>574</b> | <b>773</b> |                   | <b>170</b>  | <b>1,177</b> |                   |

<sup>a</sup> Results not statistically reliable, n<30

<sup>‡</sup> Promoted improved technology or management practice

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Farmers were allowed to give more than one response, so the percentages may not add up to 100 percent.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating rice.

Source: Feed the Future Nepal ZOI Survey 2019

## Use of inputs

This section presents information on rice farmers' inputs, including seed, fertilizer, manure, training, information, and decision-making for growing rice.

Certain hybrids of rice seed are more drought- and heat-tolerant than traditional rice and will produce greater yields when grown in very warm or drought-prone climates.<sup>110</sup> **Table 7.2.4** shows where farmers obtained their rice seeds and the types of rice seeds rice farmers used. More than half (53.3 percent) of farmers used improved open-pollinated, or modern, varieties of seeds. 45.8 percent of rice farmers used traditional types of seeds, and just 0.9 percent used hybrid seeds. Women were

<sup>110</sup> Edmeades, 2015.

significantly more likely than men to use traditional or hybrid seeds, while men were significantly more likely to use modern seeds. The type of seed used did not vary significantly based on age.

Rice farmers most frequently (46.9 percent) used their own saved seeds or seeds given to them by a friend or relative. The second-most common form of seed procurement was from an agricultural dealer, purchased in cash (40.0 percent). The distribution of seed use varied significantly based on sex, but not based on age. Women were significantly more likely than men to use their own seeds or seed purchased from a friend or relative, while men were significantly more likely to use seeds purchased from an agricultural dealer.

**Table 7.2.4: Seed types and seed sources used by rice farmers in the ZOI, in total and by farmers' sex and age**

| Characteristic or practice                                  | Total (%) | Sex        |          |                   | Age (years) |         |                   |
|-------------------------------------------------------------|-----------|------------|----------|-------------------|-------------|---------|-------------------|
|                                                             |           | Female (%) | Male (%) | Sig. <sup>a</sup> | 15–29 (%)   | 30+ (%) | Sig. <sup>a</sup> |
| Seed type <sup>b</sup>                                      |           |            |          |                   |             |         |                   |
| Unimproved or local open-pollinated varieties (traditional) | 45.8      | 53.2       | 40.1     | ***               | 49.3        | 45.2    | n/s               |
| Improved open-pollinated varieties (modern) ‡               | 53.3      | 43.7       | 60.4     | ***               | 49.0        | 53.9    | n/s               |
| Hybrid                                                      | 0.9       | 1.4        | 0.4      | ***               | 0.0         | 1.0     | n/s               |
| Main seed source                                            |           |            |          | ***               |             |         | n/s               |
| Own saved/friend or relative (not purchased)                | 46.9      | 53.4       | 42.2     |                   | 47.8        | 46.8    |                   |
| Friend or relative (purchased)                              | 3.7       | 6.3        | 1.8      |                   | 5.6         | 3.5     |                   |
| Agriculture dealer (cash)                                   | 40.0      | 31.5       | 46.2     |                   | 40.1        | 39.9    |                   |
| Agriculture dealer (voucher)                                | 0.2       | 0.2        | 0.1      |                   | 0.7         | 0.1     |                   |
| Market or non-agriculture dealer                            | 3.9       | 3.8        | 3.9      |                   | 3.9         | 3.9     |                   |
| Aid distribution                                            | 0.8       | 0.8        | 0.9      |                   | 0.0         | 1.0     |                   |
| Number of rice farmers                                      | 1,347     | 574        | 773      |                   | 170         | 1,177   |                   |

‡ Promoted improved technology or management practice

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables.

Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Farmers were allowed to give more than one response, so the percentages may not add up to 100 percent.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating rice.

Source: Feed the Future Nepal ZOI Survey 2019

Application of inorganic or organic fertilizers, such as manure and crop residues, plays an important role in soil health. Fertilizers help correct soil macro- and micro-nutrient deficiencies in many regions and promote crop growth.<sup>111</sup> Inorganic, or mineral, fertilizers are often too expensive for smallholder farmers and are frequently locally unavailable. Organic inputs can be used in place of or alongside mineral fertilizers, through improved waste recycling, crop residue composting, animal manure, and intercropping or crop rotation with legumes, trees, and shrubs.<sup>112</sup>

**Table 7.2.5** presents information related to rice farmers' fertilizer practices. Overall, 93.6 percent of rice farmers used fertilizer. Men were significantly more likely than women to use fertilizer, although age

<sup>111</sup> Lal, 2010.

<sup>112</sup> Reeves, et al., 2016; Snapp, Mafongoya, & Waddington, 1998.

was not a significant determinant of use. 81.6 percent of farmers used soil-based inorganic fertilizer, and 64.9 percent of farmers used soil-based organic fertilizer. Less than one percent of farmers used organic or inorganic foliar feeds. 92.4 percent of farmers used fertilizer at the time of planting, and 62.5 percent used fertilizer during the early growth stage. Only 27.6 percent of farmers used fertilizer in the middle of a crop cycle. Finally, neither sex nor age were significantly associated with any of these practices.

**Table 7.2.5: Rice farmers' fertilizer use, types of fertilizer, and timing of application in the ZOI, in total and by farmers' sex and age**

| Characteristic or practice                           | Total (%) | Sex        |          | Sig. <sup>a</sup> | Age (years) |         | Sig. <sup>a</sup> |
|------------------------------------------------------|-----------|------------|----------|-------------------|-------------|---------|-------------------|
|                                                      |           | Female (%) | Male (%) |                   | 15–29 (%)   | 30+ (%) |                   |
| <b>Applied fertilizer</b>                            | 93.6      | 90.8       | 95.5     | *                 | 92.9        | 93.7    | n/s               |
| <b>Number of rice farmers</b>                        | 1,191     | 486        | 705      |                   | 147         | 1,044   |                   |
| <b>Type<sup>b</sup></b>                              |           |            |          |                   |             |         |                   |
| Soil-based organic                                   | 64.9      | 66.9       | 63.6     | n/s               | 61.1        | 65.4    | n/s               |
| Soil-based inorganic                                 | 81.6      | 81.4       | 81.7     | n/s               | 81.1        | 81.6    | n/s               |
| Organic foliar feeds                                 | 0.1       | 0.2        | 0.0      | n/s               | 0.0         | 0.1     | n/s               |
| Inorganic foliar feeds                               | 0.4       | 0.5        | 0.3      | n/s               | 0.8         | 0.3     | n/s               |
| <b>Timing of application<sup>b</sup></b>             |           |            |          |                   |             |         |                   |
| Planting                                             | 92.4      | 92.9       | 92.1     | n/s               | 91.8        | 92.5    | n/s               |
| Early growth stage                                   | 62.5      | 64.5       | 61.3     | n/s               | 59.2        | 63.0    | n/s               |
| Mid-crop                                             | 27.6      | 24.4       | 29.8     | n/s               | 30.5        | 27.2    | n/s               |
| <b>Number of rice farmers who applied fertilizer</b> | 1,109     | 439        | 670      |                   | 136         | 973     |                   |

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables.

Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Farmers were allowed to give more than one response, so the percentages may not add up to 100 percent.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating rice.

Source: Feed the Future Nepal ZOI Survey 2019

Animal manure supplies beneficial nutrients to growing rice plants and improves soil fertility. In many countries, adequate quantities of animal manure for agricultural use may not be locally available and must be purchased elsewhere. **Table 7.2.6** presents information related to rice farmers' use of manure, including the percentage who use animal manure, how the manure was applied to fields, and the manure's source.

Overall, 70.8 percent of rice farmers applied animal manure. Sex was not significantly associated with manure use. However, farmers over the age of 30 were significantly more likely to use manure than younger farmers. Almost all rice farmers applied animal manure by hand (99.4 percent); method of application did not differ significantly by sex or age. The vast majority (96.2 percent) of rice farmers also used manure sourced from their own animals, and men were significantly more likely than women to do so. Only 2.6 percent of farmers used manure given to them and 1.2 percent of farmers purchased manure. Age was not a significant determinant of the source of animal manure.

**Table 7.2.6: Manure sources and application practices used by rice farmers in the ZOI, in total and by farmers' sex and age**

| Characteristic or practice                       | Total (%)    | Sex        |            | Sig. <sup>a</sup> | Age (years) |              | Sig. <sup>a</sup> |
|--------------------------------------------------|--------------|------------|------------|-------------------|-------------|--------------|-------------------|
|                                                  |              | Female (%) | Male (%)   |                   | 15–29 (%)   | 30+ (%)      |                   |
| <b>Applied animal manure</b>                     | 70.8         | 71.7       | 70.1       | n/s               | 62.8        | 71.9         | *                 |
| <b>Number of rice farmers</b>                    | <b>1,330</b> | <b>559</b> | <b>771</b> |                   | <b>165</b>  | <b>1,165</b> |                   |
| <b>Method of application</b>                     |              |            |            | n/s               |             |              | n/s               |
| Left on field after animals grazed               | 0.1          | 0.2        | 0.0        |                   | 0.0         | 0.1          |                   |
| By hand                                          | 99.4         | 99.4       | 99.4       |                   | 100         | 99.3         |                   |
| By machine                                       | 0.3          | 0.0        | 0.5        |                   | 0.0         | 0.3          |                   |
| <b>Source</b>                                    |              |            |            | *                 |             |              | n/s               |
| Own animals                                      | 96.2         | 93.9       | 98.0       |                   | 91.8        | 96.8         |                   |
| Given, did not purchase                          | 2.6          | 4.1        | 1.4        |                   | 4.3         | 2.4          |                   |
| Purchased                                        | 1.2          | 2.0        | 0.6        |                   | 3.9         | 0.9          |                   |
| <b>Number of rice farmers who applied manure</b> | <b>948</b>   | <b>408</b> | <b>540</b> |                   | <b>106</b>  | <b>842</b>   |                   |

<sup>a</sup>Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating rice.

Source: Feed the Future Nepal ZOI Survey 2019

Crop loss due to pests, weeds, and diseases can be substantial for smallholder farmers, with an estimated 20–35 percent loss (before and after harvest) of crops across Nepal from these factors.<sup>113</sup> Paddy rice is plagued by bacterial diseases including bacterial leaf streak and rice bacterial blight; fungal diseases such as leaf scald, bakanae, brown spot, false smut, narrow leaf spot, rice blast, sheath blight, and steam rot; and viral diseases such as grassy stunt and tungro. Likewise, various pests, such as leafhoppers and planthoppers, mole crickets, rice bugs, rice case worms, rice gall midges, rice mealy bugs, and steam borers are common.<sup>114</sup> Finally, common weeds include cyperus difformis, echinochloa colona, cyperus iria, ageratum conyzoides, apilanthus iabadicensis A.H. Moore, and drymaria diandra blume.<sup>115</sup>

Adequate prevention and management measures may prevent or minimize crop losses. Herbicides and manual removal may control weeds, and pesticides, insecticides, and fungicides may manage pests and crop diseases. There are also several favorable and effective non-chemical approaches to rice pest control.<sup>116</sup> Integrated pest management is an encouraged “problem-avoiding” approach to pest management that seeks to minimize pesticide use and control pests through cultural, manual, and biological means.<sup>117</sup> Intercropping and crop rotation are particularly effective non-chemical measures for pest and weed management in rice fields in Nepal.<sup>118</sup> **Table 7.2.7** presents rice farmers’ pest and weed management practices.

<sup>113</sup> PQPMC, MoALD, 2019. Annual Program and Statistics Book.

<sup>114</sup> DoA, 2018. *Crops Diseases Pests Identification Handbook*.

<sup>115</sup> S. Manandhar, 2007. Weeds of Paddy Field at Kirtipur, Kathmandu. Scientific World.

<sup>116</sup> Reeves, et al., 2016.

<sup>117</sup> FAO, 2011.

<sup>118</sup> PQPMC, MoALD, 2019. Annual Program and Statistics Book.

The majority (77.6 percent) of rice farmers in the ZOI did not use any form of chemical pest management. 20.3 percent of farmers used chemicals in response to a pest attack, and 2.1 percent used chemicals as a preventative measure. These practices varied significantly by sex but did not differ by age. Men were significantly more likely to use chemicals in response to a pest attack, while women were more likely to use no chemicals.

96.8 percent of rice farmers used some form of weed management. Pulling weeds by hand was the most common practice (91.7 percent), followed distantly by slashing (29.1 percent) and weeding with a hoe (11.9 percent). Men were significantly more likely than women to use herbicide, whereas younger farmers were significantly more likely to weed with a hoe than older farmers. Other practices did not vary significantly by age or sex.

**Table 7.2.7: Pest and weed management practices used by rice farmers in the ZOI, in total and by farmers' sex and age**

| Management practice                | Total (%)    | Sex        |            | Sig. <sup>a</sup> | Age (years) |              | Sig. <sup>a</sup> |
|------------------------------------|--------------|------------|------------|-------------------|-------------|--------------|-------------------|
|                                    |              | Female (%) | Male (%)   |                   | 15–29 (%)   | 30+ (%)      |                   |
| <b>Chemical pest management</b>    |              |            |            | *                 |             |              | n/s               |
| Preventative (routine)             | 2.1          | 2.0        | 2.2        |                   | 1.6         | 2.2          |                   |
| Response to attack                 | 20.3         | 16.1       | 23.4       |                   | 17.9        | 20.7         |                   |
| None                               | 77.6         | 81.9       | 74.5       |                   | 80.5        | 77.2         |                   |
| <b>Weed management<sup>b</sup></b> |              |            |            |                   |             |              |                   |
| Herbicide applied <sup>‡</sup>     | 6.6          | 2.0        | 10.0       | ***               | 6.0         | 6.7          | n/s               |
| Weeding with hoe                   | 11.9         | 14.3       | 10.1       | n/s               | 16.3        | 11.2         | *                 |
| Intercropping                      | 0.3          | 0.0        | 0.4        | n/s               | 0.0         | 0.3          | n/s               |
| Mulching                           | 0.0          | 0.0        | 0.0        | n/s               | 0.0         | 0.0          | n/s               |
| Slashing                           | 29.1         | 32.7       | 26.5       | n/s               | 31.4        | 28.8         | n/s               |
| Pull by hand                       | 91.7         | 92.8       | 90.8       | n/s               | 92.5        | 91.5         | n/s               |
| None                               | 3.2          | 3.0        | 3.3        | n/s               | 3.8         | 3.1          | n/s               |
| <b>Number of rice farmers</b>      | <b>1,347</b> | <b>574</b> | <b>773</b> |                   | <b>170</b>  | <b>1,177</b> |                   |

<sup>‡</sup> Promoted improved technology or management practice

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Farmers were allowed to give more than one response, so the percentages may not add up to 100 percent.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating rice.

Source: Feed the Future Nepal ZOI Survey 2019

## Harvesting and waste reuse practices

This section presents information on the drying and threshing techniques used by rice farmers. Waste reuse practices, which are how farmers use the leftover rice straw after harvesting, are also presented.

Harvesting is done when the rice has reached maturity and can be accomplished mechanically or by hand. After harvest, rice must be dried to reduce moisture content, prevent deterioration of the grain, and allow for safe storage.<sup>119</sup> Proper drying techniques are important to protect the rice from rodents and pests, prevent uneven drying, and prevent slow rates of drying, which may result in mold growth.<sup>120</sup>

**Table 7.2.8** presents the drying and threshing techniques used by rice farmers in the ZOI.

<sup>119</sup> FAO, 2003.

<sup>120</sup> Shepherd, 1999.

To dry their rice, most farmers laid the grains on tarpaulins (77.2 percent). 23.0 percent of farmers laid the grains on the bare ground and 13.9 percent left the grains to dry on the plant in the field. Female farmers were significantly more likely than male farmers to leave their rice to dry on the plant in the field. Otherwise, practices did not vary significantly by sex or age.

The most commonly used threshing method was beating rice with sticks, practiced by 48.8 percent of farmers. Farmers second-most commonly threshed their rice with a motorized thresher (41.2 percent). 13.9 percent of farmers threshed their rice by trampling it with cattle or oxen. Female farmers were significantly more likely than male farmers to thresh their rice by beating it with sticks.

**Table 7.2.8: Drying and threshing methods used by rice farmers in the ZOI, in total and by farmers' sex and age<sup>a</sup>**

| Method                                | Total (%) | Sex        |          |                   | Age (years) |         |                   |
|---------------------------------------|-----------|------------|----------|-------------------|-------------|---------|-------------------|
|                                       |           | Female (%) | Male (%) | Sig. <sup>b</sup> | 15–29 (%)   | 30+ (%) | Sig. <sup>b</sup> |
| Drying method <sup>c</sup>            |           |            |          |                   |             |         |                   |
| Laid on bare ground                   | 23.0      | 20.4       | 24.9     | n/s               | 19.5        | 23.5    | n/s               |
| Laid on ground covered with cow dung  | 9.4       | 9.9        | 9.0      | n/s               | 12.2        | 9.0     | n/s               |
| Left to dry on plant in field         | 13.9      | 18.0       | 10.8     | ***               | 15.6        | 13.6    | n/s               |
| Laid on tarpaulins                    | 77.2      | 77.6       | 76.9     | n/s               | 76.1        | 77.4    | n/s               |
| Used drying yard with cemented ground | 2.9       | 2.5        | 3.3      | n/s               | 0.0         | 3.4     | n/s               |
| Threshing method <sup>c</sup>         |           |            |          |                   |             |         |                   |
| Trampled by cattle/oxen               | 13.9      | 15.8       | 12.5     | n/s               | 14.1        | 13.9    | n/s               |
| Beat with sticks                      | 48.8      | 54.2       | 44.8     | *                 | 43.5        | 49.5    | n/s               |
| Beat with a flail                     | 0.0       | 0.0        | 0.0      | n/s               | 0.0         | 0.0     | n/s               |
| Used a treadle thresher               | 1.6       | 2.2        | 1.2      | n/s               | 0.8         | 1.7     | n/s               |
| Used a motorized thresher             | 41.2      | 39.8       | 42.3     | n/s               | 44.0        | 40.9    | n/s               |
| Number of rice farmers                | 1,347     | 574        | 773      |                   | 170         | 1,177   |                   |

<sup>a</sup> Due to an error in the CSPro programming, we are unable to report on harvesting method for rice.

<sup>b</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>c</sup> Farmers were allowed to give more than one response, so the percentages may not add up to 100 percent.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating rice.

Source: Feed the Future Nepal ZOI Survey 2019

Rice residues have many valuable uses. The residues are used for livestock feeding or are burnt and left in the field.<sup>121</sup> Straw that cannot be sold or consumed can be used directly in the field as organic fertilizer or mulch, in food preparation, as animal feed, and as a source of energy or fuel.<sup>122</sup> **Table 7.2.9** presents information on how rice farmers in the ZOI used rice crop residues. The majority of rice farmers (82.8 percent) reused rice straw by feeding it to their animals. 12.3 percent of rice farmers harvested and sold their rice straw to others and 8.0 percent used rice straw as bedding for their animals. Men were significantly more likely than women to use rice straw as bedding for their animals. Farmers over the age of 30 were significantly more likely than younger farmers to harvest and feed rice straw to their animals.

<sup>121</sup> Rawal, N. et al., 2014. Crop management practices in rice based cropping system in western terai of Nepal.

<sup>122</sup> El-Mashad, et al., 2003.

**Table 7.2.9: Use of straw by rice farmers in the ZOI, in total and by farmers' sex and age**

| Waste reuse practice              | Total (%) | Sex        |          |                   | Age (years) |         |                   |
|-----------------------------------|-----------|------------|----------|-------------------|-------------|---------|-------------------|
|                                   |           | Female (%) | Male (%) | Sig. <sup>a</sup> | 15–29 (%)   | 30+ (%) | Sig. <sup>a</sup> |
| Straw use <sup>b</sup>            |           |            |          |                   |             |         |                   |
| Burned in the field               | 5.0       | 3.3        | 6.3      | n/s               | 6.1         | 4.9     | n/s               |
| Incorporated back into soil       | 0.6       | 0.3        | 0.8      | n/s               | 1.0         | 0.5     | n/s               |
| Used as bedding for own livestock | 8.0       | 5.1        | 10.1     | *                 | 5.1         | 8.4     | n/s               |
| Used as fuel for fire             | 1.8       | 1.3        | 2.2      | n/s               | 2.7         | 1.7     | n/s               |
| Left in field for grazing animals | 0.1       | 0.3        | 0.0      | n/s               | 0.0         | 0.2     | n/s               |
| Harvested and fed to own animals  | 82.8      | 79.9       | 84.9     | n/s               | 73.5        | 84.1    | **                |
| Harvested and sold to others      | 12.3      | 14.4       | 10.7     | n/s               | 18.0        | 11.5    | *                 |
| Number of rice farmers            | 1,347     | 574        | 773      |                   | 170         | 1,177   |                   |

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables.

Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Farmers were allowed to give more than one response, so the percentages may not add up to 100 percent.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating rice.

Source: Feed the Future Nepal ZOI Survey 2019

## Storage practices

This section presents information on rice storage practices, including the use of various containers and storage locations. Storage serves several purposes in the rice post-harvest process. It protects against excessive heat, ground and rainwater, insects, rodents, birds, and harmful micro-organisms and helps ensure that the rice retains its nutritional value.<sup>123</sup> Rice farmers in Nepal use traditional technologies for threshing, winnowing, drying, storing, milling, and transporting rice from the field to storage houses. In most cases, suitable technologies are not available to reduce post-harvest losses. Even where such technologies exist, farmers lack the necessary knowledge, entrepreneurial skill, and resources to obtain and apply these technologies to reduce crop losses.<sup>124</sup>

**Table 7.2.10** presents information on how farmers stored and transported their harvested rice in the ZOI. Almost all rice farmers stored their rice in bags (98.4 percent). Just 0.8 percent of rice farmers used drums, while 0.2 percent used buckets and 0.6 percent did not use any containers. Almost all farmers stored their rice in residential houses (98.4 percent). 61.5 percent stored rice in granaries, followed by 15.3 percent in deheyri and 2.4 percent in other constructed stores. Sex was significantly associated with deheyri use: 18.1 percent of males used deheyri compared to 11.3 percent of females.

<sup>123</sup> Shepherd, 1999.

<sup>124</sup> Tripathi, BP (2019), Rice strategy for Nepal.

**Table 7.2.10: Methods of storing and transporting rice in the ZOI, in total and by farmers' sex and age**

| Storage or transport method            | Total (%)    | Sex        |            | Sig. <sup>a</sup> | Age (years) |              | Sig. <sup>a</sup> |
|----------------------------------------|--------------|------------|------------|-------------------|-------------|--------------|-------------------|
|                                        |              | Female (%) | Male (%)   |                   | 15–29 (%)   | 30+ (%)      |                   |
| <b>Storage or transport containers</b> |              |            |            | n/s               |             |              | n/s               |
| Buckets                                | 0.2          | 0.0        | 0.3        |                   | 0.0         | 0.2          |                   |
| Drums                                  | 0.8          | 0.8        | 0.8        |                   | 0.0         | 0.9          |                   |
| Bags                                   | 98.4         | 99.0       | 98.1       |                   | 99.6        | 98.3         |                   |
| Did not put in containers              | 0.6          | 0.2        | 0.9        |                   | 0.4         | 0.7          |                   |
| <b>Storage location<sup>b</sup></b>    |              |            |            |                   |             |              |                   |
| Residential house                      | 98.4         | 99.1       | 98.0       | n/s               | 99.0        | 98.4         | n/s               |
| Cribs                                  | 0.4          | 0.4        | 0.5        | n/s               | 0.0         | 0.5          | n/s               |
| Granaries                              | 61.5         | 60.1       | 62.5       | n/s               | 55.9        | 62.3         | n/s               |
| Warehouses                             | 1.4          | 2.1        | 0.9        | n/s               | 1.4         | 1.5          | n/s               |
| Storage silos                          | 0.4          | 0.9        | 0.0        | n/s               | 0.0         | 0.4          | n/s               |
| Deheyri                                | 15.3         | 11.3       | 18.1       | **                | 14.9        | 15.3         | n/s               |
| Other constructed stores               | 2.4          | 1.4        | 3.2        | n/s               | 3.5         | 2.3          | n/s               |
| <b>Number of rice farmers</b>          | <b>1,347</b> | <b>574</b> | <b>773</b> |                   | <b>170</b>  | <b>1,177</b> |                   |

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Farmers were allowed to give more than one response, so the percentages may not add up to 100 percent. Due to an error in the CSPro programming, we are unable to report on storage bags by type.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating rice.

Source: Feed the Future Nepal ZOI Survey 2019

## Training and decision-making

Farmers may receive training on agricultural production, markets and inputs, the use of fertilizers, pesticides and herbicides, and integrated pest management. Farmers may also receive agricultural information from many sources both within and outside their communities. **Table 7.2.11** presents the percentages of rice farmers who received training on the use of inorganic fertilizers, pesticides, and herbicides. Overall, very few rice farmers reported receiving agricultural training: 4.2 percent received training on the use and application of inorganic fertilizer, 1.6 percent received training on the use and application of pesticides, and 1.3 percent received training on the use and application of herbicides. These patterns did not significantly vary by sex or age.



**Table 7.2.11: Training received by rice farmers in the ZOI, in total and by farmers' sex and age<sup>a</sup>**

| Topic or source                             | Total (%) | Sex        |          | Sig. <sup>b</sup> | Age (years) |         | Sig. <sup>b</sup> |
|---------------------------------------------|-----------|------------|----------|-------------------|-------------|---------|-------------------|
|                                             |           | Female (%) | Male (%) |                   | 15–29 (%)   | 30+ (%) |                   |
| Training <sup>c</sup>                       |           |            |          |                   |             |         |                   |
| Use and application of inorganic fertilizer | 4.2       | 3.6        | 4.8      | n/s               | 4.3         | 4.3     | n/s               |
| Use and application of pesticides           | 1.6       | 0.8        | 2.2      | n/s               | 1.5         | 1.6     | n/s               |
| Use and application of herbicides           | 1.3       | 0.8        | 1.6      | n/s               | 0.6         | 1.4     | n/s               |
| Number of rice farmers                      | 1,347     | 574        | 773      |                   | 170         | 1,177   |                   |

<sup>a</sup> Due to an error in the CSPro programming, we are unable to report on main information source.

<sup>b</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>c</sup> Farmers were allowed to give more than one response, so the percentages may not add up to 100 percent.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating rice.

Source: Feed the Future Nepal ZOI Survey 2019

In households with multiple household members, one person or two or more individuals jointly may make farming decisions. **Table 7.2.12** presents the percent distribution of rice farmers who made key production decisions on the type of seed to plant and whether to use fertilizer. Just under one-third of female rice farmers made independent decisions about what types of seeds to plant and whether to fertilize. A slightly larger proportion of women made independent decisions regarding fertilizer than regarding which type of seed to plant. 7.0 percent of females made these decisions with a partner, and 4.3 percent made decisions with another person. For both types of decisions surveyed, patterns of decision-making varied significantly by sex.

Most estimates regarding patterns of decision-making were larger for male rice farmers, suggesting that male farmers made a more diverse array of decisions than female rice farmers. Just over one-third of men made independent decisions about what types of seeds to plant and whether to fertilize. Just over 14 percent of men made decisions collectively with their partner. Similar to women, a slightly larger proportion of men made independent decisions regarding whether to use fertilizer than about which type of seed to plant.

**Table 7.2.12: Percent distribution of who made key rice production decisions in the ZOI, by farmers' sex**

| Decision-makers                             | Type of seed to plant |                   | Whether to use fertilizer |                   |
|---------------------------------------------|-----------------------|-------------------|---------------------------|-------------------|
|                                             | Percent               | Sig. <sup>a</sup> | Percent                   | Sig. <sup>a</sup> |
| <b>Female farmers</b>                       |                       |                   |                           |                   |
| Self alone                                  | 30.4                  | **                | 31.9                      | **                |
| Partner/spouse alone                        | 0.4                   |                   | 0.3                       |                   |
| Self and partner together                   | 7.0                   |                   | 6.4                       |                   |
| Self and other (could also include partner) | 4.3                   |                   | 3.7                       |                   |
| Other                                       | 0.3                   |                   | 0.1                       |                   |
| <b>Number of female rice farmers</b>        | <b>559</b>            |                   | <b>559</b>                |                   |
| <b>Male farmers</b>                         |                       |                   |                           |                   |
| Self alone                                  | 34.2                  | **                | 37.0                      | **                |
| Partner/spouse alone                        | 0.5                   |                   | 0.4                       |                   |

| Decision-makers                             | Type of seed to plant |                   | Whether to use fertilizer |                   |
|---------------------------------------------|-----------------------|-------------------|---------------------------|-------------------|
|                                             | Percent               | Sig. <sup>a</sup> | Percent                   | Sig. <sup>a</sup> |
| Self and partner together                   | 14.4                  |                   | 14.1                      |                   |
| Self and other (could also include partner) | 8.5                   |                   | 6.2                       |                   |
| Other                                       | 0.1                   |                   | 0.1                       |                   |
| <b>Number of male rice farmers</b>          | <b>771</b>            |                   | <b>771</b>                |                   |

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and farmers' sex. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating rice.

Source: Feed the Future Nepal ZOI Survey 2019

## 7.2.4 Use of improved management practices and technologies

This section examines rice farmers' use of improved management practices and technologies promoted by Feed the Future in the Nepal ZOI. **Table 7.2.13** shows the percentage of rice farmers in the ZOI who applied one or more improved management practices or technologies promoted during the 12 months preceding the ZOI Survey. The table also includes the percentage of rice farmers in the ZOI who used promoted improved management practices and technologies by category.

Application of improved management practices and technologies was high among rice farmers: 92.0 percent of farmers applied at least one practice. Most farmers applied cultural practices (91.1 percent), climate adaptation management (59.5 percent), and crop genetics (53.3 percent). Only 6.3 percent of farmers applied pest and disease management. Men were significantly more likely than women to adopt all of these types of improved practices. Older farmers were significantly more likely to adopt improved cultural and climate adaptation practices.

**Table 7.2.13: Percentage of rice farmers in the ZOI who applied one or more promoted improved management practices and technologies by category, in total and by farmers' sex and age**

| Category                                                   | Total (%)    | Sex         |             | Sig. <sup>a</sup> | Age (years) |              | Sig. <sup>a</sup> |
|------------------------------------------------------------|--------------|-------------|-------------|-------------------|-------------|--------------|-------------------|
|                                                            |              | Female (%)  | Male (%)    |                   | 15-29 (%)   | 30+ (%)      |                   |
| <b>Across all categories</b>                               | <b>92.0</b>  | <b>88.1</b> | <b>94.9</b> | <b>**</b>         | <b>84.6</b> | <b>93.0</b>  | <b>***</b>        |
| Crop genetics <sup>b</sup>                                 | 53.3         | 43.7        | 60.4        | ***               | 51.4        | 54.6         | n/s               |
| Cultural practices <sup>c</sup>                            | 91.1         | 87.2        | 94.0        | *                 | 84.1        | 92.1         | **                |
| Pest and disease management <sup>d</sup>                   | 6.3          | 1.9         | 9.6         | ***               | 5.6         | 6.4          | n/s               |
| Climate adaptation or climate risk management <sup>e</sup> | 59.5         | 50.6        | 66.2        | ***               | 51.0        | 60.8         | *                 |
| <b>Number of rice farmers</b>                              | <b>1,347</b> | <b>574</b>  | <b>773</b>  |                   | <b>170</b>  | <b>1,177</b> |                   |

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Crop genetics refers to a farmer's use of improved varieties of seeds.

<sup>c</sup> Cultural practices refers to a farmer planting seedlings and/or planting in rows.

<sup>d</sup> Pest and disease management refers to farmer's use of herbicides.

<sup>e</sup> Climate adaptation or climate risk management refers to a farmer's use of improved varieties of seeds, or the use of permanent hose/drip irrigation or pump irrigation.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating rice.

Source: Feed the Future Nepal ZOI Survey 2019

**Table 7.2.14** shows the percent distribution of rice farmers in the ZOI who used promoted improved management practices and technologies, by the number of improved practice and technology categories

used. Rice farmers applied between zero and four improved management practice and technology categories. The greatest proportion of rice farmers (47.2 percent) applied three categories, followed by just one category (32.2 percent). Only 8.0 percent of farmers did not adopt any improved management categories. Men were significantly more likely to adopt a greater number of practices than women and farmers aged 30 and above were significantly more likely to adopt a greater number of management and practice categories than younger farmers.

**Table 7.2.14: Percent distribution of rice farmers by number of promoted improved management practices and technologies used in the ZOI, in total and by farmers' sex and age**

| Promoted improved practice or technology | Total (%)    | Sex        |            | Sig. <sup>a</sup> | Age (years) |              | Sig. <sup>a</sup> |
|------------------------------------------|--------------|------------|------------|-------------------|-------------|--------------|-------------------|
|                                          |              | Female (%) | Male (%)   |                   | 15–29 (%)   | 30+ (%)      |                   |
| <b>Number used</b>                       |              |            |            | ***               |             |              | **                |
| 0                                        | 8.0          | 11.9       | 5.1        |                   | 15.4        | 7.0          |                   |
| 1                                        | 32.2         | 37.4       | 28.4       |                   | 33.6        | 32.0         |                   |
| 2                                        | 6.9          | 7.7        | 6.3        |                   | 2.5         | 7.5          |                   |
| 3                                        | 47.2         | 41.4       | 51.6       |                   | 43.0        | 47.9         |                   |
| 4                                        | 5.6          | 1.6        | 8.6        |                   | 5.6         | 5.6          |                   |
| <b>Number of rice farmers</b>            | <b>1,347</b> | <b>574</b> | <b>773</b> |                   | <b>170</b>  | <b>1,177</b> |                   |

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables.

Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating rice.

Source: Feed the Future Nepal ZOI Survey 2019

### 7.2.5 Rice yields

Yield is a measure of total production per unit of area planted. For rice, yield is the weight of rice (in kilograms) harvested in the season preceding the survey divided by the area, in hectares, planted in the season preceding the survey. Total production is the amount that produced, regardless of usage. It also includes any post-harvest loss (i.e., post-harvest loss is not subtracted from total production.) All data on total production and total units of production are self-reported, thus yields are calculated using self-reported data.<sup>125</sup>

**Table 7.2.15** presents the total production in metric tons (mt), total production units in hectares (ha), and the area-weighted and farmer average yields of rice in metric tons per hectare (mt/ha) for the season preceding the ZOI Survey. The table also presents the average production (mt), average units of production (ha), and average yield of rice per farmer for the same time period. The results are disaggregated by farm size (smallholder and non-smallholder) and further by sex and age.

Overall, rice farmers in the ZOI produced an estimated total of 486,352 mt of rice in the season preceding the survey. An estimated total of 220,545 ha were cultivated, for an area-weighted average yield of 2.2 mt/ha. Average farmer yield was 4.5 mt/ha. Irrespective of farm size, total production, total

<sup>125</sup> Due to low response rates for land measurements combined with issues merging measurement data between CSPro and the area measurement software, the sample size for plot measurements was significantly reduced. Accordingly, all yield estimates are based on self-reported areas. Field teams collected self-reported area for all plots farmed (up to 8) for each of the farmers interviewed in the household (not only plots that were sampled for direct area measurement).

yield, and average yield were greater for male farmers relative to female farmers, and for farmers 30 years and older relative to younger farmers. Both sex and age are statistically associated with average yield. Because of the small sample size, estimates are not available for non-smallholder farms.

**Table 7.2.15: Rice yield in the ZOI during the season preceding the survey, by farm size and farmers' sex and age**

| Background characteristic | Area-weighted   |                          |               | Average per farmer |                          |               | Sig. <sup>a</sup> | Number of rice farmers (n) |
|---------------------------|-----------------|--------------------------|---------------|--------------------|--------------------------|---------------|-------------------|----------------------------|
|                           | Production (mt) | Units of production (ha) | Yield (mt/ha) | Production (mt)    | Units of production (ha) | Yield (mt/ha) |                   |                            |
| <b>Total</b>              | 486,352.3       | 220,545.0                | 2.2           | 0.9                | 0.3                      | 4.5           |                   | 664                        |
| <b>Sex</b>                |                 |                          |               |                    |                          |               | **                |                            |
| Female                    | 191,021.5       | 68,842.8                 | 2.8           | 0.8                | 0.2                      | 4.0           |                   | 313                        |
| Male                      | 295,080.3       | 151,702.2                | 1.9           | 1.0                | 0.4                      | 4.9           |                   | 351                        |
| <b>Age</b>                |                 |                          |               |                    |                          |               | **                |                            |
| 15-29 years               | 43,773.5        | 22,911.9                 | 1.9           | 0.6                | 0.3                      | 3.5           |                   | 92                         |
| 30+ years                 | 442,328.4       | 197,633.2                | 2.2           | 0.9                | 0.3                      | 4.7           |                   | 572                        |
| <b>Farm size</b>          |                 |                          |               |                    |                          |               |                   |                            |
| <b>Smallholder</b>        | 485,315.3       | 214,774.3                | 2.3           | 0.9                | 0.2                      | 4.5           |                   | 662                        |
| <b>Sex</b>                |                 |                          |               |                    |                          |               | **                |                            |
| Female                    | 190,531.5       | 68,842.8                 | 2.8           | 0.8                | 0.2                      | 4.0           |                   | 313                        |
| Male                      | 294,533.4       | 145,931.5                | 2.0           | 1.0                | 0.4                      | 4.9           |                   | 349                        |
| <b>Age</b>                |                 |                          |               |                    |                          |               | **                |                            |
| 15-29 years               | 43,773.5        | 22,911.9                 | 1.9           | 0.6                | 0.3                      | 3.5           |                   | 92                         |
| 30+ years                 | 441,291.4       | 191,862.4                | 2.3           | 0.9                | 0.3                      | 4.7           |                   | 570                        |
| <b>Non-smallholder</b>    | ^               | ^                        | ^             | ^                  | ^                        | ^             | -                 | 2                          |
| <b>Sex</b>                |                 |                          |               |                    |                          |               | -                 |                            |
| Female                    | ^               | ^                        | ^             | ^                  | ^                        | ^             |                   | 0                          |
| Male                      | ^               | ^                        | ^             | ^                  | ^                        | ^             |                   | 2                          |
| <b>Age</b>                |                 |                          |               |                    |                          |               | -                 |                            |
| 15-29 years               | ^               | ^                        | ^             | ^                  | ^                        | ^             |                   | 0                          |
| 30+ years                 | ^               | ^                        | ^             | ^                  | ^                        | ^             |                   | 2                          |

^ Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating rice.

Source: Feed the Future Nepal ZOI Survey 2019

**Table 7.2.16** presents the average amount of harvested rice, in kilograms (kg), consumed by farmers' own households, among all households, and the average amount of harvested rice also sold by farmers, among households that sold their rice. For rice farms of all sizes, the rice farmer's household consumed an average of 979.8 kg of rice. Among farmers who sold rice, the average amount harvested was 1,931.4 kg and the average amount sold was 1,736.0 kg. Households where the rice farmer was female consumed an average of 690.8 kg of rice and, when they sold rice, sold an average of 966.8 kg, whereas households where the rice farmer was male consumed an average of 1,192.4 kg of rice and, when they sold rice, sold an average of 1,954.7 kg. Sex was significantly associated with both amount consumed and amount sold. Age was significantly associated with amount consumed, but not amount sold. In households where the rice farmer was older than 30, the household consumed an average of 1,019.1 kg of rice and, when they sold rice, sold 1,751.2 kg, whereas households in which the rice farmer was under 30 consumed an average of 710.9 kg of rice.

Among smallholder farmers, the rice farmer's own household consumed an average of 959.0 kg of rice and, when they sold rice, sold an average of 1,582.0 kg. Again, in households where the rice farmer was male, the household consumed more rice than in households where the rice farmer was female. In households where the rice farmer was older than 30 years, the household consumed more rice than in households where the farmer was younger than 30, a statistically significant trend.

**Table 7.2.16: Average amount of rice in kilograms consumed by farmers' own households and sold by farmers in the ZOI by farm size, in total and by farmers' sex and age**

| Use of rice            | Average amount consumed (kg) | Sig. <sup>a</sup> | Number of rice farmers | Average amount harvested (kg) | Average amount sold (kg) | Sig. <sup>a</sup> | Number of rice farmers who sold rice |
|------------------------|------------------------------|-------------------|------------------------|-------------------------------|--------------------------|-------------------|--------------------------------------|
| <b>Total</b>           | 979.8                        |                   | <b>1,302</b>           | 1,931.4                       | 1,736.0                  |                   | <b>260</b>                           |
| <b>Sex</b>             |                              | ***               |                        |                               |                          | **                |                                      |
| Female                 | 690.8                        |                   | 545                    | 1,923.9                       | 966.8                    |                   | 55                                   |
| Male                   | 1,192.4                      |                   | 757                    | 1,934.9                       | 1,954.7                  |                   | 205                                  |
| <b>Age</b>             |                              | ***               |                        |                               |                          | n/s               |                                      |
| 15–29 years            | 710.9                        |                   | 163                    | 825.5                         | ^                        |                   | 17                                   |
| 30+ years              | 1,019.1                      |                   | 1,139                  | 2,007.2                       | 1,751.2                  |                   | 243                                  |
| <b>Farm size</b>       |                              |                   |                        |                               |                          |                   |                                      |
| <b>Smallholder</b>     | 959.0                        |                   | <b>1,292</b>           | 1,931.4                       | 1,582.0                  |                   | <b>254</b>                           |
| <b>Sex</b>             |                              | ***               |                        |                               |                          | *                 |                                      |
| Female                 | 690.8                        |                   | 544                    | 1,923.9                       | 966.8                    |                   | 55                                   |
| Male                   | 1,158.1                      |                   | 748                    | 1,934.9                       | 1,761.3                  |                   | 199                                  |
| <b>Age</b>             |                              | ***               |                        |                               |                          | -                 |                                      |
| 15–29 years            | 710.9                        |                   | 163                    | 825.5                         | ^                        |                   | 17                                   |
| 30+ years              | 995.6                        |                   | 1,129                  | 2,007.2                       | 1,586.5                  |                   | 237                                  |
| <b>Non-Smallholder</b> | ^                            |                   | <b>10</b>              | ^                             | ^                        |                   | <b>6</b>                             |
| <b>Sex</b>             |                              | -                 |                        |                               |                          | -                 |                                      |
| Female                 | ^                            |                   | 1                      | ^                             | ^                        |                   | 0                                    |
| Male                   | ^                            |                   | 9                      | ^                             | ^                        |                   | 6                                    |
| <b>Age</b>             |                              | -                 |                        |                               |                          | -                 |                                      |
| 15–29 years            | ^                            |                   | 0                      | ^                             | ^                        |                   | 0                                    |

| Use of rice | Average amount consumed (kg) | Sig. <sup>a</sup> | Number of rice farmers | Average amount harvested (kg) | Average amount sold (kg) | Sig. <sup>a</sup> | Number of rice farmers who sold rice |
|-------------|------------------------------|-------------------|------------------------|-------------------------------|--------------------------|-------------------|--------------------------------------|
| 30+ years   | ^                            |                   | 10                     | ^                             | ^                        |                   | 6                                    |

^ Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables.

Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating rice.

Source: Feed the Future Nepal ZOI Survey 2019

**Table 7.2.17** presents the main buyers of harvested rice in the ZOI Survey. Rice farmers' most frequent buyers were relatives or friends, at 30.9 percent of main buyers. Rice farmers also frequently sold their rice at local markets (45.1 percent). All rice farmers for which data were available were smallholder farmers.

**Table 7.2.17: Main buyers of rice produced in the ZOI by farm size, in total and by farmers' sex and age**

| Main buyer of rice                            | Total (%) | Sex        |           | Sig. <sup>a</sup> | Age (years) |           | Sig. <sup>a</sup> |
|-----------------------------------------------|-----------|------------|-----------|-------------------|-------------|-----------|-------------------|
|                                               |           | Female (%) | Male (%)  |                   | 15–29 (%)   | 30+ (%)   |                   |
| <b>Total</b>                                  |           |            |           | -                 |             |           | -                 |
| Relative or friend                            | 30.9      | ^          | 31.7      |                   | ^           | 31.6      |                   |
| Local market                                  | 45.1      | ^          | 45.1      |                   | ^           | 42.8      |                   |
| Private trader                                | 9.0       | ^          | 11.9      |                   | ^           | 9.6       |                   |
| Other                                         | 15.1      | ^          | 11.3      |                   | ^           | 16.1      |                   |
| <b>Total number of rice farmers</b>           | <b>67</b> | <b>21</b>  | <b>46</b> |                   | <b>5</b>    | <b>62</b> |                   |
| <b>Farm size</b>                              |           |            |           |                   |             |           |                   |
| <b>Smallholder</b>                            |           |            |           | -                 |             |           | -                 |
| Relative or friend                            | 30.9      | ^          | 31.7      |                   | ^           | 31.6      |                   |
| Local market                                  | 45.1      | ^          | 45.1      |                   | ^           | 42.8      |                   |
| Private trader                                | 9.0       | ^          | 11.9      |                   | ^           | 9.6       |                   |
| Other                                         | 15.1      | ^          | 11.3      |                   | ^           | 16.1      |                   |
| <b>Number of smallholder rice farmers</b>     | <b>67</b> | <b>21</b>  | <b>46</b> |                   | <b>5</b>    | <b>62</b> |                   |
| <b>Non-smallholder</b>                        |           |            |           | -                 |             |           | -                 |
| Relative or friend                            | -         | -          | -         |                   | -           | -         |                   |
| Local market                                  | -         | -          | -         |                   | -           | -         |                   |
| Private trader                                | -         | -          | -         |                   | -           | -         |                   |
| Other                                         | -         | -          | -         |                   | -           | -         |                   |
| <b>Number of non-smallholder rice farmers</b> | <b>0</b>  | <b>0</b>   | <b>0</b>  |                   | <b>0</b>    | <b>0</b>  |                   |

^ Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables.

Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating rice.

Source: Feed the Future Nepal ZOI Survey 2019

## 7.2.6 Soil characteristics

This section presents soil characteristics, including texture, rock fragment percentage, LCC, and soil limitations of plots used to grow rice in the ZOI. Texture is an important soil property that affects crop

production, land use, and land management. A soil's ability to retain nutrients and also drain is directly related to its texture.<sup>126</sup> Soil can be classified into one of 12 textural classes, as shown in **Table 7.2.18**, depending on the percentages of sand, silt, and clay that it contains.<sup>127</sup>

**Table 7.2.18** presents the percent distribution of soil textures in rice plots in the ZOI by depth or soil horizon. For rice soil samples, irrespective of the soil sample's depth, the greatest proportion of soil consisted of silty clay loam. For soil samples of depths of zero to ten centimeters, clay loam was the second-most common soil consistency. For soil samples of depths ten to 70 centimeters, silty clay was the second-most common soil consistency.

**Table 7.2.18: Soil texture by soil horizon in rice plots in the ZOI**

| Depth (cm) | Soil texture (%) |           |      |            |      |            |                 |            |           |            |                 | Number of plots |
|------------|------------------|-----------|------|------------|------|------------|-----------------|------------|-----------|------------|-----------------|-----------------|
|            | Clay             | Clay loam | Loam | Loamy sand | Sand | Sandy clay | Sandy clay loam | Sandy loam | Silt loam | Silty clay | Silty clay loam |                 |
| 0 to <1    | 3.8              | 21.7      | 6.3  | 1.9        | 0.5  | 1.6        | 13.1            | 7.9        | 3.0       | 9.9        | 30.2            | <b>1,006</b>    |
| 1 to <10   | 1.5              | 21.2      | 6.0  | 1.9        | 0.6  | 1.2        | 11.2            | 6.0        | 2.8       | 11.1       | 36.7            | <b>1,006</b>    |
| 10 to <20  | 2.4              | 13.1      | 6.7  | 3.0        | 1.2  | 1.3        | 12.1            | 8.5        | 2.2       | 16.8       | 32.8            | <b>1,004</b>    |
| 20 to <50  | 2.9              | 9.2       | 5.2  | 5.8        | 4.9  | 2.5        | 10.4            | 11.7       | 3.0       | 18.6       | 25.9            | <b>976</b>      |
| 50 to <70  | 2.4              | 8.6       | 6.1  | 6.2        | 5.2  | 1.2        | 9.6             | 9.6        | 3.2       | 22.5       | 25.4            | <b>816</b>      |

Note: Estimates are based on de jure household members who are farmers responsible for cultivating rice.

Source: Feed the Future Nepal ZOI Survey 2019

Rock fragments are unattached pieces of rock two millimeters in diameter or larger. Rock fragments are characterized by their size and shape and, in some cases, the type of rock; rock fragments classes include pebbles, cobbles, channers, flagstones, stones, and boulders.<sup>128</sup> **Table 7.2.19** presents the percent distribution of rock fragments in rice plots in the ZOI by soil horizon. Overall, soil samples from rice plots contained very low levels of rock fragments. Irrespective of the soil sample's depth, more than 75 percent of soil samples contained less than one percent rock fragments and the percentage of rock fragments was relatively consistent across soil depths. Soil samples with a depth of 20 to <50 centimeters had the greatest percentage of samples that consisted of more than one percent rock fragments.

**Table 7.2.19: Rock fragment percentage by soil horizon in rice plots in the ZOI**

| Depth (cm) | Rock fragment percentage (%) |           |            |            |      | Number of plots |
|------------|------------------------------|-----------|------------|------------|------|-----------------|
|            | 0 to <1%                     | 1 to <15% | 15 to <35% | 35 to <60% | ≥60% |                 |
| 0 to <1    | 84.9                         | 10.3      | 3.4        | 1.2        | 0.3  | <b>1,006</b>    |
| 1 to <10   | 83.5                         | 11.1      | 3.8        | 1.4        | 0.2  | <b>1,005</b>    |
| 10 to <20  | 81.7                         | 11.3      | 5.5        | 1.4        | 0.1  | <b>1,004</b>    |
| 20 to <50  | 75.9                         | 14.6      | 6.3        | 2.8        | 0.5  | <b>977</b>      |
| 50 to <70  | 80.1                         | 11.9      | 4.8        | 2.5        | 0.7  | <b>819</b>      |

Note: Estimates are based on de jure household members who are farmers responsible for cultivating rice.

Source: Feed the Future Nepal ZOI Survey 2019

<sup>126</sup> Jaja, 2016.

<sup>127</sup> USDA-NRCS, 1999.

<sup>128</sup> A Guide for Preparing Soil Profile Descriptions. Soils Properties and Processes. NRE 430/ EEB 4897.



LCC is a system of grouping soils based on their capability to produce crops without deteriorating over time.<sup>129</sup> The eight capability classes, which indicate to farmers how limited their soil is for producing crops, are described in **Table 7.2.20**. This table also presents the percentage of rice plots and average rice yield by LCC. The greatest proportion of rice plots (59.0 percent) fell into the third-best category of the LCC system, categorized as plots with soil with severe limitations that reduce the choice of plants, require special conservation practices, or both. The second-largest proportion of plots (16.9 percent) fell into the second-best category, categorized as plots with moderate limitations that reduce the choice of plants, require moderate conservation practices, or both. The smallest proportion of plots (1.0 percent) fell into the worst category, categorized as plots with limitations that prevent commercial plant production and limit use mainly to recreation, wildlife habitat, water supply, or aesthetic purposes.

**Table 7.2.20: Percentage of rice plots and average rice yield in the ZOI by LCC**

| LCC                    | Description                                                                                                                                                      | Percent of rice plots (%) | Average rice yield (mt/ha) | Number of rice farmers <sup>a</sup> |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|----------------------------|-------------------------------------|
| I (best)               | Slight limitations that restrict soil use                                                                                                                        | 2.6                       | ^                          | 4                                   |
| II                     | Moderate limitations that reduce the choice of plants or require moderate conservation practices                                                                 | 16.9                      | 5.0                        | 33                                  |
| III                    | Severe limitations that reduce the choice of plants or require special conservation practices, or both                                                           | 59.0                      | 5.0                        | 136                                 |
| IV                     | Very severe limitations that restrict the choice of plants or require very careful management, or both                                                           | 7.8                       | 5.0                        | 46                                  |
| V                      | Little or no hazard of erosion, but with other limitations; impractical to remove; limits soil use to mainly pasture, rangeland, forestland, or wildlife habitat | 1.4                       | ^                          | 13                                  |
| VI                     | Severe limitations that make soils generally unsuited to cultivation and limit their use mainly to pasture, rangeland, forestland, or wildlife habitat           | 7.5                       | 5.1                        | 61                                  |
| VII                    | Very severe limitations that make the soils unsuited to cultivation and that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat    | 3.8                       | ^                          | 23                                  |
| VIII (worst)           | Limitations that prevent use for commercial plant production and limit use mainly to recreation, wildlife habitat, water supply, or esthetic purposes            | 1.0                       | ^                          | 9                                   |
| Unclassified           |                                                                                                                                                                  | 0                         | ^                          | 0                                   |
| <b>Number of plots</b> |                                                                                                                                                                  | <b>775</b>                |                            |                                     |

<sup>a</sup> Results not statistically reliable, n<30

<sup>a</sup> Estimates include only rice farmers who cultivated rice on one plot or who cultivated rice on multiple plots that all had the same LCC score. Farmers who cultivated rice on multiple plots that did not all have the same LCC score or without a value for rice yield were excluded.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating rice.

Sources: Feed the Future Nepal ZOI Survey 2019, United States Department of Agriculture. 2018. National Soil Survey Handbook, Part 622

A sub-class designation accompanies the LCC designation. The sub-class designation indicates to farmers the main limitation of their plot's soil, such as erosion risk and low soil depth. A plot can have multiple

<sup>129</sup> USDA, n.d.5.

sub-class designations if it has more than one notable limitation. The ten sub-classes, which are indicated by letters, are described in **Table 7.2.21**. This table also presents the percentages of rice farmers in the ZOI who have plots with soil in each LCC sub-class. For the largest proportion of rice farmers (56.4 percent), soil depth was the greatest limitation of their plot's soil. The second-most common soil limitation was soil water storage capacity (39.2 percent), followed by permeability (25.5 percent). Interestingly, flooding during growing season was not the main soil limitation for any rice farmers.

**Table 7.2.21: Percentage of rice farmers in the ZOI with one or more plots that meet each LCC criteria**

| LCC criteria                         | Description                                                                                                | Reason for assessment                                                                                                                         | Classification                                  | Percent    |
|--------------------------------------|------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|------------|
| Erosion risk (e)                     | Risk of surface soil wearing away due to moving water, depending on the soil texture and land slope.       | Erosion is a major factor limiting future agricultural production. If the productive soil erodes away, the yields will significantly decline. | Plot is at risk of soil erosion.                | 10.5       |
| Soil depth (s-d)                     | Depth of soil to bedrock or other root-limiting layer.                                                     | Soil depth can limit crop root growth if not deep enough.                                                                                     | Plot soil depth is low.                         | 56.4       |
| Surface soil texture (s-t)           | Soil texture near the surface is important for seedling establishment.                                     | Poor surface soil texture can prevent seedling establishment.                                                                                 | Plot surface soil texture is poor.              | 5.7        |
| Salinity (s-k)                       | Salt on the soil surface is an indicator of high soil salinity.                                            | High soil salinity can limit crop growth.                                                                                                     | Plot soil has high salinity.                    | 3.2        |
| Surface stoniness (s-r)              | Percentage of soil covered by stones and boulders (larger than 25 cm).                                     | Soil covered by stones and boulders can impede the use of tractors and animal-pulled plows.                                                   | Plot surface too stony.                         | 9.9        |
| Soil water storage capacity (s-a)    | The amount of water that the soil can store that is usable by plants.                                      | A lower ability to store water means there is less water available for plants to grow. Farmers should plant drought-resistant crops.          | Plot soil has poor ability to store water.      | 39.2       |
| Lime requirement (s-l)               | Soil with a low soil pH (high acidity) requires lime to raise the pH to the ideal range for growing crops. | Soil with a low pH (high acidity) can limit crop production.                                                                                  | Plot soil has high acidity.                     | 4.1        |
| Flooding during growing season (w-f) | Frequency of flooding during the growing season.                                                           | Flooding can damage crops and influence crop selection.                                                                                       | Plot subject to flooding during growing season. | 0.0        |
| Water table depth (w-d)              | Typical water table depth during the growing season.                                                       | A water table that is too high can create an environment not conducive to root growth.                                                        | Plot water table depth is too high.             | 3.0        |
| Permeability (w-p)                   | The ability of water to move through the soil.                                                             | Low permeability can limit root growth during wet periods due to waterlogging.                                                                | Plot soil permeability is low.                  | 25.5       |
| <b>Number of rice farmers</b>        |                                                                                                            |                                                                                                                                               |                                                 | <b>775</b> |

Note: Estimates are based on de jure household members who are farmers responsible for cultivating rice.

Sources: Feed the Future Nepal ZOI Survey 2019; United States Department of Agriculture, 2018, National Soil Survey Handbook, Part 622

## 7.3 Cauliflower

### 7.3.1 Cultivation of cauliflower in Nepal

Feed the Future targets the cauliflower value chain in Nepal. Vegetables, including cauliflower, contribute approximately 9.7 percent to total GDP. The share of cauliflower in total vegetable production is 13.5 percent and average yield is 15 mt/ha.<sup>130</sup> The GoN has prioritized the production of off-season vegetables, including cauliflower, which is among the most popular and profitable of these vegetables.<sup>131</sup> Additionally, cauliflower is considered a cash crop and, therefore, the government has prioritized cauliflower in agricultural policies.

Feed the Future targets the cauliflower value chain because of its high potential for growth in focus districts, high potential to increase demand, and high nutritional value. By increasing productivity and expanding production of nutrient-rich vegetables such as cauliflower, Feed the Future aims to increase the affordability of nutritious foods at local markets and their availability for farmer consumption.<sup>132</sup> Vegetables such as cauliflower are particularly lucrative for farmers, even on small plots, leading to increased incomes. Feed the Future targets smallholder farmers through groups such as cooperatives to improve market access, while also supporting the role of women throughout the value chain with literacy and business skills training.<sup>133</sup> Through the NSAF Activity, Feed the Future also works to link seed companies with GoN agencies.<sup>134</sup>

### 7.3.2 Farmers' background

**Table 7.3.1** presents the age and education characteristics of cauliflower farmers in the ZOI. Overall, there were more male (62.6 percent) cauliflower farmers at baseline than female (37.4 percent). The largest proportion of cauliflower farmers (15.3 percent) was aged 45-49, and the smallest proportion (0.0 percent) was aged 15-19. The greatest proportion of cauliflower farmers had completed primary school (36.6 percent) and the smallest proportion had completed higher education (1.1 percent). Due to the small sample size, estimates for female farmers are not statistically reliable.

**Table 7.3.1: Age and education of cauliflower farmers in the ZOI, in total and by farmers' sex**

| Background characteristic | Total (%) | Sex      |            | Sig. <sup>a</sup> | Number of cauliflower farmers |
|---------------------------|-----------|----------|------------|-------------------|-------------------------------|
|                           |           | Male (%) | Female (%) |                   |                               |
| <b>Total</b>              | 100       | 62.6     | 37.4       |                   | 67                            |
| <b>Age</b>                |           |          |            | -                 |                               |

<sup>130</sup> MoALD (2019) Fact Sheet of Agricultural Data.

<sup>131</sup> Pandey, G. & et. al., 2017. An Analysis of Vegetables and Fruits Production Scenario in Nepal. Asian Research Journal of Agriculture, 6(3): 1-10, 2017.

<sup>132</sup> Feed the Future, 2018. The Global Food Security Strategy (GFSS) Nepal Country Plan. Page 15.

<sup>133</sup> Ibid. Page 9.

<sup>134</sup> Digital Green, 2019. Strengthening Private Sector Extension and Advisory Services Portfolio Review. Developing Local Extension Capacity (DLEC) Project. USAID. Page 174.

| Background characteristic            | Total (%) | Sex       |            | Sig. <sup>a</sup> | Number of cauliflower farmers |
|--------------------------------------|-----------|-----------|------------|-------------------|-------------------------------|
|                                      |           | Male (%)  | Female (%) |                   |                               |
| 15–19                                | 0.0       | 0.0       | ^          |                   | 0                             |
| 20–24                                | 5.2       | 2.4       | ^          |                   | 3                             |
| 25–29                                | 11.5      | 9.6       | ^          |                   | 7                             |
| 30–34                                | 12.2      | 8.8       | ^          |                   | 8                             |
| 35–39                                | 15.2      | 17.5      | ^          |                   | 10                            |
| 40–44                                | 12.5      | 10.2      | ^          |                   | 9                             |
| 45–49                                | 15.3      | 18.2      | ^          |                   | 11                            |
| 50–54                                | 12.0      | 11.9      | ^          |                   | 8                             |
| 55–59                                | 5.9       | 7.0       | ^          |                   | 4                             |
| 60+                                  | 10.2      | 14.4      | ^          |                   | 7                             |
| <b>Education</b>                     |           |           |            | -                 |                               |
| No education                         | 21.1      | 14.1      | ^          |                   | 16                            |
| Less than primary                    | 31.2      | 31.7      | ^          |                   | 21                            |
| Completed primary                    | 36.6      | 42.8      | ^          |                   | 24                            |
| Completed secondary                  | 9.9       | 9.7       | ^          |                   | 5                             |
| Higher                               | 1.1       | 1.8       | ^          |                   | 1                             |
| <b>Number of cauliflower farmers</b> | <b>67</b> | <b>42</b> | <b>25</b>  |                   | <b>67</b>                     |

<sup>a</sup>Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables.

Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating cauliflower.

Source: Feed the Future Nepal ZOI Survey 2019

**Table 7.3.2** presents information about why farmers cultivated cauliflower, specifically for consumption, market, or both. Some data were unavailable because of the small sample size. A majority (89.1 percent) of cauliflower farmers cultivated cauliflower both for consumption and for sale at the market. 10.9 percent of cauliflower farmers cultivated the crop for consumption only, and none reported cultivating the crop purely to sell at the market. Because of the small sample size, estimates for females and younger farmers are not statistically reliable and statistical tests of differences across these categories are not reported.

**Table 7.3.2: Reasons for cultivating cauliflower in the ZOI, in total and by farmers' sex and age**

| Reason for cauliflower cultivation   | Total (%) | Sex        |           | Sig. <sup>a</sup> | Age (years) |           | Sig. <sup>a</sup> |
|--------------------------------------|-----------|------------|-----------|-------------------|-------------|-----------|-------------------|
|                                      |           | Female (%) | Male (%)  |                   | 15–29 (%)   | 30+ (%)   |                   |
| <b>Reason</b>                        |           |            |           | -                 |             |           | -                 |
| Consumption only                     | 10.9      | ^          | 17.4      |                   | ^           | 9.5       |                   |
| Market only                          | 0.0       | ^          | 0.0       |                   | ^           | 0.0       |                   |
| Consumption and market               | 89.1      | ^          | 82.6      |                   | ^           | 90.5      |                   |
| <b>Number of cauliflower farmers</b> | <b>67</b> | <b>25</b>  | <b>42</b> |                   | <b>10</b>   | <b>57</b> |                   |

<sup>a</sup>Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables.

Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating cauliflower.

Source: Feed the Future Nepal ZOI Survey 2019

### 7.3.3 Application of management practices and technologies by cauliflower farmers

This section examines the management practices and technologies that farmers used to grow cauliflower. In all tables, Feed the Future-promoted improved management practices and technologies are indicated with a double dagger (‡).

#### Land preparation and management practices

Proper land preparation practices are important to provide the necessary conditions for improved soil health and successful crop growth. Land preparation includes the approaches that farmers take to prepare their plots for planting, including plowing or zero tillage practices. Improved land management practices increase soil fertility and enhance water-use efficiency to improve overall plot productivity. Land management includes crop rotation practices and approaches farmers take to soil and water management and irrigation of their plots. Globally, water-use efficiency in irrigation of crop plots is low. Raised-bed planting with trench irrigation, as well as bunding or terracing, can significantly increase water-use efficiency.<sup>135</sup> Using appropriate irrigation techniques, minimizing soil disturbances, using surface mulch, and rotating crops help boost crop yields.<sup>136</sup> Cauliflower farmers may choose to grow complementary crops, such as radish and mustard, alongside cauliflower. Such intercropping enhances soil nutrition and fertility by adding much-needed nitrogen to the soil, increases resource-use efficiency, and discourages weeds, pests, and other crop diseases.<sup>137</sup>

**Table 7.3.3** shows the land preparation practices, planting practices, and cropping practices that cauliflower farmers used in the ZOI. Overall, 50.1 percent of cauliflower farmers practiced hand weeding, 1.3 percent of farmers practiced plowing, and 3.8 percent did not follow any land preparation practices. A majority (77.2 percent) of cauliflower farmers grew seedlings in raised beds, while 43.5 percent treated the seed and 9.8 percent hardened off the seedlings. A majority (87.3 percent) of cauliflower farmers rotated their crops, while 12.7 percent left their plot fallow. A majority (76.3 percent) of farmers also managed their plots with soil bands and trenches, while 43.8 percent practiced terracing, and just 2.9 percent practiced mulching. Finally, irrigation by hand (33.6 percent) was most frequently practiced, followed by a pump system (28.3 percent) and no system at all (21.5 percent). Because of the small sample size, estimates for females and younger farmers are not statistically reliable and statistical tests of differences across these categories are not reported.

**Table 7.3.3: Land preparation, planting practices, and management practices used by cauliflower farmers in the ZOI, in total and by farmers' sex and age**

| Practice                      | Total (%) | Sex        |          | Sig. <sup>a</sup> | Age (years) |         | Sig. <sup>a</sup> |
|-------------------------------|-----------|------------|----------|-------------------|-------------|---------|-------------------|
|                               |           | Female (%) | Male (%) |                   | 15–29 (%)   | 30+ (%) |                   |
| Land preparation <sup>b</sup> |           |            |          |                   |             |         |                   |
| Hand weeding                  | 50.1      | ^          | 54.2     | -                 | ^           | 50.4    | -                 |
| Plowing                       | 1.3       | ^          | 2.1      | -                 | ^           | 1.6     | -                 |
| Zero tillage                  | 0.0       | ^          | ^        | -                 | ^           | 0.0     | -                 |
| None                          | 3.8       | ^          | 4.2      | -                 | ^           | 3.2     | -                 |

<sup>135</sup> Solh, Braun, & Tadesse, 2014; Djagba, Rodenburg, Zwart, Houndagba, & Kiepe, 2014.

<sup>136</sup> Reeves, et al., 2016.

<sup>137</sup> Wilkins, 2008.

| Practice                               | Total (%) | Sex        |          |                   | Age (years) |         |                   |
|----------------------------------------|-----------|------------|----------|-------------------|-------------|---------|-------------------|
|                                        |           | Female (%) | Male (%) | Sig. <sup>a</sup> | 15–29 (%)   | 30+ (%) | Sig. <sup>a</sup> |
| Planting practices <sup>b</sup>        |           |            |          |                   |             |         |                   |
| Seed treatment                         | 43.5      | ^          | 45.1     | -                 | ^           | 43.6    | -                 |
| Harden off seedlings                   | 9.8       | ^          | 11.6     | -                 | ^           | 8.7     | -                 |
| Start seedlings in flats               | 5.6       | ^          | 9.0      | -                 | ^           | 6.8     | -                 |
| Start seedlings in other containers    | 1.4       | ^          | 2.3      | -                 | ^           | 1.7     | -                 |
| Grow seedlings in raised beds‡         | 77.2      | ^          | 77.4     | -                 | ^           | 79.0    | -                 |
| Crop rotated                           |           |            |          | -                 |             |         | -                 |
| Yes, rotated                           | 87.3      | ^          | 85.9     |                   | ^           | 85.0    |                   |
| No, did not rotate                     | 0.0       | ^          | 0.0      |                   | ^           | 0.0     |                   |
| No, left plot fallow                   | 12.7      | ^          | 14.1     |                   | ^           | 15.1    |                   |
| Soil and water management <sup>b</sup> |           |            |          |                   |             |         |                   |
| Terracing                              | 43.8      | ^          | 41.0     | -                 | ^           | 43.8    | -                 |
| Mulching‡                              | 2.9       | ^          | 2.4      | -                 | ^           | 1.9     | -                 |
| Soil bands, trenches                   | 76.3      | ^          | 76.2     | -                 | ^           | 77.5    | -                 |
| Adding lime to soil                    | 0.0       | ^          | 0.0      | -                 | ^           | 0.0     | -                 |
| None                                   | 3.0       | ^          | 0.0      | -                 | ^           | 1.8     | -                 |
| Irrigation <sup>b</sup>                |           |            |          |                   |             |         |                   |
| Hand (watering can, hose)              | 33.6      | ^          | 22.6     | -                 | ^           | 35.7    | -                 |
| Canals                                 | 6.9       | ^          | 8.6      | -                 | ^           | 8.2     | -                 |
| Permanent hose                         | 5.6       | ^          | 4.8      | -                 | ^           | 3.6     | -                 |
| Pump system                            | 28.3      | ^          | 32.5     | -                 | ^           | 32.2    | -                 |
| Flood (basin, furrow, border)          | 0.0       | ^          | 0.0      | -                 | ^           | 0.0     | -                 |
| Drip‡                                  | 0.0       | ^          | 0.0      | -                 | ^           | 0.0     | -                 |
| Traveling gun/moving sprinkler         | 5.6       | ^          | 7.0      | -                 | ^           | 3.1     | -                 |
| Sprinkler                              | 3.5       | ^          | 3.0      | -                 | ^           | 2.3     | -                 |
| Center pivot                           | 0.0       | ^          | 0.0      | -                 | ^           | 0.0     | -                 |
| Forest                                 | 0.0       | ^          | 0.0      | -                 | ^           | 0.0     | -                 |
| None                                   | 21.5      | ^          | 28.6     | -                 | ^           | 22.2    | -                 |
| Number of cauliflower farmers          | 67        | 25         | 42       |                   | 10          | 57      |                   |

<sup>a</sup> Results not statistically reliable, n<30

<sup>‡</sup> Promoted improved technology or management practice

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Farmers were allowed to give more than one response, so the percentages may not add up to 100 percent.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating cauliflower.

Source: Feed the Future Nepal ZOI Survey 2019

## Use of inputs

This section presents information on cauliflower farmers' inputs, including seed, fertilizer, manure, training, information, and decision-making for growing cauliflower. Certain hybrids of cauliflower seed are more drought- and heat-tolerant than traditional cauliflower and will produce greater yields when grown in very warm or drought-prone climates.<sup>138</sup>

**Table 7.3.4** shows where farmers obtained their cauliflower seeds and the type of cauliflower seeds used. A majority (82.9 percent) of cauliflower farmers used modern seeds and 14.2 percent of farmers

<sup>138</sup> Edmeades, 2015.

used traditional seeds. No farmers in the sample used hybrid seeds. These seeds were most frequently procured from an agriculture dealer (76.7 percent), distantly followed by from a market or non-agricultural dealer (8.4 percent) and from aid distribution (7.7 percent). Statistical significance of sex and age differences could not be calculated due to small sample size among females and farmers ages 15-29.

**Table 7.3.4: Seed types and seed sources used by cauliflower farmers in the ZOI, in total and by farmers' sex and age**

| Characteristic or practice                                  | Total (%) | Sex        |           | Sig. <sup>a</sup> | Age (years) |           | Sig. <sup>a</sup> |
|-------------------------------------------------------------|-----------|------------|-----------|-------------------|-------------|-----------|-------------------|
|                                                             |           | Female (%) | Male (%)  |                   | 15–29 (%)   | 30+ (%)   |                   |
| <b>Seed type<sup>b</sup></b>                                |           |            |           |                   |             |           |                   |
| Unimproved or local open-pollinated varieties (traditional) | 14.2      | ^          | 19.0      |                   | ^           | 15.7      |                   |
| Improved open-pollinated varieties (modern) ‡               | 82.9      | ^          | 81.0      |                   | ^           | 82.5      |                   |
| Hybrid ‡                                                    | 0.0       | ^          | 0.0       |                   | ^           | 0.0       |                   |
| <b>Main seed source</b>                                     |           |            |           |                   |             |           |                   |
| Own saved/friend or relative (not purchased)                | 2.3       | ^          | 0.0       |                   | ^           | 0.0       |                   |
| Friend or relative (purchased)                              | 2.8       | ^          | 2.4       |                   | ^           | 3.3       |                   |
| Agriculture dealer (cash)                                   | 76.7      | ^          | 83.0      |                   | ^           | 81.8      |                   |
| Market or non-agriculture dealer                            | 8.4       | ^          | 4.9       |                   | ^           | 6.9       |                   |
| Aid distribution                                            | 7.7       | ^          | 6.8       |                   | ^           | 5.8       |                   |
| Other                                                       | 1.9       | ^          | 2.9       |                   | ^           | 2.2       |                   |
| <b>Number of cauliflower farmers</b>                        | <b>67</b> | <b>25</b>  | <b>42</b> |                   | <b>10</b>   | <b>57</b> |                   |

<sup>a</sup> Results not statistically reliable, n<30

<sup>‡</sup> Promoted improved technology or management practice

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Farmers were allowed to give more than one response, so the percentages may not add up to 100 percent.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating cauliflower.

Source: Feed the Future Nepal ZOI Survey 2019

Application of inorganic or organic fertilizers, such as manure and crop residues, plays an important role in soil health. Fertilizers help correct soil macro- and micro-nutrient deficiencies in many regions and promote crop growth.<sup>139</sup> Inorganic, or mineral, fertilizers are often too expensive for smallholder farmers and are frequently locally unavailable. Organic inputs can be used in place of or alongside mineral fertilizers, through improved waste recycling, crop residue composting, animal manure, and intercropping or crop rotation with legumes, trees, and shrubs.<sup>140</sup> **Table 7.3.5** presents information related to cauliflower farmers' fertilizer practices.

Overall, 98.1 percent of cauliflower farmers applied fertilizer. Soil-based organic fertilizer was most common (91.1 percent), followed by soil-based inorganic fertilizer (80.0 percent). No cauliflower farmers used organic or inorganic foliar seeds. A majority (78.1 percent) of cauliflower farmers applied fertilizer at the early growth stage and before planting (60.2 percent). 44.6 and 20.7 percent of farmers

<sup>139</sup> Lal, 2010.

<sup>140</sup> Reeves, et al., 2016; Snapp, Mafongoya, & Waddington, 1998.

applied fertilizer at the planting and mid-crop stages, respectively. Statistical significance of sex and age differences could not be calculated due to small sample size among females and farmers ages 15-29.

**Table 7.3.5: Cauliflower farmers' fertilizer use, types of fertilizer, and timing of application in the ZOI, in total and by farmers' sex and age**

| Characteristic or practice                                  | Total (%) | Sex        |           | Sig. <sup>a</sup> | Age (years) |           | Sig. <sup>a</sup> |
|-------------------------------------------------------------|-----------|------------|-----------|-------------------|-------------|-----------|-------------------|
|                                                             |           | Female (%) | Male (%)  |                   | 15-29 (%)   | 30+ (%)   |                   |
| <b>Applied fertilizer</b>                                   | 98.1      | ^          | 97.1      | -                 | ^           | 97.8      | -                 |
| <b>Number of cauliflower farmers</b>                        | <b>65</b> | <b>23</b>  | <b>42</b> |                   | <b>9</b>    | <b>56</b> |                   |
| <b>Type<sup>b</sup></b>                                     |           |            |           |                   |             |           |                   |
| Soil-based organic                                          | 91.1      | ^          | 88.5      | -                 | ^           | 89.6      | -                 |
| Soil-based inorganic                                        | 80.0      | ^          | 86.4      | -                 | ^           | 85.1      | -                 |
| Organic foliar feeds                                        | 0.0       | ^          | 0.0       | -                 | ^           | 0.0       | -                 |
| Inorganic foliar feeds                                      | 0.0       | ^          | 0.0       | -                 | ^           | 0.0       | -                 |
| <b>Timing of application<sup>b</sup></b>                    |           |            |           |                   |             |           |                   |
| Pre-planting                                                | 60.2      | ^          | 63.0      | -                 | ^           | 58.5      | -                 |
| Planting                                                    | 44.6      | ^          | 42.2      | -                 | ^           | 45.5      | -                 |
| Early growth stage                                          | 78.1      | ^          | 75.6      | -                 | ^           | 81.4      | -                 |
| Mid-crop                                                    | 20.7      | ^          | 24.0      | -                 | ^           | 22.3      | -                 |
| <b>Number of cauliflower farmers who applied fertilizer</b> | <b>64</b> | <b>23</b>  | <b>41</b> |                   | <b>9</b>    | <b>55</b> |                   |

^ Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables.

Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Farmers were allowed to give more than one response, so the percentages may not add up to 100 percent.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating cauliflower.

Source: Feed the Future Nepal ZOI Survey 2019

Animal manure supplies beneficial nutrients to growing cauliflower plants and improves soil fertility. In many countries, adequate quantities of animal manure for agricultural use may not be locally available and must be purchased elsewhere. **Table 7.3.6** presents information related to cauliflower farmers' use of manure, including the percentage who use animal manure, how the manure was applied to fields, and the manure's source. 92.4 percent of cauliflower farmers applied manure at baseline. All farmers applied manure by hand, and 93.1 percent sourced this manure from their own animals. Only 5.2 percent were gifted the manure that they used, and 1.7 percent purchased the manure. Statistical significance of sex and age differences could not be calculated due to small sample size among females and farmers ages 15-29.



**Table 7.3.6: Manure sources and application practices used by cauliflower farmers in the ZOI, in total and by farmers' sex and age**

| Characteristic or practice                              | Total (%) | Sex        |           | Sig. <sup>a</sup> | Age (years) |           | Sig. <sup>a</sup> |
|---------------------------------------------------------|-----------|------------|-----------|-------------------|-------------|-----------|-------------------|
|                                                         |           | Female (%) | Male (%)  |                   | 15–29 (%)   | 30+ (%)   |                   |
| <b>Applied animal manure</b>                            | 92.4      | ^          | 90.7      | -                 | ^           | 91.2      | -                 |
| <b>Number of cauliflower farmers</b>                    | <b>65</b> | <b>23</b>  | <b>42</b> |                   | <b>9</b>    | <b>56</b> |                   |
| <b>Method of application</b>                            |           |            |           | -                 |             |           | -                 |
| Other                                                   | 0.0       | ^          | 0.0       |                   | ^           | 0.0       |                   |
| By hand                                                 | 100       | ^          | 100       |                   | ^           | 100       |                   |
| By machine                                              | 0.0       | ^          | 0.0       |                   | ^           | 0.0       |                   |
| <b>Source</b>                                           |           |            |           | -                 |             |           | -                 |
| Own animals                                             | 93.1      | ^          | 92.1      |                   | ^           | 91.9      |                   |
| Given, did not purchase                                 | 5.2       | ^          | 5.2       |                   | ^           | 6.1       |                   |
| Purchased                                               | 1.7       | ^          | 2.7       |                   | ^           | 2.0       |                   |
| <b>Number of cauliflower farmers who applied manure</b> | <b>60</b> | <b>22</b>  | <b>38</b> |                   | <b>9</b>    | <b>51</b> |                   |

^ Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating cauliflower.

Source: Feed the Future Nepal ZOI Survey 2019

Cauliflower is plagued by bacterial soft rot and black rot; fungal diseases including blackleg, clubroot, downy mildew, powdery mildew, sclerotinia stem rot, white rust, ring spot, and wirestem; viral diseases including cauliflower mosaic; and nematodal diseases including root knot. Common pests afflicting cauliflower include beet armyworm, cabbage aphid, cabbage looper, cucumber beetles, cut worms, diamondback moth, flea beetles, large cabbage white, and thrips.<sup>141</sup>

Crop losses may be prevented or minimized through adequate prevention and management measures. Herbicides and manual removal may control weeds, and pesticides, insecticides, and fungicides may manage pests and crop diseases. There are also several favorable and effective non-chemical approaches to cauliflower pest control.<sup>142</sup> Integrated pest management is an encouraged “problem-avoiding” approach to pest management that seeks to minimize pesticide use and control pests through cultural, manual, and biological means.<sup>143</sup> Intercropping and crop rotation is a particularly effective non-chemical measure for pest and weed management in cauliflower fields in Nepal.<sup>144</sup>

**Table 7.3.7** presents cauliflower farmers' pest and weed management practices. The greatest proportion of farmers did not practice any form of chemical pest management (43.2 percent). 42.2 percent used chemicals in response to a pest attack and 14.6 percent used chemicals routinely. The sample of female cauliflower farmers and those aged 15-29 were too small to present disaggregates. However, the share of male cauliflower farmers that used chemicals in response to a pest attack (43.6 percent) closely matched the share of males that did not use any chemical pest management (43.4

<sup>141</sup> DoA (2018). Crops Disease Pests Identification Handbook.

<sup>142</sup> Reeves, et al., 2016.

<sup>143</sup> FAO, 2011.

<sup>144</sup> PQPMC, MoALD (2019), Annual Program and Statistics Book.

percent). Similarly, 39.8 percent of farmers over 30 years of age used chemicals in response to a pest attack, while just 17.3 percent did so routinely. Almost all farmers (98.8 percent) practiced weeding with a hoe, and a majority (51.7 percent) also pulled weeds by hand. Statistical significance of sex and age differences could not be calculated due to small sample size among females and farmers ages 15-29.

**Table 7.3.7: Pest and weed management practices used by cauliflower farmers in the ZOI, in total and by farmers' sex and age**

| Management practice                  | Total (%) | Sex        |           | Sig. <sup>a</sup> | Age (years) |           | Sig. <sup>a</sup> |
|--------------------------------------|-----------|------------|-----------|-------------------|-------------|-----------|-------------------|
|                                      |           | Female (%) | Male (%)  |                   | 15-29 (%)   | 30+ (%)   |                   |
| <b>Chemical pest management</b>      |           |            |           | n/s               |             |           | n/s               |
| Preventative (routine) ‡             | 14.6      | ^          | 13.0      |                   | ^           | 17.3      |                   |
| Response to attack‡                  | 42.2      | ^          | 43.6      |                   | ^           | 39.8      |                   |
| None                                 | 43.2      | ^          | 43.4      |                   | ^           | 42.8      |                   |
| <b>Weed management<sup>b</sup></b>   |           |            |           | n/s               |             |           | n/s               |
| Herbicide applied‡                   | 0.0       | ^          | 0.0       | -                 | ^           | 0.0       | -                 |
| Weeding with hoe                     | 98.8      | ^          | 98.2      | n/s               | ^           | 98.6      | n/s               |
| Intercropping                        | 1.4       | ^          | 0.0       | n/s               | ^           | 0.0       | *                 |
| Mulching‡                            | 1.4       | ^          | 0.0       | n/s               | ^           | 0.0       | *                 |
| Slashing                             | 6.6       | ^          | 7.6       | n/s               | ^           | 5.8       | n/s               |
| Pull by hand                         | 51.7      | ^          | 54.2      | n/s               | ^           | 51.7      | n/s               |
| None                                 | 0.0       | ^          | 0.0       | -                 | ^           | 0.0       | -                 |
| <b>Number of cauliflower farmers</b> | <b>65</b> | <b>23</b>  | <b>42</b> |                   | <b>9</b>    | <b>56</b> |                   |

<sup>a</sup> Results not statistically reliable, n<30

‡ Promoted improved technology or management practice

<sup>a</sup>Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Farmers were allowed to give more than one response, so the percentages may not add up to 100 percent.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating cauliflower.

Source: Feed the Future Nepal ZOI Survey 2019

## Waste reuse practices

This section presents information on waste reuse practices, which are how farmers use the leftover cauliflower stems after harvesting, and uses of cauliflower after harvest. Harvesting occurs when the cauliflower has reached maturity and can be accomplished mechanically or by hand. The large external cauliflower leaves are removed before being transported to the market. Cauliflower stems have many valuable uses. The leaves and stems are used for animal feed, and those that cannot be sold or consumed can be used directly in the field as organic fertilizer.<sup>145</sup>

**Table 7.3.8** presents information on how cauliflower crop residues are used by cauliflower farmers in the ZOI. A majority (64.8 percent) of cauliflower farmers used cauliflower stems as feed for their animals. A sizeable proportion (31.2 percent) also incorporated the stems back into their soil. Fewer than eight percent of cauliflower farmers burned their stems in the field, used the stems as fuel for fire, or harvested the stems and sold them to others. Immediately following harvest, most cauliflower farmers either cooked their produce (91.8 percent) or sold it to others (73.6 percent). Statistical

<sup>145</sup> DADO, 2016. Maize Farming Technique Manual. DADO Sindhupalchok & Gorkha and JICA.

significance of sex and age differences could not be calculated due to small sample size among females and farmers ages 15-29.

**Table 7.3.8: Use of stems and post-harvest crop by cauliflower farmers in the ZOI, in total and by farmers' sex and age**

| Waste reuse practice                      | Total<br>(%) | Sex           |             |                   | Age (years)  |            |                   |
|-------------------------------------------|--------------|---------------|-------------|-------------------|--------------|------------|-------------------|
|                                           |              | Female<br>(%) | Male<br>(%) | Sig. <sup>a</sup> | 15–29<br>(%) | 30+<br>(%) | Sig. <sup>a</sup> |
| Cauliflower stems use <sup>b</sup>        |              |               |             |                   |              |            |                   |
| Burned in the field                       | 5.0          | ^             | 0.0         | -                 | ^            | 5.9        | -                 |
| Incorporated back into soil               | 31.2         | ^             | 30.7        | -                 | ^            | 33.6       | -                 |
| Used as bedding for own livestock         | 0.0          | ^             | 0.0         | -                 | ^            | 0.0        | -                 |
| Used as fuel for fire                     | 1.2          | ^             | 1.8         | -                 | ^            | 1.4        | -                 |
| Left in field for grazing animals         | 0.0          | ^             | 0.0         | -                 | ^            | 0.0        | -                 |
| Harvested and fed to own animals          | 64.8         | ^             | 64.3        | -                 | ^            | 62.0       | -                 |
| Harvested and sold to others              | 1.6          | ^             | 2.4         | -                 | ^            | 1.9        | -                 |
| Cauliflower post-harvest use <sup>b</sup> |              |               |             |                   |              |            |                   |
| Eat them fresh                            | 4.2          | ^             | 3.9         | -                 | ^            | 3.7        | -                 |
| Cook them                                 | 91.8         | ^             | 87.4        | -                 | ^            | 92.2       | -                 |
| Wash and clean them                       | 20.9         | ^             | 26.5        | -                 | ^            | 23.0       | -                 |
| Sell directly                             | 73.6         | ^             | 70.9        | -                 | ^            | 76.8       | -                 |
| Grade by size for selling                 | 13.3         | ^             | 14.3        | -                 | ^            | 12.8       | -                 |
| Grade by quality for selling              | 13.9         | ^             | 19.1        | -                 | ^            | 14.6       | -                 |
| Package them for sale                     | 12.5         | ^             | 10.2        | -                 | ^            | 11.7       | -                 |
| Store them in closed container            | 0.0          | ^             | 0.0         | -                 | ^            | 0.0        | -                 |
| Store them in a ventilated container      | 0.6          | ^             | 0.0         | -                 | ^            | 0.7        | -                 |
| Give to friends, neighbors                | 0.0          | ^             | 0.0         | -                 | ^            | 0.0        | -                 |
| Number of cauliflower farmers             | 65           | 23            | 42          |                   | 9            | 56         |                   |

^ Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Farmers were allowed to give more than one response, so the percentages may not add up to 100 percent.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating cauliflower.

Source: Feed the Future Nepal ZOI Survey 2019

## Storage practices

This section presents information on cauliflower storage practices, including the use of various containers and storage locations. Storage serves several purposes in the cauliflower post-harvest process. Since cauliflower is a perishable vegetable, it is stored for only one or two days before being sent to the market. Storage protects against excessive heat, ground- and rainwater, rodents, and harmful micro-organisms and helps ensure that the cauliflower retains its nutritional value.<sup>146</sup>

**Table 7.3.9** presents information on how farmers store and transport their harvested cauliflower in the ZOI. A majority (81.7 percent) of cauliflower farmers usually sold their crop the day of harvest, while 18.3 percent usually took one to two days to sell their produce. Most farmers (69.6 percent) sold their produce before it became soft. 28.6 percent of farmers noted that their crop sometimes became

<sup>146</sup> Shepherd, 1999.

soft before sale and 1.8 percent noted that their crop often became soft before sale. Statistical significance of sex and age differences could not be calculated due to small sample sizes.

A majority (51.7 percent) of cauliflower farmers sold their produce in the market. 22.1 percent sold their cauliflower at the farm gate, and 21.5 percent sold their crop to the collection center. Statistical significance of sex and age differences could not be calculated due to small sample size among females and farmers ages 15-29.

**Table 7.3.9: Timing and location of the sale of cauliflower in the ZOI, in total and by farmers' sex and age**

| Storage or transport method          | Total (%) | Sex        |           | Sig. <sup>a</sup> | Age (years) |           | Sig. <sup>a</sup> |
|--------------------------------------|-----------|------------|-----------|-------------------|-------------|-----------|-------------------|
|                                      |           | Female (%) | Male (%)  |                   | 15-29 (%)   | 30+ (%)   |                   |
| <b>Days to sell cauliflower</b>      |           |            |           | -                 |             |           | -                 |
| Usually sell the day it's harvested  | 81.7      | ^          | 79.2      |                   | ^           | 78.6      |                   |
| 1-2 days                             | 18.3      | ^          | 20.8      |                   | ^           | 21.4      |                   |
| <b>Became soft before sale</b>       |           |            |           | -                 |             |           | -                 |
| Often                                | 1.8       | ^          | 3.0       |                   | ^           | 2.1       |                   |
| Sometimes                            | 28.6      | ^          | 39.3      |                   | ^           | 29.9      |                   |
| Never                                | 69.6      | ^          | 57.7      |                   | ^           | 68.0      |                   |
| <b>Location of sale</b>              |           |            |           | -                 |             |           | -                 |
| At the farm gate                     | 22.1      | ^          | 8.0       |                   | ^           | 20.1      |                   |
| To the collection center             | 21.5      | ^          | 30.4      |                   | ^           | 23.0      |                   |
| In the market                        | 51.7      | ^          | 61.6      |                   | ^           | 53.0      |                   |
| Through the farmer cooperative       | 1.3       | ^          | 0.0       |                   | ^           | 1.5       |                   |
| Other                                | 3.4       | ^          | 0.0       |                   | ^           | 2.4       |                   |
| <b>Number of cauliflower farmers</b> | <b>57</b> | <b>23</b>  | <b>34</b> |                   | <b>8</b>    | <b>49</b> |                   |

<sup>a</sup> Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables.

Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating cauliflower.

Source: Feed the Future Nepal ZOI Survey 2019

### Training, record keeping, information sources, and decision-making

Farmers may receive training on agricultural production, markets, and inputs, the use of fertilizers, pesticides, and herbicides, and integrated pest management. Farmers may also receive agricultural information from many sources, both within and outside their communities. **Table 7.3.10** presents the percentages of cauliflower farmers who received training on the use of inorganic fertilizers, pesticides, and herbicides, and the farmers' main sources of information for how to grow their crops well.

Overall, few cauliflower farmers received agricultural training. 10.2 percent received training on the use and application of pesticides, 7.8 percent received training on the use and application of inorganic fertilizer, and 4.6 percent received training on the use and application of herbicides. A majority (62.6 percent) of farmers received market information from a friend or neighbor, while 16.3 percent received information from an agro-input dealer. While the most frequent source of information on crop success was also friends or neighbors (51.9 percent), cauliflower farmers received information on crop success from agro-input dealers (25.2 percent) more frequently than with information on markets (16.3

percent). Statistical significance of sex and age differences could not be calculated due to small sample sizes.

**Table 7.3.10: Record keeping, training received, and main information sources among cauliflower farmers in the ZOI, in total and by farmers' sex and age**

| Topic or source                             | Total (%) | Sex        |          | Sig. <sup>a</sup> | Age (years) |         | Sig. <sup>a</sup> |
|---------------------------------------------|-----------|------------|----------|-------------------|-------------|---------|-------------------|
|                                             |           | Female (%) | Male (%) |                   | 15–29 (%)   | 30+ (%) |                   |
| Training <sup>b</sup>                       |           |            |          |                   |             |         |                   |
| Use and application of inorganic fertilizer | 7.8       | ^          | 9.8      | -                 | ^           | 7.4     | -                 |
| Use and application of pesticides‡          | 10.2      | ^          | 9.8      | -                 | ^           | 10.3    | -                 |
| Use and application of herbicides‡          | 4.6       | ^          | 7.2      | -                 | ^           | 3.6     | -                 |
| Number of cauliflower famers                | 67        | 25         | 42       |                   | 10          | 57      |                   |
| Main information source: markets            |           |            |          | -                 |             |         | -                 |
| Friend or neighbor                          | 62.6      | ^          | 61.7     |                   | ^           | 60.1    |                   |
| Agro-input dealer                           | 16.3      | ^          | 20.0     |                   | ^           | 19.1    |                   |
| Agriculture extension worker                | 6.0       | ^          | 2.3      |                   | ^           | 7.0     |                   |
| Television                                  | 4.1       | ^          | 6.9      |                   | ^           | 4.8     |                   |
| Mobile phone messaging                      | 3.6       | ^          | 6.1      |                   | ^           | 4.2     |                   |
| Other                                       | 7.5       | ^          | 3.1      |                   | ^           | 4.8     |                   |
| Main information source: crop success       |           |            |          |                   |             |         |                   |
| Friend or neighbor                          | 51.9      | ^          | 51.0     |                   | ^           | 48.2    |                   |
| Agro-input dealer                           | 25.2      | ^          | 26.0     |                   | ^           | 29.9    |                   |
| Agriculture extension worker                | 8.6       | ^          | 8.4      |                   | ^           | 8.4     |                   |
| Television                                  | 1.6       | ^          | 2.4      |                   | ^           | 1.9     |                   |
| Mobile phone messaging                      | 0.0       | ^          | 0.0      |                   | ^           | 0.0     |                   |
| Other                                       | 12.7      | ^          | 12.1     |                   | ^           | 11.7    |                   |
| Number of cauliflower famers                | 65        | 23         | 42       |                   | 9           | 56      |                   |

^ Results not statistically reliable, n<30

‡ Promoted improved technology or management practice

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables.

Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Farmers were allowed to give more than one response, so the percentages may not add up to 100 percent.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating cauliflower.

Source: Feed the Future Nepal ZOI Survey 2019

In households with multiple household members, one person or two or more individuals jointly may make farming decisions. **Table 7.3.11** presents the percent distribution of cauliflower farmers by who made key production decisions, such as the type of seed to plant, whether to use fertilizer, and whether to irrigate. Male cauliflower farmers most frequently made key production decisions alone. Over half of male farmers made independent decisions about which type of seed to plant, whether to use fertilizer, and whether to irrigate. Of these three types of decisions, men were most likely to make independent decisions about which type of seed to plant (60.9 percent). Approximately 30 percent of male farmers made these decisions together with a partner. Interestingly, no farmers had decisions made by their partner unilaterally. Because of the small sample size, estimates were not available for female farmers.

**Table 7.3.11: Percent distribution of who made key cauliflower production decisions in the ZOI, by farmers' sex**

| Decision-makers                             | Type of seed to plant |                   | Whether to use fertilizer |                   | Whether to irrigate |                   |
|---------------------------------------------|-----------------------|-------------------|---------------------------|-------------------|---------------------|-------------------|
|                                             | Percent               | Sig. <sup>a</sup> | Percent                   | Sig. <sup>a</sup> | Percent             | Sig. <sup>a</sup> |
| <b>Female farmers</b>                       |                       | -                 |                           | -                 |                     | -                 |
| Self alone                                  | ^                     |                   | ^                         |                   | ^                   |                   |
| Partner/spouse alone                        | ^                     |                   | ^                         |                   | ^                   |                   |
| Self and partner together                   | ^                     |                   | ^                         |                   | ^                   |                   |
| Self and other (could also include partner) | ^                     |                   | ^                         |                   | ^                   |                   |
| Other                                       | ^                     |                   | ^                         |                   | ^                   |                   |
| <b>Number of female cauliflower farmers</b> | <b>23</b>             |                   | <b>23</b>                 |                   | <b>23</b>           |                   |
| <b>Male farmers</b>                         |                       | n/s               |                           | n/s               |                     | n/s               |
| Self alone                                  | 60.9                  |                   | 53.8                      |                   | 56.2                |                   |
| Partner/spouse alone                        | 0.0                   |                   | 0.0                       |                   | 0.0                 |                   |
| Self and partner together                   | 29.3                  |                   | 36.4                      |                   | 34.0                |                   |
| Self and other (could also include partner) | 7.4                   |                   | 7.4                       |                   | 7.4                 |                   |
| Other                                       | 2.4                   |                   | 2.4                       |                   | 2.4                 |                   |
| <b>Number of male cauliflower farmers</b>   | <b>42</b>             |                   | <b>42</b>                 |                   | <b>42</b>           |                   |

^ Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and farmers' sex. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating cauliflower.

Source: Feed the Future Nepal ZOI Survey 2019

### 7.3.4 Use of improved management practices and technologies

This section examines cauliflower farmers' use of improved management practices and technologies promoted by Feed the Future in the Nepal ZOI. **Table 7.3.12** shows the percentage of cauliflower farmers in the ZOI who applied one or more improved management practices or technologies promoted during the 12 months preceding the ZOI Survey. The table also includes the percentage of cauliflower farmers in the ZOI who used promoted improved management practices and technologies, by category.

93.3 percent of cauliflower farmers applied at least one improved management practice or technology. The most frequently applied practices were crop genetics and climate adaptation, each of which was applied by 82.9 percent of farmers. 77.2 percent applied cultural practices and 56.1 percent applied pest and disease management. Interestingly, no cauliflower farmers applied irrigation. Statistical significance of sex and age differences could not be calculated due to small sample size among females and farmers ages 15-29.

**Table 7.3.12: Percentage of cauliflower farmers in the ZOI who applied one or more promoted improved management practices and technologies by category, in total and by farmers' sex and age**

| Category                                                   | Total (%) | Sex        |           |                   | Age (years) |           |                   |
|------------------------------------------------------------|-----------|------------|-----------|-------------------|-------------|-----------|-------------------|
|                                                            |           | Female (%) | Male (%)  | Sig. <sup>a</sup> | 15–29 (%)   | 30+ (%)   | Sig. <sup>a</sup> |
| <b>Across all categories</b>                               | 93.3      | ^          | 97.6      | -                 | ^           | 96.8      | -                 |
| Crop genetics <sup>b</sup>                                 | 82.9      | ^          | 81.0      | -                 | ^           | 82.5      | -                 |
| Cultural practices <sup>c</sup>                            | 77.2      | ^          | 77.4      | -                 | ^           | 79.0      | -                 |
| Pest and disease management <sup>d</sup>                   | 56.1      | ^          | 56.4      | -                 | ^           | 59.1      | -                 |
| Irrigation <sup>e</sup>                                    | 0.0       | ^          | 0.0       | -                 | ^           | 0.0       | -                 |
| Climate adaptation or climate risk management <sup>f</sup> | 82.9      | ^          | 81.0      | -                 | ^           | 82.5      | -                 |
| <b>Number of cauliflower farmers</b>                       | <b>67</b> | <b>25</b>  | <b>42</b> |                   | <b>10</b>   | <b>57</b> |                   |

<sup>a</sup> Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Crop genetics refers to a farmer's use of improved varieties of seeds.

<sup>c</sup> Cultural practices refers to a farmer using raised beds.

<sup>d</sup> Pest and disease management refers to farmer's use of chemical pest control, herbicides, or mulching.

<sup>e</sup> Irrigation refers to a farmer's use of drip irrigation.

<sup>f</sup> Climate adaptation or climate risk management refers to a farmer's use of improved open-pollinated and/or hybrid varieties of seeds.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating cauliflower.

Source: Feed the Future Nepal ZOI Survey 2019

**Table 7.3.13** shows the percent distribution of cauliflower farmers in the ZOI who used promoted improved management practices and technologies, by the number of categories used. The application of promoted improved management practices and technologies was high among cauliflower farmers. The largest proportion of cauliflower farmers applied four improved management practice or technology categories, at 47.8 percent. 27.2 percent of farmers applied three categories, 7.8 percent applied two, and 10.4 percent applied just one. Statistical significance of sex and age differences could not be calculated due to small sample size among females and farmers ages 15-29.

**Table 7.3.13: Percent distribution of cauliflower farmers by number of promoted improved management practices and technologies used in the ZOI, in total and by farmers' sex and age**

| Promoted improved practice or technology | Total (%) | Sex        |           |                   | Age (years) |           |                   |
|------------------------------------------|-----------|------------|-----------|-------------------|-------------|-----------|-------------------|
|                                          |           | Female (%) | Male (%)  | Sig. <sup>a</sup> | 15–29 (%)   | 30+ (%)   | Sig. <sup>a</sup> |
| <b>Number used</b>                       |           |            |           | -                 |             |           | -                 |
| 0                                        | 6.7       | ^          | 2.4       |                   | ^           | 5.1       |                   |
| 1                                        | 10.4      | ^          | 16.6      |                   | ^           | 12.5      |                   |
| 2                                        | 7.8       | ^          | 8.1       |                   | ^           | 6.1       |                   |
| 3                                        | 27.2      | ^          | 28.7      |                   | ^           | 27.2      |                   |
| 4                                        | 47.8      | ^          | 44.2      |                   | ^           | 49.2      |                   |
| <b>Number of cauliflower farmers</b>     | <b>67</b> | <b>25</b>  | <b>42</b> |                   | <b>10</b>   | <b>57</b> |                   |

<sup>a</sup> Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating cauliflower.

Source: Feed the Future Nepal ZOI Survey 2019

### 7.3.5 Cauliflower yields

Yield is a measure of total production per unit of area planted. For cauliflower, yield is the weight of cauliflower (in kilograms) harvested in the season preceding the survey divided by the area, in hectares, planted in the season preceding the survey. Total production is the amount produced, regardless of how it was ultimately used. It also includes any post-harvest loss (i.e., post-harvest loss is not subtracted from total production). All data on total production and total units of production are self-reported, thus yields are calculated using self-reported data.<sup>147</sup>

**Table 7.3.14** presents the total production in metric tons (mt), total production units in hectares (ha), and the area-weighted and farmer average yields of cauliflower in metric tons per hectare (mt/ha) for the season preceding the ZOI Survey. The results are disaggregated by farm size (smallholder and non-smallholder) and further by sex and age. Because of the small sample size, no yield estimates were available for cauliflower. Statistical significance of sex and age differences could not be calculated due to small sample sizes.

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<sup>147</sup> Due to low response rates for land measurements combined with issues merging measurement data between CSPro and the area measurement software, the sample size for plot measurements was significantly reduced. Accordingly, all yield estimates are based on self-reported areas. Field teams collected self-reported area for all plots farmed (up to eight) for each of the farmers interviewed in the household (not only plots that were sampled for direct area measurement).



**Table 7.3.14: Cauliflower yield in the ZOI during the season preceding the survey, by farm size and farmers' sex and age**

| Background characteristic | Area-weighted   |                          |               | Average per farmer |                          |               | Sig. <sup>a</sup> | Number of cauliflower farmers (n) |
|---------------------------|-----------------|--------------------------|---------------|--------------------|--------------------------|---------------|-------------------|-----------------------------------|
|                           | Production (mt) | Units of production (ha) | Yield (mt/ha) | Production (mt)    | Units of production (ha) | Yield (mt/ha) |                   |                                   |
| <b>Total</b>              | ^               | ^                        | ^             | ^                  | ^                        | ^             |                   | <b>21</b>                         |
| <b>Sex</b>                |                 |                          |               |                    |                          |               | -                 |                                   |
| Female                    | ^               | ^                        | ^             | ^                  | ^                        | ^             |                   | 8                                 |
| Male                      | ^               | ^                        | ^             | ^                  | ^                        | ^             |                   | 13                                |
| <b>Age</b>                |                 |                          |               |                    |                          |               | -                 |                                   |
| 15-29 years               | ^               | ^                        | ^             | ^                  | ^                        | ^             |                   | 2                                 |
| 30+ years                 | ^               | ^                        | ^             | ^                  | ^                        | ^             |                   | 19                                |
| <b>Farm size</b>          |                 |                          |               |                    |                          |               |                   |                                   |
| <b>Smallholder</b>        |                 |                          |               |                    |                          |               |                   |                                   |
| <b>Sex</b>                |                 |                          |               |                    |                          |               | -                 |                                   |
| Female                    | ^               | ^                        | ^             | ^                  | ^                        | ^             |                   | 8                                 |
| Male                      | ^               | ^                        | ^             | ^                  | ^                        | ^             |                   | 13                                |
| <b>Age</b>                |                 |                          |               |                    |                          |               | -                 |                                   |
| 15-29 years               | ^               | ^                        | ^             | ^                  | ^                        | ^             |                   | 2                                 |
| 30+ years                 | ^               | ^                        | ^             | ^                  | ^                        | ^             |                   | 19                                |
| <b>Non-smallholder</b>    |                 |                          |               |                    |                          |               |                   |                                   |
| <b>Sex</b>                |                 |                          |               |                    |                          |               | -                 |                                   |
| Female                    | ^               | ^                        | ^             | ^                  | ^                        | ^             |                   | 0                                 |
| Male                      | ^               | ^                        | ^             | ^                  | ^                        | ^             |                   | 0                                 |
| <b>Age</b>                |                 |                          |               |                    |                          |               | -                 |                                   |
| 15-29 years               | ^               | ^                        | ^             | ^                  | ^                        | ^             |                   | 0                                 |
| 30+ years                 | ^               | ^                        | ^             | ^                  | ^                        | ^             |                   | 0                                 |

^ Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating cauliflower.

Source: Feed the Future Nepal ZOI Survey 2019

**Table 7.3.15** presents the average amount of harvested cauliflower, in kilograms (kg), consumed by farmers' own households, among all households, and the average amount of harvested cauliflower also sold by farmers, among households that sold their cauliflower. For cauliflower farms of all sizes, the farmer's own household consumed an average of 102.5 kg of cauliflower, whereas farmers that sold cauliflower sold an average of 397.4 kg. In households where the cauliflower farmer was male, the household consumed 98.6 kg of cauliflower and, when they sold cauliflower, sold 421.3 kg; in households where the farmer was older than 30, the household consumed an average of 111.4 kg of cauliflower and, when they sold cauliflower, sold 430.9 kg. Statistical significance of sex and age differences could not be calculated due to small sample size among females and farmers ages 15-29. All cauliflower farmers were smallholder farmers.

**Table 7.3.15: Average amount of cauliflower in kilograms consumed by farmers' own households and sold by farmers in the ZOI by farm size, in total and by farmers' sex and age**

| Use of Cauliflower     | Average amount consumed (kg) | Sig. <sup>a</sup> | Number of cauliflower farmers | Average amount harvested (kg) | Average amount sold (kg) | Sig. | Number of farmers who sold cauliflower |
|------------------------|------------------------------|-------------------|-------------------------------|-------------------------------|--------------------------|------|----------------------------------------|
| <b>Total</b>           | 102.5                        |                   | <b>64<sup>a</sup></b>         | 297.7                         | 397.4                    |      | <b>57</b>                              |
| <b>Sex</b>             |                              | -                 |                               |                               |                          | -    |                                        |
| Female                 | ^                            |                   | 22                            | ^                             | ^                        |      | 22                                     |
| Male                   | 98.6                         |                   | 41                            | 290.6                         | 421.3                    |      | 35                                     |
| <b>Age</b>             |                              | -                 |                               |                               |                          | -    |                                        |
| 15-29 years            | ^                            |                   | 8                             | ^                             | ^                        |      | 7                                      |
| 30+ years              | 111.4                        |                   | 55                            | 298.0                         | 430.9                    |      | 50                                     |
| <b>Farm size</b>       |                              |                   |                               |                               |                          |      |                                        |
| <b>Smallholder</b>     | 102.5                        |                   | <b>64</b>                     | 297.7                         | 397.42                   |      | <b>57</b>                              |
| <b>Sex</b>             |                              | -                 |                               |                               |                          | -    |                                        |
| Female                 | ^                            |                   | 22                            | ^                             | ^                        |      | 22                                     |
| Male                   | 98.6                         |                   | 41                            | 290.6                         | 421.3                    |      | 35                                     |
| <b>Age</b>             |                              | -                 |                               |                               |                          | -    |                                        |
| 15-29 years            | ^                            |                   | 8                             | ^                             | ^                        |      | 7                                      |
| 30+ years              | 111.4                        |                   | 55                            | 298.0                         | 430.9                    |      | 50                                     |
| <b>Non-smallholder</b> | -                            |                   | <b>0</b>                      | -                             | -                        |      | <b>0</b>                               |
| <b>Sex</b>             |                              | -                 |                               |                               |                          | -    |                                        |
| Female                 | -                            |                   | 0                             | -                             | -                        |      | 0                                      |
| Male                   | -                            |                   | 0                             | -                             | -                        |      | 0                                      |
| <b>Age</b>             |                              | -                 |                               |                               |                          | -    |                                        |
| 15-29 years            | -                            |                   | 0                             | -                             | -                        |      | 0                                      |
| 30+ years              | -                            |                   | 0                             | -                             | -                        |      | 0                                      |

<sup>a</sup> Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Disaggregate values do not sum to total due to missing values for some disaggregate variables.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating cauliflower.

Source: Feed the Future Nepal ZOI Survey 2019

**Table 7.3.16** presents the main buyers of harvested cauliflower in the ZOI Survey. 69.2 percent of cauliflower farmers expressed that the local market most commonly purchases their produce. Private traders were the second most frequent buyers, representing 14.7 percent of cauliflower farmers' buyers. Statistical significance of sex and age differences could not be calculated due to small sample size among females and farmers ages 15-29. All cauliflower farmers for which data were available were smallholder farmers.

**Table 7.3.16: Main buyers of cauliflower produced in the ZOI by farm size, in total and by farmers' sex and age**

| Main buyer of cauliflower                            | Total (%) | Sex        |           | Sig. <sup>a</sup> | Age (years) |           | Sig. <sup>a</sup> |
|------------------------------------------------------|-----------|------------|-----------|-------------------|-------------|-----------|-------------------|
|                                                      |           | Female (%) | Male (%)  |                   | 15-29 (%)   | 30+ (%)   |                   |
| <b>Total</b>                                         |           |            |           | -                 |             |           | -                 |
| Relative or friend                                   | 7.0       | ^          | ^         |                   | ^           | 5.8       |                   |
| Local market                                         | 69.2      | ^          | ^         |                   | ^           | 67.8      |                   |
| Private trader                                       | 14.7      | ^          | ^         |                   | ^           | 16.3      |                   |
| Agriculture co-op                                    | 9.1       | ^          | ^         |                   | ^           | 10.1      |                   |
| <b>Total number of cauliflower farmers</b>           | <b>36</b> | <b>17</b>  | <b>19</b> |                   | <b>5</b>    | <b>31</b> |                   |
| <b>Farm size</b>                                     |           |            |           |                   |             |           |                   |
| <b>Smallholder</b>                                   |           |            |           | -                 |             |           | -                 |
| Relative or friend                                   | 7.0       | ^          | ^         |                   | ^           | 5.8       |                   |
| Local market                                         | 69.2      | ^          | ^         |                   | ^           | 67.8      |                   |
| Private trader                                       | 14.7      | ^          | ^         |                   | ^           | 16.3      |                   |
| Agriculture co-op                                    | 9.1       | ^          | ^         |                   | ^           | 10.1      |                   |
| <b>Number of smallholder cauliflower farmers</b>     | <b>36</b> | <b>17</b>  | <b>19</b> |                   | <b>5</b>    | <b>31</b> |                   |
| <b>Non-smallholder</b>                               |           |            |           | -                 |             |           | -                 |
| Relative or friend                                   | -         | -          | -         |                   | -           | -         |                   |
| Local market                                         | -         | -          | -         |                   | -           | -         |                   |
| Private trader                                       | -         | -          | -         |                   | -           | -         |                   |
| Agriculture co-op                                    | -         | -          | -         |                   | -           | -         |                   |
| <b>Number of non-smallholder cauliflower farmers</b> | <b>0</b>  | <b>0</b>   | <b>0</b>  |                   | <b>0</b>    | <b>0</b>  |                   |

<sup>a</sup> Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables.

Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating cauliflower.

Source: Feed the Future Nepal ZOI Survey 2019

### 7.3.6 Soil characteristics

This section presents soil characteristics, including texture, rock fragment percentage, LCC, and soil limitations of plots used to grow cauliflower in the ZOI. Texture is an important soil property that affects crop production, land use, and land management. A soil's ability to retain nutrients and drain is

directly related to its texture.<sup>148</sup> Soil can be classified into one of 12 textural classes, as shown in **Table 7.3.17**, depending on the percentages of sand, silt, and clay that it contains.<sup>149</sup>

**Table 7.3.17** presents the percent distribution of soil textures in cauliflower plots in the ZOI by depth, or soil horizon. For cauliflower soil samples for all depths excepting ten to 20 centimeters, the largest proportion of soil consisted of silty clay loam. For soil samples of depths ten to 20 centimeters, sandy clay loam was the most common soil consistency. Interestingly, for soil samples of depths zero to 20 centimeters, no soil samples primarily consisted of sand.

**Table 7.3.17: Soil texture by soil horizon in cauliflower plots in the ZOI**

| Depth (cm) | Soil texture (%) |           |      |            |      |            |                 |            |            |            |                 | Number of plots |
|------------|------------------|-----------|------|------------|------|------------|-----------------|------------|------------|------------|-----------------|-----------------|
|            | Clay             | Clay loam | Loam | Loamy sand | Sand | Sandy clay | Sandy clay loam | Sandy loam | Silty Loam | Silty clay | Silty clay loam |                 |
| 0 to <1    | 6.0              | 15.3      | 2.0  | 3.4        | 0.0  | 1.2        | 27.9            | 8.2        | 0.0        | 5.8        | 30.1            | 54              |
| 1 to <10   | 3.3              | 14.0      | 0.0  | 1.8        | 0.0  | 6.2        | 23.1            | 8.9        | 0.0        | 7.2        | 35.6            | 54              |
| 10 to <20  | 1.7              | 10.6      | 1.4  | 3.4        | 0.0  | 5.0        | 29.7            | 9.2        | 3.0        | 10.9       | 25.3            | 54              |
| 20 to <50  | 3.1              | 16.2      | 1.4  | 3.9        | 3.4  | 7.2        | 14.0            | 9.3        | 4.9        | 14.0       | 22.5            | 49              |
| 50 to <70  | 0.0              | 11.7      | 1.9  | 8.9        | 2.2  | 4.5        | 15.8            | 8.3        | 8.9        | 14.9       | 22.9            | 41              |

Note: Estimates are based on de jure household members who are farmers responsible for cultivating cauliflower.

Source: Feed the Future Nepal ZOI Survey 2019

Rock fragments are unattached pieces of rock, two millimeters in diameter or larger. Rock fragments are characterized by their size and shape and, in some cases, the type of rock. Rock fragments classes include pebbles, cobbles, channers, flagstones, stones, and boulders.<sup>150</sup> **Table 7.3.18** presents the percent distribution of rock fragments in cauliflower plots in the ZOI by soil horizon.

Overall, soil samples from cauliflower plots contained low levels of rock fragments. Irrespective of the depth of the soil sample, more than 60 percent of soil samples contained less than one percent rock fragments. For all but one depth group (ten to 20 centimeters), less than one-third of soil samples contained one to 15 percent rock fragments. No soil samples at any depth contained rock fragments of 60 percent or greater.

**Table 7.3.18: Rock fragment percentage by soil horizon in cauliflower plots in the ZOI**

| Depth (cm) | Rock fragment percentage (%) |           |            |            |      | Number of plots |
|------------|------------------------------|-----------|------------|------------|------|-----------------|
|            | 0 to <1%                     | 1 to <15% | 15 to <35% | 35 to <60% | ≥60% |                 |
| 0 to <1    | 67.3                         | 31.1      | 1.5        | 0.0        | 0.0  | 54              |
| 1 to <10   | 65.2                         | 28.4      | 6.4        | 0.0        | 0.0  | 54              |
| 10 to <20  | 60.3                         | 33.6      | 6.1        | 0.0        | 0.0  | 54              |
| 20 to <50  | 60.5                         | 24.1      | 13.0       | 2.4        | 0.0  | 50              |
| 50 to <70  | 73.9                         | 15.1      | 11.0       | 0.0        | 0.0  | 40              |

Note: Estimates are based on de jure household members who are farmers responsible for cultivating cauliflower.

Source: Feed the Future Nepal ZOI Survey 2019

<sup>148</sup> Jaja, 2016.

<sup>149</sup> USDA-NRCS, 1999.

<sup>150</sup> A Guide for Preparing Soil Profile Descriptions. Soils Properties and Processes. NRE 430/ EEB 489.

LCC is a system of grouping soils based on their capability to produce crops without deteriorating over time.<sup>151</sup> The eight capability classes, which indicate to farmers how limited their soil is for producing crops, are described in **Table 7.3.19**. This table also presents the percentage of cauliflower plots and average cauliflower yield by LCC. The greatest proportion of cauliflower plots (37.4 percent) fell into the third-best category of the LCC system, categorized as plots with soil with severe limitations that reduce the choice of plants, require special conservation practices, or both. The second-largest proportion of plots (26.3 percent) fell into the second-best category, categorized as plots with moderate limitations that reduce the choice of plants, require moderate conservation practices, or both.

**Table 7.3.19: Percentage of cauliflower plots and average cauliflower yield in the ZOI by LCC**

| LCC                    | Description                                                                                                                                                      | Percent of cauliflower plots (%) | Average cauliflower yield (mt/ha) | Number of cauliflower farmers <sup>a</sup> |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-----------------------------------|--------------------------------------------|
| I (best)               | Slight limitations that restrict soil use                                                                                                                        | 2.1                              | ^                                 | 0                                          |
| II                     | Moderate limitations that reduce the choice of plants or require moderate conservation practices                                                                 | 26.3                             | ^                                 | 3                                          |
| III                    | Severe limitations that reduce the choice of plants or require special conservation practices, or both                                                           | 37.4                             | ^                                 | 11                                         |
| IV                     | Very severe limitations that restrict the choice of plants or require very careful management, or both                                                           | 10.6                             | ^                                 | 1                                          |
| V                      | Little or no hazard of erosion, but with other limitations; impractical to remove; limits soil use to mainly pasture, rangeland, forestland, or wildlife habitat | 1.7                              | ^                                 | 0                                          |
| VI                     | Severe limitations that make soils generally unsuited to cultivation and limit their use mainly to pasture, rangeland, forestland, or wildlife habitat           | 14.6                             | ^                                 | 1                                          |
| VII                    | Very severe limitations that make the soils unsuited to cultivation and that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat    | 1.5                              | ^                                 | 0                                          |
| VIII (worst)           | Limitations that prevent use for commercial plant production and limit use mainly to recreation, wildlife habitat, water supply, or esthetic purposes            | 5.9                              | ^                                 | 0                                          |
| Unclassified           |                                                                                                                                                                  | 0.0                              |                                   |                                            |
| <b>Number of plots</b> |                                                                                                                                                                  | <b>48</b>                        |                                   |                                            |

^ Results not statistically reliable, n<30

<sup>a</sup> Estimates include only cauliflower farmers who cultivated cauliflower on one plot or who cultivated cauliflower on multiple plots that all had the same LCC score. Farmers who cultivated cauliflower on multiple plots that did not all have the same LCC score or without a value for cauliflower yield were excluded.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating cauliflower.

Sources: Feed the Future Nepal ZOI Survey 2019, United States Department of Agriculture. 2018. National Soil Survey Handbook, Part 622

<sup>151</sup> USDA, n.d.

The LCC designation is accompanied by a sub-class designation. The sub-class designation indicates to farmers the main limitation of their plot's soil, such as erosion risk and low soil depth. A plot can have multiple sub-class designations if it has more than one notable limitation. The ten sub-classes, which are indicated by letters, are described in **Table 7.3.20**. This table also presents the percentages of cauliflower farmers in the ZOI who have plots with soil in each LCC sub-class.

For the largest proportion of cauliflower farmers (56.3 percent), soil water storage capacity was the greatest limitation of their plot's soil. The second-most common soil limitation was soil depth (46.3 percent), followed by permeability (37.7 percent). Flooding during growing season was not the main soil limitation for any cauliflower farmers.

**Table 7.3.20: Percentage of cauliflower farmers in the ZOI with one or more plots that meet each LCC criteria**

| LCC criteria                         | Description                                                                                                | Reason for assessment                                                                                                                         | Classification                                  | Percent |
|--------------------------------------|------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|---------|
| Erosion risk (e)                     | Risk of surface soil wearing away due to moving water, depending on the soil texture and land slope.       | Erosion is a major factor limiting future agricultural production. If the productive soil erodes away, the yields will significantly decline. | Plot is at risk of soil erosion.                | 11.7    |
| Soil depth (s-d)                     | Depth of soil to bedrock or other root-limiting layer.                                                     | Soil depth can limit crop root growth if not deep enough.                                                                                     | Plot soil depth is low.                         | 46.3    |
| Surface soil texture (s-t)           | Soil texture near the surface is important for seedling establishment.                                     | Poor surface soil texture can prevent seedling establishment.                                                                                 | Plot surface soil texture is poor.              | 6.5     |
| Salinity (s-k)                       | Salt on the soil surface is an indicator of high soil salinity.                                            | High soil salinity can limit crop growth.                                                                                                     | Plot soil has high salinity.                    | 3.9     |
| Surface stoniness (s-r)              | Percentage of soil covered by stones and boulders (larger than 25 cm).                                     | Soil covered by stones and boulders can impede the use of tractors and animal-pulled plows.                                                   | Plot surface too stony.                         | 13.3    |
| Soil water storage capacity (s-a)    | The amount of water that the soil can store that is usable by plants.                                      | A lower ability to store water means there is less water available for plants to grow. Farmers should plant drought-resistant crops.          | Plot soil has poor ability to store water.      | 56.3    |
| Lime requirement (s-l)               | Soil with a low soil pH (high acidity) requires lime to raise the pH to the ideal range for growing crops. | Soil with a low pH (high acidity) can limit crop production.                                                                                  | Plot soil has high acidity.                     | 2.1     |
| Flooding during growing season (w-f) | Frequency of flooding during the growing season.                                                           | Flooding can damage crops and influence crop selection.                                                                                       | Plot subject to flooding during growing season. | 0.0     |

| LCC criteria                         | Description                                          | Reason for assessment                                                                  | Classification                      | Percent   |
|--------------------------------------|------------------------------------------------------|----------------------------------------------------------------------------------------|-------------------------------------|-----------|
| Water table depth (w-d)              | Typical water table depth during the growing season. | A water table that is too high can create an environment not conducive to root growth. | Plot water table depth is too high. | 2.1       |
| Permeability (w-p)                   | The ability of water to move through the soil.       | Low permeability can limit root growth during wet periods due to waterlogging.         | Plot soil permeability is low.      | 37.7      |
| <b>Number of cauliflower farmers</b> |                                                      |                                                                                        |                                     | <b>48</b> |

Note: Estimates are based on de jure household members who are farmers responsible for cultivating cauliflower.

Sources: Feed the Future Nepal ZOI Survey 2019; United States Department of Agriculture, 2018, National Soil Survey Handbook, Part 622

## 7.4 Tomatoes

### 7.4.1 Cultivation of tomato in Nepal

Feed the Future targets the tomato value chain in Nepal. Tomato, like cauliflower, is also an off-season vegetable and a profitable cash crop. As such, governmental agricultural policies have prioritized tomatoes. The share of tomato in total vegetable production is 10.4 percent and the average yield is 19 mt/ha.<sup>152</sup>

Feed the Future works to increase the tomato value chain's effectiveness because of a high potential to increase production and tomatoes' prioritization in GoN agricultural policies. Vegetables such as tomatoes offer higher gross margins than cereals such as maize or rice and can provide an escape from poverty for marginalized groups.<sup>153</sup> Since many smallholders are primarily subsistence farmers and consume a sizeable fraction of the crops they grow, increased production of vegetables such as tomatoes can contribute to improved nutrition.<sup>154</sup> Through KISAN II, Feed the Future partners with wholesale agrovets to both promote new products and technologies and improve business models, leading to improved agricultural practices.<sup>155</sup> When properly trained by Feed the Future, these agrovets provide free advice to farmers on agricultural practices, such as tunnel farming, and help to connect them with reliable market chains for selling produce.<sup>156</sup>

### 7.4.2 Farmers' background

**Table 7.4.1** presents the age and education characteristics of tomato farmers in the ZOI. Due to the small number of tomato farmers, few data points were available. Overall, 61.5 percent of tomato farmers were male, and 38.5 percent were female. Statistical significance of education and age differences could not be calculated due to small sample sizes. The largest proportion (18.1 percent) of tomato farmers were aged 35 to 39, and the smallest proportion were aged 15 to 19 (0.0 percent). The

<sup>152</sup> MoALD, 2019. Fact Sheet of Agricultural Data.

<sup>153</sup> Feed the Future. (2018). The Global Food Security Strategy (GFSS) Nepal Country Plan. Page 15.

<sup>154</sup> Ibid.

<sup>155</sup> Digital Green, 2019. Strengthening Private Sector Extension and Advisory Services Portfolio Review. Developing Local Extension Capacity (DLEC) Project. USAID. Page 174.

<sup>156</sup> Feed the Future, 2019. A Brighter Future in Farming for Nepal's Youth. USAID.  
<https://www.feedthefuture.gov/article/a-brighter-future-in-farming-for-nepals-youth/>.

largest proportion of tomato farmers had completed less than primary school (40.5 percent), and the smallest proportion had completed higher education (1.8 percent).



**Table 7.4.1: Age and education of tomato farmers in the ZOI, in total and by farmers' sex**

| Background characteristic       | Total (%) | Sex       |            | Sig. <sup>a</sup> | Number of tomato farmers |
|---------------------------------|-----------|-----------|------------|-------------------|--------------------------|
|                                 |           | Male (%)  | Female (%) |                   |                          |
| <b>Total</b>                    | 100       | 61.5      | 38.5       |                   | 46                       |
| <b>Age</b>                      |           |           |            | -                 |                          |
| 15–19                           | 0.0       | ^         | ^          |                   | 0                        |
| 20–24                           | 4.1       | ^         | ^          |                   | 2                        |
| 25–29                           | 13.9      | ^         | ^          |                   | 5                        |
| 30–34                           | 4.4       | ^         | ^          |                   | 2                        |
| 35–39                           | 18.1      | ^         | ^          |                   | 9                        |
| 40–44                           | 17.3      | ^         | ^          |                   | 8                        |
| 45–49                           | 10.1      | ^         | ^          |                   | 5                        |
| 50–54                           | 11.7      | ^         | ^          |                   | 5                        |
| 55–59                           | 9.1       | ^         | ^          |                   | 4                        |
| 60+                             | 11.4      | ^         | ^          |                   | 6                        |
| <b>Education</b>                |           |           |            | -                 |                          |
| No education                    | 19.5      | ^         | ^          |                   | 9                        |
| Less than primary               | 40.5      | ^         | ^          |                   | 19                       |
| Completed primary               | 32.8      | ^         | ^          |                   | 15                       |
| Completed secondary             | 5.4       | ^         | ^          |                   | 2                        |
| Higher                          | 1.8       | ^         | ^          |                   | 1                        |
| <b>Number of tomato farmers</b> | <b>46</b> | <b>28</b> | <b>18</b>  |                   | <b>46</b>                |

<sup>a</sup> Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables.

Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating tomato.

Source: Feed the Future Nepal ZOI Survey 2019

**Table 7.4.2** presents information about why farmers cultivated tomatoes, specifically for consumption, market, or both. Again, some data points were not statistically reliable because of the small sample size. A majority (91.1 percent) of tomato farmers cultivated tomatoes both for consumption and for sale at the market. 8.9 percent of tomato farmers cultivated the crop for consumption only, and none reported cultivating the crop purely to sell at the market. Statistical significance of sex and age differences could not be calculated due to small sample sizes.

**Table 7.4.2: Reasons for cultivating tomato in the ZOI, in total and by farmers' sex and age**

| Reason for tomato cultivation   | Total (%) | Sex        |           | Sig. <sup>a</sup> | Age (years) |           | Sig. <sup>a</sup> |
|---------------------------------|-----------|------------|-----------|-------------------|-------------|-----------|-------------------|
|                                 |           | Female (%) | Male (%)  |                   | 15–29 (%)   | 30+ (%)   |                   |
| <b>Reason</b>                   |           |            |           | -                 |             |           | -                 |
| Consumption only                | 8.9       | ^          | ^         |                   | ^           | 5.4       |                   |
| Market only                     | 0.0       | ^          | ^         |                   | ^           | 0.0       |                   |
| Consumption and market          | 91.1      | ^          | ^         |                   | ^           | 94.6      |                   |
| <b>Number of tomato farmers</b> | <b>46</b> | <b>18</b>  | <b>28</b> |                   | <b>7</b>    | <b>39</b> |                   |

<sup>a</sup> Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables.

Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating tomato.

Source: Feed the Future Nepal ZOI Survey 2019

### 7.4.3 Application of management practices and technologies by tomato farmers

This section examines the management practices and technologies that farmers used to grow tomatoes. In all tables, Feed the Future-promoted improved management practices and technologies are indicated with a double dagger (‡).

#### Land preparation and management practices

Proper land preparation practices are important to provide the necessary conditions for improved soil health and successful crop growth. Land preparation includes the approaches that farmers take to prepare their plots for planting, including plowing or zero tillage practices. Improved land management practices increase soil fertility and enhance water-use efficiency to improve overall plot productivity. Land management includes crop rotation practices and approaches farmers take to soil and water management and irrigation of their plots. Globally, water-use efficiency in irrigation of crop plots is low. Raised-bed planting with trench irrigation, as well as bunding or terracing, can significantly increase water-use efficiency.<sup>157</sup> Using appropriate irrigation techniques, minimizing soil disturbances, using surface mulch, and rotating crops help boost crop yields.<sup>158</sup> Tomato farmers may choose to grow complementary crops, such as baby corn, alongside tomato. Such intercropping enhances soil nutrition and fertility by adding much-needed nitrogen to the soil, increases resource-use efficiency, and discourages weeds, pests, and other crop diseases.<sup>159</sup>

**Table 7.4.3** shows the land preparation practices, planting practices, and cropping practices that tomato farmers used in the ZOI. A majority of tomato farmers engaged in some form of land preparation. 54.8 percent of tomato farmers performed hand weeding. Only 2.1 percent of tomato farmers ploughed their land and all of these farmers used a tractor. 6.9 percent of farmers performed zero tillage and 2.7 percent engaged in no land preparation. Statistical significance of sex and age differences could not be calculated due to small sample sizes.

The majority (71.3 percent) of tomato farmers grew seedling in raised beds. No farmers started seedlings in other containers. Statistical significance of sex and age differences could not be calculated due to small sample sizes.

Two-thirds of tomato farmers practiced crop rotation, while 7.6 percent did not rotate their crops, and 24.9 percent left their plots fallow. Most tomato farmers practiced soil and water management of some kind. A majority (74.1 percent) of tomato farmers used soil bands or trenches and 41.6 percent practiced terracing. Mulching and adding lime to soil were less common, at 9.8 percent and 1.8 percent, respectively. Statistical significance of sex and age differences could not be calculated due to small sample sizes.

Finally, a majority (79.5 percent) of tomato farmers practiced irrigation. Irrigation by hand was most common (32 percent), followed by a pump system (19.3 percent) and a hose (17.7 percent). Statistical significance of sex and age differences could not be calculated due to small sample sizes.

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<sup>157</sup> Solh, Braun, & Tadesse, 2014; Djagba et al., 2014.

<sup>158</sup> Reeves et al., 2016.

<sup>159</sup> Wilkins, 2008.

**Table 7.4.3: Land preparation, planting practices, and management practices used by tomato farmers in the ZOI, in total and by farmers' sex and age**

| Practice                               | Total (%) | Sex        |          |                   | Age (years) |         |                   |
|----------------------------------------|-----------|------------|----------|-------------------|-------------|---------|-------------------|
|                                        |           | Female (%) | Male (%) | Sig. <sup>a</sup> | 15–29 (%)   | 30+ (%) | Sig. <sup>a</sup> |
| Land preparation <sup>b</sup>          |           |            |          |                   |             |         |                   |
| Hand weeding                           | 54.8      | ^          | ^        | -                 | ^           | 55.9    | -                 |
| Plowing <sup>b</sup>                   | 2.1       | ^          | ^        | -                 | ^           | 2.5     | -                 |
| Hand tillage                           | 0.0       | ^          | ^        | -                 | ^           | 0.0     | -                 |
| Animal traction                        | 0.0       | ^          | ^        | -                 | ^           | 0.0     | -                 |
| Motorized tiller                       | 0.0       | ^          | ^        | -                 | ^           | 0.0     | -                 |
| Tractor                                | 2.7       | ^          | ^        | -                 | ^           | 3.3     | -                 |
| Zero tillage                           | 6.9       | ^          | ^        | -                 | ^           | 8.3     | -                 |
| None                                   | 2.7       | ^          | ^        | -                 | ^           | 3.3     | -                 |
| Planting practices <sup>b</sup>        |           |            |          |                   |             |         |                   |
| Start seedlings in other containers‡   | 0.0       | ^          | ^        | -                 | ^           | 0.0     | -                 |
| Grow seedlings in raised beds‡         | 71.3      | ^          | ^        | -                 | ^           | 70.7    | -                 |
| Crop rotated                           |           |            |          | -                 |             |         | -                 |
| Yes, rotated                           | 67.5      | ^          | ^        |                   | ^           | 69.2    |                   |
| No, did not rotate                     | 7.6       | ^          | ^        |                   | ^           | 9.1     |                   |
| No, left plot fallow                   | 24.9      | ^          | ^        |                   | ^           | 21.7    |                   |
| Soil and water management <sup>b</sup> |           |            |          |                   |             |         |                   |
| Terracing                              | 41.6      | ^          | ^        | -                 | ^           | 41.9    | -                 |
| Mulching‡                              | 9.8       | ^          | ^        | -                 | ^           | 11.9    | -                 |
| Soil bands, trenches                   | 74.1      | ^          | ^        | -                 | ^           | 81.5    | -                 |
| Adding lime to soil                    | 1.8       | ^          | ^        | -                 | ^           | 2.2     | -                 |
| None                                   | 4.4       | ^          | ^        | -                 | ^           | 2.9     | -                 |
| Irrigation <sup>b</sup>                |           |            |          |                   |             |         |                   |
| Hand (watering can, hose)              | 32.0      | ^          | ^        | -                 | ^           | 36.0    | -                 |
| Canals                                 | 14.5      | ^          | ^        | -                 | ^           | 17.6    | -                 |
| Permanent hose                         | 17.7      | ^          | ^        | -                 | ^           | 16.3    | -                 |
| Pump system                            | 19.3      | ^          | ^        | -                 | ^           | 20.7    | -                 |
| Flood (basin, furrow, border)          | 0.0       | ^          | ^        | -                 | ^           | 0.0     | -                 |
| Drip‡                                  | 0.9       | ^          | ^        | -                 | ^           | 1.1     | -                 |
| Traveling gun/moving sprinkler         | 6.6       | ^          | ^        | -                 | ^           | 2.6     | -                 |
| Sprinkler                              | 2.5       | ^          | ^        | -                 | ^           | 0.0     | -                 |
| Center pivot                           | 0.0       | ^          | ^        | -                 | ^           | 0.0     | -                 |
| Forest                                 | 0.0       | ^          | ^        | -                 | ^           | 0.0     | -                 |
| None                                   | 20.5      | ^          | ^        | -                 | ^           | 22.2    | -                 |
| Number of tomato farmers               | 46        | 18         | 28       |                   | 7           | 39      |                   |

<sup>^</sup> Results not statistically reliable, n<30

<sup>‡</sup> Promoted improved technology or management practice

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Farmers were allowed to give more than one response, so the percentages may not add up to 100 percent.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating tomato.

Source: Feed the Future Nepal ZOI Survey 2019

## Use of inputs

This section presents information on tomato farmers' inputs, including seed, fertilizer, manure, training, information, and decision-making for growing tomatoes. Certain hybrids of tomato seed are more drought- and heat-tolerant than traditional tomato and will produce greater yields when grown in very warm or drought-prone climates.<sup>160</sup>

**Table 7.4.4** shows where farmers obtained their tomato seeds and the types of tomato seeds they used. The majority (89.9 percent) of tomato farmers used modern seeds, 3.8 percent used traditional seeds, and no tomato farmers used hybrid seeds. Statistical significance of sex and age differences could not be calculated due to small sample sizes.

A majority (71.7 percent) of tomato farmers sourced their seeds from an agricultural dealer. The second most common source was aid distribution (9.4 percent), followed by purchased from a friend or relative (6.8 percent). Statistical significance of sex and age differences could not be calculated due to small sample sizes.

**Table 7.4.4: Seed types and seed sources used by tomato farmers in the ZOI, in total and by farmers' sex and age**

| Characteristic or practice                                  | Total (%) | Sex        |           | Sig. <sup>a</sup> | Age (years) |           | Sig. <sup>a</sup> |
|-------------------------------------------------------------|-----------|------------|-----------|-------------------|-------------|-----------|-------------------|
|                                                             |           | Female (%) | Male (%)  |                   | 15–29 (%)   | 30+ (%)   |                   |
| <b>Seed type<sup>b</sup></b>                                |           |            |           | -                 |             |           | -                 |
| Unimproved or local open-pollinated varieties (traditional) | 3.8       | ^          | ^         |                   | ^           | 4.6       |                   |
| Improved open-pollinated varieties (modern) ‡               | 89.9      | ^          | ^         |                   | ^           | 90.3      |                   |
| Hybrid                                                      | 0.0       | ^          | ^         |                   | ^           | 0.0       |                   |
| <b>Main seed source</b>                                     |           |            |           | -                 |             |           | -                 |
| Own saved/friend or relative (not purchased)                | 6.0       | ^          | ^         |                   | ^           | 7.2       |                   |
| Friend or relative (purchased)                              | 6.8       | ^          | ^         |                   | ^           | 5.4       |                   |
| Agriculture dealer (cash)                                   | 71.7      | ^          | ^         |                   | ^           | 79.9      |                   |
| Market or non-agriculture dealer                            | 3.8       | ^          | ^         |                   | ^           | 2.4       |                   |
| Aid distribution                                            | 9.4       | ^          | ^         |                   | ^           | 2.5       |                   |
| Other                                                       | 2.2       | ^          | ^         |                   | ^           | 2.7       |                   |
| <b>Number of tomato farmers</b>                             | <b>46</b> | <b>18</b>  | <b>28</b> |                   | <b>7</b>    | <b>39</b> |                   |

^ Results not statistically reliable, n<30

‡ Promoted improved technology or management practice

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Farmers were allowed to give more than one response, so the percentages may not add up to 100 percent.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating tomato.

Source: Feed the Future Nepal ZOI Survey 2019

Application of inorganic or organic fertilizers, such as manure and crop residues, plays an important role in soil health. Fertilizers help correct soil macro- and micro-nutrient deficiencies in many regions and

<sup>160</sup> Edmeades, 2015.

promote crop growth.<sup>161</sup> Inorganic, or mineral, fertilizers are often too expensive for smallholder farmers and are frequently locally unavailable. Organic inputs can be used in place of or alongside mineral fertilizers, through improved waste recycling, crop residue composting, animal manure, and intercropping or crop rotation with legumes, trees, and shrubs.<sup>162</sup> **Table 7.4.5** presents information related to tomato farmers' fertilizer practices.

93.9 percent of tomato farmers applied fertilizer to their crops. Most tomato farmers used soil-based organic (95.4 percent) or soil-based inorganic (69.2 percent) fertilizers. Only 3.8 percent and 2.8 percent of farmers used organic and inorganic foliar seeds, respectively. Tomato farmers most commonly applied fertilizer at the early growth stage (74.0 percent), followed by the pre-planting stage (69.3 percent). 42.9 percent of tomato farmers applied fertilizer during planting, and 27.8 percent applied fertilizer in the middle of a crop cycle. Statistical significance of sex and age differences could not be calculated due to small sample sizes.

**Table 7.4.5: Tomato farmers' fertilizer use, types of fertilizer, and timing of application in the ZOI, in total and by farmers' sex and age**

| Characteristic or practice                             | Total (%) | Sex        |          | Sig. <sup>a</sup> | Age (years) |         | Sig. <sup>a</sup> |
|--------------------------------------------------------|-----------|------------|----------|-------------------|-------------|---------|-------------------|
|                                                        |           | Female (%) | Male (%) |                   | 15–29 (%)   | 30+ (%) |                   |
| <b>Applied fertilizer</b>                              | 93.9      | ^          | ^        | -                 | ^           | 94.8    | -                 |
| <b>Number of tomato farmers</b>                        | 44        | 16         | 28       |                   | 6           | 38      |                   |
| <b>Type<sup>b</sup></b>                                |           |            |          |                   |             |         |                   |
| Soil-based organic                                     | 95.4      | ^          | ^        | -                 | ^           | 94.6    | -                 |
| Soil-based inorganic                                   | 69.2      | ^          | ^        | -                 | ^           | 72.7    | -                 |
| Organic foliar feeds                                   | 3.8       | ^          | ^        | -                 | ^           | 1.2     | -                 |
| Inorganic foliar feeds                                 | 2.8       | ^          | ^        | -                 | ^           | 0.0     | -                 |
| <b>Timing of application<sup>b</sup></b>               |           |            |          |                   |             |         |                   |
| Pre-planting                                           | 69.3      | ^          | ^        | -                 | ^           | 66.7    | -                 |
| Planting                                               | 42.9      | ^          | ^        | -                 | ^           | 47.8    | -                 |
| Early growth stage                                     | 74.0      | ^          | ^        | -                 | ^           | 78.5    | -                 |
| Mid-crop                                               | 27.8      | ^          | ^        | -                 | ^           | 26.7    | -                 |
| <b>Number of tomato farmers who applied fertilizer</b> | 41        | 15         | 26       |                   | 5           | 36      |                   |

^ Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Farmers were allowed to give more than one response, so the percentages may not add up to 100 percent.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating tomato.

Source: Feed the Future Nepal ZOI Survey 2019

Animal manure supplies beneficial nutrients to growing tomato plants and improves soil fertility. In many countries, adequate quantities of animal manure for agricultural use may not be locally available and must be purchased elsewhere. **Table 7.4.6** presents information related to tomato farmers' use of manure, including the percentage who used animal manure, how the manure was applied to fields, and the manure's source. A majority (95.7 percent) of tomato farmers applied animal manure to their crops. Of

<sup>161</sup> Lal, 2010.

<sup>162</sup> Reeves, et al., 2016; Snapp, Mafongoya, & Waddington, 1998.

those who applied manure, 100 percent applied the manure by hand. The vast majority (95.1) also sourced the manure from their own animals. 2.8 percent of tomato farmers were given manure and 2.1 percent purchased their manure. Statistical significance of sex and age differences could not be calculated due to small sample sizes.

**Table 7.4.6: Manure sources and application practices used by tomato farmers in the ZOI, in total and by farmers' sex and age**

| Characteristic or practice                         | Total (%) | Sex        |           | Sig. <sup>a</sup> | Age (years) |           | Sig. <sup>a</sup> |
|----------------------------------------------------|-----------|------------|-----------|-------------------|-------------|-----------|-------------------|
|                                                    |           | Female (%) | Male (%)  |                   | 15–29 (%)   | 30+ (%)   |                   |
| <b>Applied animal manure</b>                       | 95.7      | ^          | ^         | -                 | ^           | 94.9      | -                 |
| <b>Number of tomato farmers</b>                    | <b>44</b> | <b>16</b>  | <b>28</b> |                   | <b>6</b>    | <b>38</b> |                   |
| <b>Application practice</b>                        |           |            |           | -                 |             |           | -                 |
| Other                                              | 0.0       | ^          | ^         |                   | ^           | 0.0       |                   |
| By hand                                            | 100       | ^          | ^         |                   | ^           | 100       |                   |
| By machine                                         | 0.0       | ^          | ^         |                   | ^           | 0.0       |                   |
| <b>Source</b>                                      |           |            |           | -                 |             |           | -                 |
| Own animals                                        | 95.1      | ^          | ^         |                   | ^           | 94.1      |                   |
| Given, did not purchase                            | 2.8       | ^          | ^         |                   | ^           | 2.8       |                   |
| Purchased                                          | 2.1       | ^          | ^         |                   | ^           | 2.5       |                   |
| <b>Number of tomato farmers who applied manure</b> | <b>42</b> | <b>16</b>  | <b>26</b> |                   | <b>6</b>    | <b>36</b> |                   |

^ Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating tomato.

Source: Feed the Future Nepal ZOI Survey 2019

Crop loss due to pests, weeds, and diseases can be substantial for smallholder farmers, with an estimated 20–35 percent loss of crops across Nepal from these factors.<sup>163</sup> Tomato is plagued by diseases including late blight, damping off, early blight, bacterial wilt, root knot nematodes, bacterial soft rot, pith necrosis, and viral diseases. Common pests afflicting tomato in the ZOI include tomato fruit borer, aphids, white fly, leaf miner, myrid bug, and tobacco caterpillar.<sup>164</sup>

Adequate prevention and management measures may prevent or minimize crop losses. Herbicides and manual removal may control weeds, and pesticides, insecticides, and fungicides may help manage pests and crop diseases. There are also several favorable and effective non-chemical approaches to tomato pest control.<sup>165</sup> Integrated pest management is an encouraged “problem-avoiding” approach to pest management that seeks to minimize pesticide use and control pests through cultural, manual, and biological means.<sup>166</sup> Intercropping and crop rotation is a particularly effective non-chemical measure for pest and weed management in Nepalese tomato fields.<sup>167</sup>

<sup>163</sup> PQPMC, MoALD, 2019. Annual Program and Statistics Book.

<sup>164</sup> USAID, 2015. *IPM Package: Tomato*. Integrated Pest Management Innovation Lab.

<sup>165</sup> Reeves, et al., 2016.

<sup>166</sup> FAO, 2011.

<sup>167</sup> PQPMC, MoALD, 2019. Annual Program and Statistics Book.

**Table 7.4.7** presents tomato farmers' pest and weed management practices. A majority (52.5 percent) of tomato farmers used chemical pest management in response to an attack. 24.3 percent used no chemicals at all, and 23.2 percent used chemicals as a preventative measure. 97.1 percent of tomato farmers managed their weeds by weeding with a hoe and/or by pulling the weeds by hand (57.4 percent). 21.5 percent of tomato farmers slashed the weeds. Statistical significance of sex and age differences could not be calculated due to small sample sizes.

**Table 7.4.7: Pest and weed management practices used by tomato farmers in the ZOI, in total and by farmers' sex and age**

| Management practice                | Total (%) | Sex        |           | Sig. <sup>a</sup> | Age (years) |           | Sig. <sup>a</sup> |
|------------------------------------|-----------|------------|-----------|-------------------|-------------|-----------|-------------------|
|                                    |           | Female (%) | Male (%)  |                   | 15–29 (%)   | 30+ (%)   |                   |
| <b>Chemical pest management</b>    |           |            |           | -                 |             |           | -                 |
| Preventative (routine) ‡           | 23.2      | ^          | ^         |                   | ^           | 27.8      |                   |
| Response to attack‡                | 52.5      | ^          | ^         |                   | ^           | 56.9      |                   |
| None                               | 24.3      | ^          | ^         |                   | ^           | 15.3      |                   |
| <b>Weed management<sup>b</sup></b> |           |            |           |                   |             |           |                   |
| Herbicide applied‡                 | 0.0       | ^          | ^         | -                 | ^           | 0.0       | -                 |
| Weeding with hoe                   | 97.1      | ^          | ^         | -                 | ^           | 96.6      | -                 |
| Intercropping                      | 0.0       | ^          | ^         | -                 | ^           | 0.0       | -                 |
| Mulching‡                          | 0.0       | ^          | ^         | -                 | ^           | 0.0       | -                 |
| Slashing                           | 21.5      | ^          | ^         | -                 | ^           | 19.6      | -                 |
| Pull by hand                       | 57.4      | ^          | ^         | -                 | ^           | 57.5      | -                 |
| None                               | 0.0       | ^          | ^         | -                 | ^           | 0.0       | -                 |
| <b>Number of tomato farmers</b>    | <b>44</b> | <b>16</b>  | <b>28</b> |                   | <b>6</b>    | <b>38</b> |                   |

<sup>a</sup> Results not statistically reliable, n<30

<sup>‡</sup> Promoted improved technology or management practice

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Farmers were allowed to give more than one response, so the percentages may not add up to 100 percent.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating tomato.

Source: Feed the Future Nepal ZOI Survey 2019

## Waste reuse practices

This section presents information on waste reuse practices, which is how farmers use the leftover tomato stems after harvesting, and uses of tomato after harvest. Harvesting occurs when the tomato has reached maturity and is performed by hand. Tomatoes are sent to the market as soon as they are harvested. Tomato stems have valuable uses. After harvest, the stems are burnt or left in the field and used as organic fertilizer.

**Table 7.4.8** presents information on how tomato crop residues are used by tomato farmers in the ZOI. Tomato farmers used their tomato stems for a variety of purposes immediately after harvesting. 54.0 percent of farmers incorporated their tomato stems back into the soil. 33.8 percent of farmers burned their stems in the field and 12.0 percent used them as bedding for their livestock. Statistical significance of sex and age differences could not be calculated due to small sample sizes.

Tomato farmers also used the tomatoes for a variety of purposes after harvesting. 83.5 percent of farmers cooked their tomatoes, 71.6 percent sold them directly, and 29.2 percent washed and cleaned them. Statistical significance of sex and age differences could not be calculated due to small sample sizes.

**Table 7.4.8: Use of stems and post-harvest crop by tomato farmers in the ZOI, in total and by farmers' sex and age**

| Waste reuse practice                 | Total<br>(%) | Sex           |             |                   | Age (years)  |            |                   |
|--------------------------------------|--------------|---------------|-------------|-------------------|--------------|------------|-------------------|
|                                      |              | Female<br>(%) | Male<br>(%) | Sig. <sup>a</sup> | 15–29<br>(%) | 30+<br>(%) | Sig. <sup>a</sup> |
| Tomato stems use <sup>b</sup>        |              |               |             |                   |              |            |                   |
| Burned in the field                  | 33.8         | ^             | ^           | -                 | ^            | 31.6       | -                 |
| Incorporated back into soil          | 54.0         | ^             | ^           | -                 | ^            | 56.5       | -                 |
| Used as bedding for own livestock    | 12.0         | ^             | ^           | -                 | ^            | 14.4       | -                 |
| Used as fuel for fire                | 2.3          | ^             | ^           | -                 | ^            | 2.7        | -                 |
| Left in field for grazing animals    | 2.3          | ^             | ^           | -                 | ^            | 2.7        | -                 |
| Harvested and fed to own animals     | 4.6          | ^             | ^           | -                 | ^            | 2.5        | -                 |
| Harvested and sold to others         | 0.0          | ^             | ^           | -                 | ^            | 0.0        | -                 |
| Tomato post-harvest use <sup>b</sup> |              |               |             |                   |              |            |                   |
| Eat them fresh                       | 2.3          | ^             | ^           | -                 | ^            | 2.7        | -                 |
| Cook them                            | 83.5         | ^             | ^           | -                 | ^            | 89.0       | -                 |
| Wash and clean them                  | 29.2         | ^             | ^           | -                 | ^            | 25.9       | -                 |
| Sell directly                        | 71.6         | ^             | ^           | -                 | ^            | 77.0       | -                 |
| Grade by size for selling            | 13.0         | ^             | ^           | -                 | ^            | 15.6       | -                 |
| Grade by quality for selling         | 17.6         | ^             | ^           | -                 | ^            | 18.3       | -                 |
| Package them for sale                | 7.9          | ^             | ^           | -                 | ^            | 7.3        | -                 |
| Store them in closed container       | 0.0          | ^             | ^           | -                 | ^            | 0.0        | -                 |
| Store them in a ventilated container | 6.7          | ^             | ^           | -                 | ^            | 8.0        | -                 |
| Give to friends, neighbors           | 0.0          | ^             | ^           | -                 | ^            | 0.0        | -                 |
| Number of Tomato farmers             | 44           | 16            | 28          |                   | 6            | 38         |                   |

<sup>a</sup> Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Farmers were allowed to give more than one response, so the percentages may not add up to 100 percent.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating tomato.

Source: Feed the Future Nepal ZOI Survey 2019

## Storage practices

This section presents information on tomato storage practices, including the use of various containers and storage locations. Storage serves several purposes in the tomato post-harvest process. Since tomatoes are perishable, they are stored for a maximum of one to two days before being sent to the market. Otherwise, they are sent directly to the market after harvest. Storage protects against excessive heat, ground- and rainwater, insects, rodents, birds, and harmful micro-organisms and helps ensure that the tomato retains its nutritional value.<sup>168</sup>

**Table 7.4.9** presents information on how farmers store and transport their harvested tomato in the ZOI. Most tomato farmers usually sell their crops on the day of harvest; only 15.6 percent typically take one to two days to sell their tomatoes after harvest. Most farmers could always sell their tomatoes

<sup>168</sup> Shepherd, 1999.



before they became soft. For 34.4 percent of farmers, their crop sometimes became soft before sale and 9.8 percent of farmers noted that their crop often became soft before sale. Tomato farmers most commonly sold their crop at the market (47.6 percent), followed by to the collection center (25.6 percent) and at the farm gate (18.4 percent). Statistical significance of sex and age differences could not be calculated due to small sample sizes.

**Table 7.4.9: Timing and location of the sale of tomato in the ZOI, in total and by farmers' sex and age**

| Storage or transport method         | Total (%) | Sex        |           | Sig. <sup>a</sup> | Age (years) |           | Sig. <sup>a</sup> |
|-------------------------------------|-----------|------------|-----------|-------------------|-------------|-----------|-------------------|
|                                     |           | Female (%) | Male (%)  |                   | 15–29 (%)   | 30+ (%)   |                   |
| <b>Days to sell tomato</b>          |           |            |           | -                 |             |           | -                 |
| Usually sell the day it's harvested | 84.4      | ^          | ^         |                   | ^           | 84.4      |                   |
| 1–2 days                            | 15.6      | ^          | ^         |                   | ^           | 15.6      |                   |
| <b>Became soft before sale</b>      |           |            |           | -                 |             |           | -                 |
| Often                               | 9.8       | ^          | ^         |                   | ^           | 8.3       |                   |
| Sometimes                           | 34.4      | ^          | ^         |                   | ^           | 34.0      |                   |
| Never                               | 55.8      | ^          | ^         |                   | ^           | 57.8      |                   |
| <b>Location of sale</b>             |           |            |           | -                 |             |           | -                 |
| At the farm gate                    | 18.4      | ^          | ^         |                   | ^           | 17.9      |                   |
| To the collection center            | 25.6      | ^          | ^         |                   | ^           | 26.5      |                   |
| In the market                       | 47.6      | ^          | ^         |                   | ^           | 47.6      |                   |
| Through the farmer cooperative      | 2.3       | ^          | ^         |                   | ^           | 2.3       |                   |
| Other                               | 6.1       | ^          | ^         |                   | ^           | 6.1       |                   |
| <b>Number of tomato farmers</b>     | <b>41</b> | <b>16</b>  | <b>25</b> |                   | <b>5</b>    | <b>36</b> |                   |

<sup>a</sup> Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating tomato.

Source: Feed the Future Nepal ZOI Survey 2019

### Training, record keeping, information sources, and decision-making

Farmers may receive training on agricultural production, markets, and inputs, the use of fertilizers, pesticides, and herbicides, and integrated pest management. Farmers may also receive agricultural information from many sources, both within and outside their communities. **Table 7.4.10** presents the percentages of tomato farmers who received training on the use of inorganic fertilizers, pesticides, and herbicides, and farmers' main sources of information for how to grow their crops well.

14.1 percent of tomato farmers received training on the use and application of pesticides. 9.6 percent received training on the use of inorganic fertilizer and 4.7 percent received training on the use and application of herbicides. Most tomato farmers (74.5 percent) received market information from a friend or neighbor, while 10.6 percent received information from a public agriculture extension worker and 7.7 percent received information from an agro-input dealer. While the most frequent source of information on crop success was also friends or neighbors (41.9 percent), tomato farmers received information on crop success from public agriculture extension workers (27.9 percent) and agro-input dealers (26.0 percent) more frequently than with market information. Statistical significance of sex and age differences could not be calculated due to small sample sizes.

**Table 7.4.10: Recordkeeping, training received, and main information sources among tomato farmers in the ZOI, in total and by farmers' sex and age**

| Topic or source                              | Total (%) | Sex        |           | Sig. <sup>a</sup> | Age (years) |           | Sig. <sup>a</sup> |
|----------------------------------------------|-----------|------------|-----------|-------------------|-------------|-----------|-------------------|
|                                              |           | Female (%) | Male (%)  |                   | 15–29 (%)   | 30+ (%)   |                   |
| <b>Training<sup>b</sup></b>                  |           |            |           |                   |             |           |                   |
| Use and application of inorganic fertilizer  | 9.6       | ^          | ^         | -                 | ^           | 11.5      | -                 |
| Use and application of pesticides‡           | 14.1      | ^          | ^         | -                 | ^           | 16.9      | -                 |
| Use and application of herbicides‡           | 4.7       | ^          | ^         | -                 | ^           | 5.6       | -                 |
| <b>Main information source: markets</b>      |           |            |           | -                 |             |           | -                 |
| Friend or neighbor                           | 74.5      | ^          | ^         |                   | ^           | 70.6      |                   |
| Agro-input dealer                            | 7.7       | ^          | ^         |                   | ^           | 8.9       |                   |
| Public agriculture extension worker          | 10.6      | ^          | ^         |                   | ^           | 12.1      |                   |
| Radio program                                | 2.7       | ^          | ^         |                   | ^           | 3.1       |                   |
| Television                                   | 0.0       | ^          | ^         |                   | ^           | 0.0       |                   |
| Mobile phone messaging                       | 2.6       | ^          | ^         |                   | ^           | 3.0       |                   |
| Internet                                     | 0.0       | ^          | ^         |                   | ^           | 0.0       |                   |
| Other                                        | 2.0       | ^          | ^         |                   | ^           | 2.3       |                   |
| <b>Main information source: crop success</b> |           |            |           |                   |             |           |                   |
| Friend or neighbor                           | 41.9      | ^          | ^         |                   | ^           | 44.3      |                   |
| Agro-input dealer                            | 26.0      | ^          | ^         |                   | ^           | 31.1      |                   |
| Public agriculture extension worker          | 27.9      | ^          | ^         |                   | ^           | 24.6      |                   |
| Radio program                                | 0.0       | ^          | ^         |                   | ^           | 0.0       |                   |
| Television                                   | 1.8       | ^          | ^         |                   | ^           | 0.0       |                   |
| Mobile phone messaging                       | 0.0       | ^          | ^         |                   | ^           | 0.0       |                   |
| Internet                                     | 0.0       | ^          | ^         |                   | ^           | 0.0       |                   |
| Other                                        | 2.4       | ^          | ^         |                   | ^           | 0.0       |                   |
| <b>Number of tomato farmers</b>              | <b>41</b> | <b>16</b>  | <b>25</b> |                   | <b>5</b>    | <b>36</b> |                   |

<sup>a</sup> Results not statistically reliable, n<30

<sup>‡</sup> Promoted improved technology or management practice

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Farmers were allowed to give more than one response, so the percentages may not add up to 100 percent.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating tomato.

Source: Feed the Future Nepal ZOI Survey 2019

In households with multiple household members, one person or two or more individuals jointly may make farming decisions. **Table 7.4.11** presents the percent distribution of tomato farmers by who made key production decisions, such as the type of seed to plant, whether to use fertilizer, and whether to irrigate. Because of the small sample sizes, the estimates were not available.

**Table 7.4.11: Percent distribution of who made key tomato production decisions in the ZOI, by farmers' sex**

| Decision-makers       | Type of seed to plant |                   | Whether to use fertilizer |                   | Whether to irrigate |                   |
|-----------------------|-----------------------|-------------------|---------------------------|-------------------|---------------------|-------------------|
|                       | Percent               | Sig. <sup>a</sup> | Percent                   | Sig. <sup>a</sup> | Percent             | Sig. <sup>a</sup> |
| <b>Female farmers</b> |                       |                   |                           |                   |                     |                   |
| Self alone            | ^                     |                   | ^                         |                   | ^                   |                   |

| Decision-makers                             | Type of seed to plant |                   | Whether to use fertilizer |                   | Whether to irrigate |                   |
|---------------------------------------------|-----------------------|-------------------|---------------------------|-------------------|---------------------|-------------------|
|                                             | Percent               | Sig. <sup>a</sup> | Percent                   | Sig. <sup>a</sup> | Percent             | Sig. <sup>a</sup> |
| Partner/spouse alone                        | ^                     |                   | ^                         |                   | ^                   |                   |
| Self and partner together                   | ^                     |                   | ^                         |                   | ^                   |                   |
| Self and other (could also include partner) | ^                     |                   | ^                         |                   | ^                   |                   |
| Other                                       | ^                     |                   | ^                         |                   | ^                   |                   |
| <b>Number of female tomato farmers</b>      | <b>16</b>             |                   | <b>16</b>                 |                   | <b>16</b>           |                   |
| <b>Male farmers</b>                         |                       | -                 |                           | -                 |                     | -                 |
| Self alone                                  | ^                     |                   | ^                         |                   | ^                   |                   |
| Partner/spouse alone                        | ^                     |                   | ^                         |                   | ^                   |                   |
| Self and partner together                   | ^                     |                   | ^                         |                   | ^                   |                   |
| Self and other (could also include partner) | ^                     |                   | ^                         |                   | ^                   |                   |
| Other                                       | ^                     |                   | ^                         |                   | ^                   |                   |
| <b>Number of male tomato farmers</b>        | <b>28</b>             |                   | <b>28</b>                 |                   | <b>28</b>           |                   |

<sup>a</sup> Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and farmers' sex. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating tomato.

Source: Feed the Future Nepal ZOI Survey 2019

#### 7.4.4 Use of improved management practices and technologies

This section examines tomato farmers' use of improved management practices and technologies promoted by Feed the Future in the Nepal ZOI.

**Table 7.4.12** shows the percentage of tomato farmers in the ZOI who applied one or more improved management practices or technologies promoted during the 12 months preceding the ZOI Survey. The table also includes the percentage of tomato farmers in the ZOI who used promoted improved management practices and technologies, by category.

95.6 percent of tomato farmers applied at least one promoted improved management practice or technology. A majority of tomato farmers applied crop genetics and climate adaptation (89.9 percent each). Most farmers also applied pests and disease management (72.3 percent) and cultural practices (71.3 percent). Only 0.9 percent of tomato farmers applied irrigation. Statistical significance of sex and age differences could not be calculated due to small sample size among females and farmers ages 15-29.

**Table 7.4.12: Percentage of tomato farmers in the ZOI who applied one or more promoted improved management practices and technologies by category, in total and by farmers' sex and age**

| Category                        | Total (%) | Sex        |          |                   | Age (years) |         |                   |
|---------------------------------|-----------|------------|----------|-------------------|-------------|---------|-------------------|
|                                 |           | Female (%) | Male (%) | Sig. <sup>a</sup> | 15-29 (%)   | 30+ (%) | Sig. <sup>a</sup> |
| <b>Across all categories</b>    | 95.6      | ^          | ^        | -                 | ^           | 97.2    | -                 |
| Crop genetics <sup>b</sup>      | 89.9      | ^          | ^        | -                 | ^           | 90.3    | -                 |
| Cultural practices <sup>c</sup> | 71.3      | ^          | ^        | -                 | ^           | 70.7    | -                 |

| Category                                                   | Total (%) | Sex        |           | Sig. <sup>a</sup> | Age (years) |           | Sig. <sup>a</sup> |
|------------------------------------------------------------|-----------|------------|-----------|-------------------|-------------|-----------|-------------------|
|                                                            |           | Female (%) | Male (%)  |                   | 15–29 (%)   | 30+ (%)   |                   |
| Pest and disease management <sup>d</sup>                   | 72.3      | ^          | ^         | -                 | ^           | 82.3      | -                 |
| Irrigation <sup>e</sup>                                    | 0.9       | ^          | ^         | -                 | ^           | 1.1       | -                 |
| Climate adaptation or climate risk management <sup>f</sup> | 89.9      | ^          | ^         | -                 | ^           | 90.3      | -                 |
| <b>Number of tomato farmers</b>                            | <b>46</b> | <b>18</b>  | <b>28</b> |                   | <b>7</b>    | <b>39</b> |                   |

<sup>a</sup> Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Crop genetics refers to a farmer's use of improved varieties of seeds.

<sup>c</sup> Cultural practices refers to a farmer using raised beds or containers.

<sup>d</sup> Pest and disease management refers to farmer's use of chemical, pest control, herbicides, and/or mulching.

<sup>e</sup> Irrigation refers to a farmer's use of drip irrigation.

<sup>f</sup> Climate adaptation or climate risk management refers to a farmer's use of improved varieties of seeds.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating tomato.

Source: Feed the Future Nepal ZOI Survey 2019

**Table 7.4.13** shows the percent distribution of tomato farmers in the ZOI who used promoted improved management practices and technologies, by the number used. A majority (51.0 percent) of tomato farmers applied four out of the five promoted improved management practice and technology categories. 32.1 percent of farmers applied three categories, and 8.1 percent applied two categories. Only 3.5 percent and 0.9 percent applied one and five categories, respectively.

**Table 7.4.13: Percent distribution of tomato farmers by number of promoted improved management practices and technologies used in the ZOI, in total and by farmers' sex and age**

| Promoted improved practice or technology | Total (%) | Sex        |           | Sig. <sup>a</sup> | Age (years) |           | Sig. <sup>a</sup> |
|------------------------------------------|-----------|------------|-----------|-------------------|-------------|-----------|-------------------|
|                                          |           | Female (%) | Male (%)  |                   | 15–29 (%)   | 30+ (%)   |                   |
| <b>Number used</b>                       |           |            |           | -                 |             |           | -                 |
| 0                                        | 4.4       | ^          | ^         |                   | ^           | 2.8       |                   |
| 1                                        | 3.5       | ^          | ^         |                   | ^           | 4.3       |                   |
| 2                                        | 8.1       | ^          | ^         |                   | ^           | 9.9       |                   |
| 3                                        | 32.1      | ^          | ^         |                   | ^           | 22.6      |                   |
| 4                                        | 51.0      | ^          | ^         |                   | ^           | 59.3      |                   |
| 5                                        | 0.9       | ^          | ^         |                   | ^           | 1.1       |                   |
| <b>Number of tomato farmers</b>          | <b>46</b> | <b>18</b>  | <b>28</b> |                   | <b>7</b>    | <b>39</b> |                   |

<sup>a</sup> Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating tomato.

Source: Feed the Future Nepal ZOI Survey 2019

## 7.4.5 Tomato yields

Yield is a measure of total production per unit of area planted. For tomato, yield is the weight of tomato (in kilograms) harvested in the season preceding the survey divided by the area, in hectares, planted in the season before the survey. Total production is the amount produced, regardless of how it was ultimately used. It also includes any post-harvest loss (i.e., post-harvest loss is not subtracted from total

production). All data on total production and total units of production are self-reported, thus yields are calculated using self-reported data.<sup>169</sup>

**Table 7.4.14** presents the total production in metric tons (mt), total production units in hectares (ha), and the area-weighted and farmer average yields of tomato in metric tons per hectare (mt/ha) for the season preceding the ZOI Survey. The results are disaggregated by farm size (smallholder and non-smallholder) and further by sex and age. Due to the small sample size, yield estimates were not available for tomatoes. Statistical significance of sex and age differences could not be calculated due to small sample sizes.

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<sup>169</sup> Due to low response rates for land measurements combined with issues merging measurement data between CSPro and the area measurement software, the sample size for plot measurements was significantly reduced. Accordingly, all yield estimates are based on self-reported areas. Field teams collected self-reported area for all plots farmed (up to 8) for each of the farmers interviewed in the household (not only plots that were sampled for direct area measurement).

**Table 7.4.14: Tomato yield in the ZOI during the season preceding the survey, by farm size and farmers' sex and age**

| Background characteristic | Area-weighted   |                          |               | Average per farmer |                          |               | Sig. <sup>a</sup> | Number of tomato farmers (n) |
|---------------------------|-----------------|--------------------------|---------------|--------------------|--------------------------|---------------|-------------------|------------------------------|
|                           | Production (mt) | Units of production (ha) | Yield (mt/ha) | Production (mt)    | Units of production (ha) | Yield (mt/ha) |                   |                              |
| <b>Total</b>              | ^               | ^                        | ^             | ^                  | ^                        | ^             |                   | <b>5</b>                     |
| <b>Sex</b>                |                 |                          |               |                    |                          |               | -                 |                              |
| Female                    | ^               | ^                        | ^             | ^                  | ^                        | ^             |                   | 3                            |
| Male                      | ^               | ^                        | ^             | ^                  | ^                        | ^             |                   | 2                            |
| <b>Age</b>                |                 |                          |               |                    |                          |               | -                 |                              |
| 15-29 years               | ^               | ^                        | ^             | ^                  | ^                        | ^             |                   | 0                            |
| 30+ years                 | ^               | ^                        | ^             | ^                  | ^                        | ^             |                   | 5                            |
| <b>Farm size</b>          |                 |                          |               |                    |                          |               |                   | <b>5</b>                     |
| <b>Smallholder</b>        |                 |                          |               |                    |                          |               |                   |                              |
| <b>Sex</b>                |                 |                          |               |                    |                          |               | -                 | <b>5</b>                     |
| Female                    | ^               | ^                        | ^             | ^                  | ^                        | ^             |                   |                              |
| Male                      | ^               | ^                        | ^             | ^                  | ^                        | ^             |                   | 3                            |
| <b>Age</b>                |                 |                          |               |                    |                          |               | -                 | 2                            |
| 15-29 years               | ^               | ^                        | ^             | ^                  | ^                        | ^             |                   |                              |
| 30+ years                 | ^               | ^                        | ^             | ^                  | ^                        | ^             |                   | 0                            |
| <b>Non-smallholder</b>    |                 |                          |               |                    |                          |               |                   | 5                            |
| <b>Sex</b>                |                 |                          |               |                    |                          |               | -                 | <b>5</b>                     |
| Female                    | ^               | ^                        | ^             | ^                  | ^                        | ^             |                   | 0                            |
| Male                      | ^               | ^                        | ^             | ^                  | ^                        | ^             |                   |                              |
| <b>Age</b>                |                 |                          |               |                    |                          |               | -                 | 0                            |
| 15-29 years               | ^               | ^                        | ^             | ^                  | ^                        | ^             |                   | 0                            |
| 30+ years                 | ^               | ^                        | ^             | ^                  | ^                        | ^             |                   | 0                            |

^ Results not statistically reliable, n<30

<sup>a</sup>Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating tomato.

Source: Feed the Future Nepal ZOI Survey 2019

**Table 7.4.15** presents the average amount of harvested tomato, in kilograms, consumed by farmers' households and sold by farmers. For tomato farms of all sizes, the farmer's own household consumed an average of 224.1 kg of tomatoes, whereas the farmer sold an average of 568.0 kg. In households where the tomato farmer was older than 30, the household consumed an average of 250.3 kg of tomato and sold 603.5 kg. Due to the small sample size, estimates are not statistically reliable for sex or farmers under 30. All tomato farmers were smallholder farmers.

**Table 7.4.15: Average amount of tomato in kilograms consumed by farmers' own households and sold by farmers in the ZOI by farm size, in total and by farmers' sex and age**

| Use of tomatoes        | Average amount consumed (kg) | Sig. <sup>a</sup> | Number of tomato farmers | Average amount harvested (kg) | Average amount sold (kg) | Sig. <sup>a</sup> | Number of farmers who sold tomatoes |
|------------------------|------------------------------|-------------------|--------------------------|-------------------------------|--------------------------|-------------------|-------------------------------------|
| <b>Total</b>           | 224.1                        |                   | <b>44</b>                | ^                             | 568.0                    |                   | <b>41</b>                           |
| <b>Sex</b>             |                              | -                 |                          |                               |                          | -                 |                                     |
| Female                 | ^                            |                   | 16                       | ^                             | ^                        |                   | 16                                  |
| Male                   | ^                            |                   | 28                       | ^                             | ^                        |                   | 25                                  |
| <b>Age</b>             |                              | *                 |                          |                               |                          | -                 |                                     |
| 15–29 years            | ^                            |                   | 6                        | ^                             | ^                        |                   | 5                                   |
| 30+ years              | 250.3                        |                   | 38                       | ^                             | 603.5                    |                   | 36                                  |
| <b>Farm size</b>       |                              |                   |                          |                               |                          |                   |                                     |
| <b>Smallholder</b>     | 224.1                        |                   | <b>44</b>                | ^                             | 568.0                    |                   | <b>41</b>                           |
| <b>Sex</b>             |                              | -                 |                          |                               |                          | -                 |                                     |
| Female                 | ^                            |                   | 16                       | ^                             | ^                        |                   | 16                                  |
| Male                   | ^                            |                   | 28                       | ^                             | ^                        |                   | 25                                  |
| <b>Age</b>             |                              | *                 |                          |                               |                          | -                 |                                     |
| 15–29 years            | ^                            |                   | 6                        | ^                             | ^                        |                   | 5                                   |
| 30+ years              | 250.3                        |                   | 38                       | ^                             | 603.5                    |                   | 36                                  |
| <b>Non-smallholder</b> | -                            |                   | <b>0</b>                 | -                             | -                        |                   | <b>0</b>                            |
| <b>Sex</b>             |                              | -                 |                          |                               |                          | -                 |                                     |
| Female                 | -                            |                   | 0                        | -                             | -                        |                   | 0                                   |
| Male                   | -                            |                   | 0                        | -                             | -                        |                   | 0                                   |
| <b>Age</b>             |                              | -                 |                          |                               |                          | -                 |                                     |
| 15–29 years            | -                            |                   | 0                        | -                             | -                        |                   | 0                                   |
| 30+ years              | -                            |                   | 0                        | -                             | -                        |                   | 0                                   |

^ Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables.

Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating tomato.

Source: Feed the Future Nepal ZOI Survey 2019

**Table 7.4.16** presents the main buyers of harvested tomato in the ZOI Survey. Due to the small sample size, estimates were not available for buyers of tomatoes.

**Table 7.4.16: Main buyers of tomato produced in the ZOI by farm size, in total and by farmers' sex and age**

| Main buyer of tomato                            | Total (%) | Sex        |           | Sig. <sup>a</sup> | Age (years) |           | Sig. <sup>a</sup> |
|-------------------------------------------------|-----------|------------|-----------|-------------------|-------------|-----------|-------------------|
|                                                 |           | Female (%) | Male (%)  |                   | 15–29 (%)   | 30+ (%)   |                   |
| <b>Total</b>                                    |           |            |           | -                 |             |           | -                 |
| Relative or friend                              | ^         | ^          | ^         |                   | ^           | ^         |                   |
| Local market                                    | ^         | ^          | ^         |                   | ^           | ^         |                   |
| Private trader                                  | ^         | ^          | ^         |                   | ^           | ^         |                   |
| Agriculture co-op                               | ^         | ^          | ^         |                   | ^           | ^         |                   |
| Other                                           | ^         | ^          | ^         |                   | ^           | ^         |                   |
| <b>Total number of tomato farmers</b>           | <b>25</b> | <b>12</b>  | <b>13</b> |                   | <b>4</b>    | <b>21</b> |                   |
| <b>Farm size</b>                                |           |            |           |                   |             |           |                   |
| <b>Smallholder</b>                              |           |            |           | -                 |             |           | -                 |
| Relative or friend                              | ^         | ^          | ^         |                   | ^           | ^         |                   |
| Local market                                    | ^         | ^          | ^         |                   | ^           | ^         |                   |
| Private trader                                  | ^         | ^          | ^         |                   | ^           | ^         |                   |
| Agriculture co-op                               | ^         | ^          | ^         |                   | ^           | ^         |                   |
| Other                                           | ^         | ^          | ^         |                   | ^           | ^         |                   |
| <b>Number of smallholder tomato farmers</b>     | <b>25</b> | <b>12</b>  | <b>13</b> |                   | <b>4</b>    | <b>21</b> |                   |
| <b>Non-smallholder</b>                          |           |            |           | -                 |             |           | -                 |
| Relative or friend                              | -         | -          | -         |                   | -           | -         |                   |
| Local market                                    | -         | -          | -         |                   | -           | -         |                   |
| Private trader                                  | -         | -          | -         |                   | -           | -         |                   |
| Agriculture co-op                               | -         | -          | -         |                   | -           | -         |                   |
| <b>Number of non-smallholder tomato farmers</b> | <b>0</b>  | <b>0</b>   | <b>0</b>  |                   | <b>0</b>    | <b>0</b>  |                   |

^ Results not statistically reliable, n<30

<sup>a</sup>Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating tomato.

Source: Feed the Future Nepal ZOI Survey 2019

#### 7.4.6 Soil characteristics

This section presents soil characteristics, including texture, rock fragment percentage, LCC, and soil limitations of plots used to grow tomatoes in the ZOI. Texture is an important soil property that affects crop production, land use, and land management. A soil's ability to retain nutrients and drain is directly related to its texture.<sup>170</sup> Soil can be classified into one of 12 textural classes, as shown in **Table 7.4.17**, depending on the percentages of sand, silt, and clay that it contains.<sup>171</sup>

**Table 7.4.17** presents percent distribution of soil textures in tomato plots in the ZOI by depth, or soil horizon. For tomato soil samples up to 50 centimeters of depth, the greatest proportion of soil consisted of silty clay loam. Sandy loam was the second-most common soil texture for samples between 10 and 50 centimeters in depth. For depths of one to ten centimeters, sandy clay loam was the second-

<sup>170</sup> Jaja, 2016.

<sup>171</sup> USDA-NRCS, 1999.



most common soil texture. For depths of less than one-centimeter, sandy clay was the second-most common texture. Because of the small sample size, estimates for soil samples 50 to 70 centimeters are not statistically reliable.

**Table 7.4.17: Soil texture by soil horizon in tomato plots in the ZOI**

| Depth (cm) | Soil texture (%) |           |      |            |      |            |                 |            |            |            |                 | Number of plots |
|------------|------------------|-----------|------|------------|------|------------|-----------------|------------|------------|------------|-----------------|-----------------|
|            | Clay             | Clay loam | Loam | Loamy sand | Sand | Sandy clay | Sandy clay loam | Sandy loam | Silty loam | Silty clay | Silty clay loam |                 |
| 0 to <1    | 7.2              | 10.9      | 5.2  | 7.6        | 0.0  | 15.7       | 9.9             | 13.1       | 0.0        | 7.6        | 22.8            | 37              |
| 1 to <10   | 4.6              | 10.7      | 4.5  | 8.1        | 0.0  | 10.1       | 18.0            | 10.5       | 2.3        | 8.1        | 23.1            | 37              |
| 10 to <20  | 0.0              | 16.1      | 2.1  | 5.2        | 2.9  | 12.7       | 9.1             | 17.1       | 2.3        | 5.3        | 27.3            | 37              |
| 20 to <50  | 0.00             | 9.3       | 2.3  | 8.2        | 3.3  | 5.7        | 10.5            | 23.2       | 2.6        | 8.3        | 26.7            | 33              |
| 50 to <70  | ^                | ^         | ^    | ^          | ^    | ^          | ^               | ^          | ^          | ^          | ^               | 27              |

^ Results not statistically reliable, n<30

Note: Estimates are based on de jure household members who are farmers responsible for cultivating tomato.

Source: Feed the Future Nepal ZOI Survey 2019

Rock fragments are unattached pieces of rock, two millimeters in diameter or larger. Rock fragments are characterized by their size and shape and, in some cases, the type of rock. Rock fragment classes include pebbles, cobbles, channers, flagstones, stones, and boulders.<sup>172</sup> **Table 7.4.18** presents the percent distribution of rock fragments in tomato plots in the ZOI by soil horizon.

For tomato soil samples zero to 50 centimeters deep, the largest proportion of plots contained zero to one percent rock fragments, followed by one to 15 percent rock fragments. A small percentage of soil samples with ten to 50 centimeters of depth contained 35 to 60 percent rock fragments and no soil samples less than 50 centimeters in depth had greater than 60 percent rock fragments. Because of the small sample size, estimates for soil samples 50 to 70 centimeters are not available.

**Table 7.4.18: Rock fragment percentage by soil horizon in tomato plots in the ZOI**

| Depth (cm) | Rock fragment percentage (%) |           |            |            |      | Number of plots |
|------------|------------------------------|-----------|------------|------------|------|-----------------|
|            | 0 to <1%                     | 1 to <15% | 15 to <35% | 35 to <60% | ≥60% |                 |
| 0 to <1    | 49.5                         | 48.3      | 2.3        | 0.0        | 0.0  | 37              |
| 1 to <10   | 52.9                         | 32.1      | 15.0       | 0.0        | 0.0  | 37              |
| 10 to <20  | 46.4                         | 40.9      | 9.8        | 2.9        | 0.0  | 37              |
| 20 to <50  | 48.5                         | 29.6      | 18.6       | 3.3        | 0.0  | 33              |
| 50 to <70  | ^                            | ^         | ^          | ^          | ^    | 27              |

^ Results not statistically reliable, n<30

Note: Estimates are based on de jure household members who are farmers responsible for cultivating tomato.

Source: Feed the Future Nepal ZOI Survey 2019

LCC is a system of grouping soils based on their capability to produce crops without deteriorating over time.<sup>173</sup> The eight capability classes, which indicate to farmers how limited their soil is for producing

<sup>172</sup> A Guide for Preparing Soil Profile Descriptions. Soils Properties and Processes. NRE 430/ EEB 489.

<sup>173</sup> USDA, n.d.

crops, are described in **Table 7.4.19**. This table also presents the percentage of tomato plots and average tomato yield by LCC.

The largest proportion of tomato plots (35.4 percent) fell into the third-best category of the LCC system, categorized as plots with soil with severe limitations that reduce the choice of plants, require special conservation practices, or both. The second-largest proportion of plots (23.4 percent) fell into the second-best category, described as plots with moderate limitations that reduce the choice of plants or require moderate conservation practices. The smallest proportion of plots (2.5 percent) fell into the fifth category, categorized as plots with little or no hazard of erosion, but with other limitations; impractical to remove; limits soil use to mainly pasture, rangeland, forestland, or wildlife habitat. Notably, no tomato plots fell into the best category, described as plots with slight limitations restricting soil use. Because of the small sample size, yield estimates for tomato are not available.

**Table 7.4.19: Percentage of tomato plots and average tomato yield in the ZOI by LCC**

| LCC                    | Description                                                                                                                                                      | Percent of tomato plots (%) | Average tomato yield (mt/ha) | Number of tomato farmers <sup>a</sup> |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|------------------------------|---------------------------------------|
| I (best)               | Slight limitations that restrict soil use                                                                                                                        | 0.0                         | ^                            | 0                                     |
| II                     | Moderate limitations that reduce the choice of plants or require moderate conservation practices                                                                 | 23.4                        | ^                            | 1                                     |
| III                    | Severe limitations that reduce the choice of plants or require special conservation practices, or both                                                           | 35.4                        | ^                            | 1                                     |
| IV                     | Very severe limitations that restrict the choice of plants or require very careful management, or both                                                           | 10.7                        | ^                            | 1                                     |
| V                      | Little or no hazard of erosion, but with other limitations; impractical to remove; limits soil use to mainly pasture, rangeland, forestland, or wildlife habitat | 2.5                         | ^                            | 0                                     |
| VI                     | Severe limitations that make soils generally unsuited to cultivation and limit their use mainly to pasture, rangeland, forestland, or wildlife habitat           | 14.2                        | ^                            | 0                                     |
| VII                    | Very severe limitations that make the soils unsuited to cultivation and that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat    | 2.6                         | ^                            | 0                                     |
| VIII (worst)           | Limitations that prevent use for commercial plant production and limit use mainly to recreation, wildlife habitat, water supply, or esthetic purposes            | 11.2                        | ^                            | 1                                     |
| Unclassified           |                                                                                                                                                                  | 0.0                         | ^                            | 0                                     |
| <b>Number of plots</b> |                                                                                                                                                                  | <b>33</b>                   |                              |                                       |

^ Results not statistically reliable, n<30

<sup>a</sup> Estimates include only tomato farmers who cultivated tomato on one plot or who cultivated tomato on multiple plots that all had the same LCC score. Farmers who cultivated tomato on multiple plots that did not all have the same LCC score or without a value for tomato yield were excluded.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating tomato.

Sources: Feed the Future Nepal ZOI Survey 2019, United States Department of Agriculture. 2018. National Soil Survey Handbook, Part 622

The LCC designation is accompanied by a sub-class designation. The sub-class designation indicates to farmers the main limitation of their plot's soil, such as erosion risk and low soil depth. A plot can have

multiple sub-class designations if it has more than one notable limitation. The ten sub-classes, which are indicated by letters, are described in **Table 7.4.20**. This table also presents the percentages of tomato farmers in the ZOI who have plots with soil in each LCC sub-class.

For the largest proportion of tomato farmers (54.7 percent), soil water storage capacity was the greatest limitation of their plot's soil. The second-most common soil limitation was soil depth (53.0 percent), followed by permeability (32.4 percent). Salinity, lime requirement, flooding during growing season, and water table depth were not the greatest soil limitations for any tomato farmers.

**Table 7.4.20: Percentage of tomato farmers in the ZOI with one or more plots that meet each LCC criteria**

| LCC criteria                         | Description                                                                                                | Reason for assessment                                                                                                                         | Classification                                  | Percent |
|--------------------------------------|------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|---------|
| Erosion risk (e)                     | Risk of surface soil wearing away due to moving water, depending on the soil texture and land slope.       | Erosion is a major factor limiting future agricultural production. If the productive soil erodes away, the yields will significantly decline. | Plot is at risk of soil erosion.                | 8.9     |
| Soil depth (s-d)                     | Depth of soil to bedrock or other root-limiting layer.                                                     | Soil depth can limit crop root growth if not deep enough.                                                                                     | Plot soil depth is low.                         | 53.0    |
| Surface soil texture (s-t)           | Soil texture near the surface is important for seedling establishment.                                     | Poor surface soil texture can prevent seedling establishment.                                                                                 | Plot surface soil texture is poor.              | 11.5    |
| Salinity (s-k)                       | Salt on the soil surface is an indicator of high soil salinity.                                            | High soil salinity can limit crop growth.                                                                                                     | Plot soil has high salinity.                    | 0.0     |
| Surface stoniness (s-r)              | Percentage of soil covered by stones and boulders (larger than 25 cm).                                     | Soil covered by stones and boulders can impede the use of tractors and animal-pulled plows.                                                   | Plot surface too stony.                         | 18.6    |
| Soil water storage capacity (s-a)    | The amount of water that the soil can store that is usable by plants.                                      | A lower ability to store water means there is less water available for plants to grow. Farmers should plant drought-resistant crops.          | Plot soil has poor ability to store water.      | 54.7    |
| Lime requirement (s-l)               | Soil with a low soil pH (high acidity) requires lime to raise the pH to the ideal range for growing crops. | Soil with a low pH (high acidity) can limit crop production.                                                                                  | Plot soil has high acidity.                     | 0.0     |
| Flooding during growing season (w-f) | Frequency of flooding during the growing season.                                                           | Flooding can damage crops and influence crop selection.                                                                                       | Plot subject to flooding during growing season. | 0.0     |
| Water table depth (w-d)              | Typical water table depth during the growing season.                                                       | A water table that is too high can create an environment not conducive to root growth.                                                        | Plot water table depth is too high.             | 0.0     |

| LCC criteria                    | Description                                    | Reason for assessment                                                          | Classification                 | Percent   |
|---------------------------------|------------------------------------------------|--------------------------------------------------------------------------------|--------------------------------|-----------|
| Permeability (w-p)              | The ability of water to move through the soil. | Low permeability can limit root growth during wet periods due to waterlogging. | Plot soil permeability is low. | 32.4      |
| <b>Number of tomato farmers</b> |                                                |                                                                                |                                | <b>33</b> |

Note: Estimates are based on de jure household members who are farmers responsible for cultivating tomato.

Sources: Feed the Future Nepal ZOI Survey 2019, United States Department of Agriculture. 2018. National Soil Survey Handbook, Part 622.

## 7.5 Looking across maize, rice, cauliflower and tomatoes

This section examines farmers' use of improved management practices and technologies promoted by Feed the Future in the Nepal ZOI across all targeted value chains: maize, rice, cauliflower and tomatoes.

**Table 7.5.1** shows the percentage of targeted VCC farmers in the ZOI who applied one or more improved management practice or technology promoted by the Nepal mission during the 12 months preceding the ZOI Survey. The table also includes the percentage of targeted VCC farmers in the ZOI who used promoted improved management practices and technologies by category. 77.7 percent of targeted value chain commodity farmers applied one or more promoted improved management practices and technologies across all categories. Male farmers were significantly more likely to apply these practices than female farmers, and those 30 years of age or older were significantly more likely to do so than those aged 15-29. Cultural practices were the most commonly applied category (90.9 percent), followed by climate adaptation or risk management (56.1 percent), and crop genetics (51.9 percent). Older farmers were significantly more likely to apply at least one cultural practice or climate adaptation or risk management approach than younger farmers, and male farmers were significantly more likely than female farmers to apply crop genetics, pest and disease management, cultural practices or climate adaption or risk management.

**Table 7.5.1: Percentage of Targeted Value Chain Commodity Farmers in the ZOI Who Applied One or More Promoted Improved Management Practices and Technologies by Category, in Total and by Farmers' Sex and Age**

| Category                                                    | Total (%) | Sex        |          | Sig. <sup>a</sup> | Age (years) |         | Sig. <sup>a</sup> |
|-------------------------------------------------------------|-----------|------------|----------|-------------------|-------------|---------|-------------------|
|                                                             |           | Female (%) | Male (%) |                   | 15-29 (%)   | 30+ (%) |                   |
| <b>Across all categories</b>                                | 77.7      | 71.0       | 83.8     | ***               | 69.2        | 79.1    | **                |
| Crop genetics <sup>b</sup>                                  | 51.9      | 44.4       | 58.7     | ***               | 45.9        | 52.9    | n/s               |
| Cultural practices <sup>c</sup>                             | 90.9      | 86.8       | 93.9     | **                | 83.8        | 91.9    | ***               |
| Pest and disease management <sup>d</sup>                    | 13.0      | 8.9        | 16.9     | ***               | 10.7        | 13.4    | n/s               |
| Irrigation <sup>e</sup>                                     | 0.0       | 0.0        | 0.0      | n/s               | 0.0         | 0.0     | n/s               |
| Climate adaptation or climate risk management <sup>f</sup>  | 56.1      | 48.6       | 63.0     | ***               | 47.7        | 57.5    | *                 |
| Post-harvest, handling and storage <sup>g</sup>             | 0.1       | 0.2        | 0.0      | n/s               | 0.0         | 0.1     | n/s               |
| <b>Number of targeted value chain commodity farmers (n)</b> | 1,874     | 889        | 985      |                   | 256         | 1,618   |                   |

<sup>a</sup> Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Crop genetics includes the following practices: use of improved seeds (maize, rice, cauliflower, tomato), use of hybrid seeds (maize).

<sup>c</sup> Cultural practices includes the following practices: planting seedlings (rice), planting in rows (rice), using raised beds (cauliflower, tomato), and using other containers for planting (tomato).

<sup>d</sup> Pest and disease management includes the following practices: use of chemicals (maize, cauliflower), herbicides (maize, rice, cauliflower), and mulching (maize, cauliflower).

<sup>e</sup> Irrigation includes the following practices: flood irrigation (maize), and drip irrigation (cauliflower, tomato).

<sup>f</sup> Climate adaptation or climate risk management includes the following practices: improved seeds (maize, rice, cauliflower, tomato), hybrid seeds (maize, cauliflower), permanent hose irrigation (maize, rice), drip irrigation (maize, rice), and pump irrigation (maize, rice).

<sup>g</sup> Post-harvest, handling and storage includes the following practices: use of hermetic bags (maize).

Note: Estimates are based on de jure household members who are farmers responsible for cultivating maize or raising fish or dairy cows.

Source: Feed the Future Nepal ZOI Survey 2019

**Table 7.5.2** shows the percent distribution of targeted VCC farmers in the ZOI who used promoted improved management practices and technologies by the number used. 20.6 percent of farmers used a single practice category, 11.4 percent used two practice categories, while 28.1 percent used three different practice categories. In total, 17.6 percent of farmers used four or more practice categories. Gender was significantly associated with the number of practices used, with female farmers applying fewer practices categories than male farmers.

**Table 7.5.2: Percent Distribution of Targeted Value Chain Commodity Farmers by Number of Promoted Improved Management Practices and Technologies Used in the ZOI, in Total and by Farmers' Sex and Age**

| Promoted improved practice or technology                    | Total (%) | Sex        |          | Sig. <sup>a</sup> | Age (years) |         | Sig. <sup>a</sup> |
|-------------------------------------------------------------|-----------|------------|----------|-------------------|-------------|---------|-------------------|
|                                                             |           | Female (%) | Male (%) |                   | 15-29 (%)   | 30+ (%) |                   |
| <b>Number used</b>                                          |           |            |          | ***               |             |         | n/s               |
| 0                                                           | 22.3      | 29.0       | 16.2     |                   | 30.8        | 22.3    |                   |
| 1                                                           | 20.6      | 21.7       | 19.5     |                   | 19.8        | 20.6    |                   |
| 2                                                           | 11.4      | 13.6       | 9.4      |                   | 11.6        | 11.4    |                   |
| 3                                                           | 28.1      | 24.9       | 31.1     |                   | 26.9        | 28.1    |                   |
| 4                                                           | 6.9       | 3.2        | 10.3     |                   | 4.8         | 6.9     |                   |
| 5                                                           | 6.9       | 4.6        | 9.0      |                   | 2.9         | 6.9     |                   |
| 6                                                           | 1.4       | 1.0        | 1.8      |                   | 0.8         | 1.4     |                   |
| 7                                                           | 0.7       | 0.5        | 0.8      |                   | 0.8         | 0.6     |                   |
| 8+                                                          | 1.7       | 1.6        | 1.9      |                   | 1.5         | 1.7     |                   |
| <b>Number of targeted value chain commodity farmers (n)</b> | 1,874     | 889        | 985      |                   | 256         | 1,618   |                   |

<sup>a</sup> Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables.

Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

Note: Estimates are based on de jure household members who are farmers responsible for cultivating maize or raising fish or dairy cows.

Source: Feed the Future Nepal ZOI Survey 2019

## 7.6 Agrometeorological context

Understanding the agrometeorological context (specifically, rainfall, temperature, and greenness during the main growing season) allows a better understanding of the agricultural data collected in the ZOI Surveys. For example, when analyzing combined temperature and precipitation data with Normalized Difference Vegetation Index (NDVI) data, researchers can more clearly understand the reasons for measured yield levels and the degree of change in crop productivity that Feed the Future interventions may have contributed to. Farmer decision-making about area planted and input use is also influenced by and can be better understood with information about the agrometeorological context.

### *Rainfall (Standardized Precipitation Index)*

Rainfall is one of the primary factors affecting crop productivity, especially for rainfed agriculture. Lower or less than optimum crop yields are usually associated with lower than normal (or higher than normal) rainfall conditions. The rainfall indicator presented here measures by how much the total amount of rainfall during the main growing season within the Feed the Future ZOI deviated from the 30-year climatological average, also known as the Standardized Precipitation Index (SPI). The following categories obtained from the National Drought Mitigation Center illustrate the amount of rainfall and its relevance to context:<sup>174</sup>

#### **Standardized Precipitation Index Values**

|                 |                |
|-----------------|----------------|
| 2.00 and above  | Extremely wet  |
| 1.50 to 1.99    | Very wet       |
| 1.00 to 1.49    | Moderately wet |
| -0.99 to 0.99   | Near normal    |
| -1.00 to -1.49  | Moderately dry |
| -1.50 to -1.99  | Severely dry   |
| -2.00 and below | Extremely dry  |

### *Temperature (Total number of heat stress days above 30°C)*

Air temperature influences plant growth through photosynthesis and respiration, affects soil temperature, and impacts the amount of available water in the soil. Temperatures exceeding 30°C, especially during certain growth phases (e.g., flowering and seed development), can negatively impact crop yields. Assessing the number of days on which temperatures exceed 30°C during the main growing season in conjunction with precipitation data can help determine whether temperature was a factor affecting crop yield. This indicator measures the total number of heat stress days where air temperatures exceeded 30°C during the main growing season within the Feed the Future ZOI. The total number of days above 30°C during the main growing season is compared to the prior ten-year average number of days that exceeded 30°C during the main growing season.

### *Greenness (NDVI)*

NDVI represents the greenness of plants covering a landscape or field and serves as a proxy for photosynthetic activity in plants. Photosynthesis is the process that captures solar energy and converts it to biomass, driving primary productivity of the entire food chain. The indicator of greenness used by Feed the Future measures by how much the normal NDVI values during the main growing season within the Feed the Future ZOI deviated from a rolling ten-year average NDVI during that season.

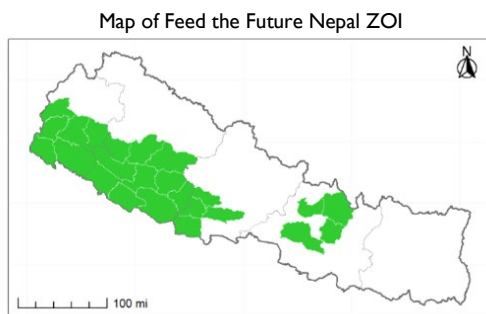
Data from vegetated areas will yield positive values for NDVI. As the amount of green vegetation increases in a pixel, NDVI increases in value up to nearly 1.0.<sup>175</sup> In contrast, bare soil and rocks typically

<sup>174</sup> National Drought Mitigation Center website: <https://drought.unl.edu/droughtmonitoring/SPI.aspx>.

<sup>175</sup> From the NASA Earth Observatory website: "Satellite imagery is made up of tiny squares, each a different color or shade of grey. These squares are called pixels—short for picture elements—and represent the relative reflected light energy recorded for that part of the image. Each pixel represents a square area on an image that is a measure of the sensor's ability to resolve (see) objects of different sizes. Higher resolution (smaller pixel area) means that the sensor

produce lower NDVI values close to zero. Water, clouds, and snow produce negative NDVIs.

| NDVI Range    | Type of land cover                                           |
|---------------|--------------------------------------------------------------|
| -1.00 to 0.00 | Barren surfaces (rock, soil) and water, snow, ice and clouds |
| 0.01 to 0.49  | Vegetation cover                                             |
| 0.50 to 0.69  | Dense vegetation                                             |
| 0.70 to 0.99  | Very dense and green vegetation                              |



In Nepal, the main growing season for rice in 2018 was June to November. The SPI value indicates that rainfall in the ZOI during the cropping season was near normal, with a value of 0.08, suggesting that the rice crop had adequate rainfall for normal production. There was a below average number of days (two) above 30°C (heat stress days) relative to the ten-year average (7.7 days), which suggests conditions for production were relatively favorable, given that rice grain quality and yield are adversely affected by heat stress, especially when occurring at the crop's flowering stage.<sup>176</sup> However, NDVI values were 1.68 percent lower than the ten-year average NDVI for the main cropping season, indicating that the amount of green vegetation on the ground was slightly lower than normal. Taken together, these findings suggest that rice yields for the season before the survey were about average.

The graphs presented in **Figure 7** below show the trends in rainfall, temperature, and greenness indicators for the Nepal ZOI in 2018.

**Figure 7.1a** shows higher than normal rainfall in July and August, the middle of the monsoon season; although rainfall in September and October are lower than average, the July and August rains likely fortified rice paddies against lower rainfall levels in the following months of the rice production season.

**Figure 7.1b** shows a much smaller number of heat stress days at the outset of the 2018 rice production season relative to the ten-year average, which is favorable for rice production.

**Figure 7.1c** presents information on monthly NDVI values that do not appear to be consistent with the rainfall and temperature trends for the rice cropping season: the anomalous dip in NDVI in July does not correspond to the higher-than-average rainfall observed for the month (and in light of the average

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is able to discern smaller objects. By adding up the number of pixels in an image, you can calculate the area of a scene. For example, if you count the number of green pixels in a false color image, you can calculate the total area covered with vegetation.” [https:// earthobservatory.nasa.gov/ features/ RemoteSensing/ remote\\_06.php](https://earthobservatory.nasa.gov/features/RemoteSensing/remote_06.php).

<sup>176</sup> See Wang et al., 2019. Research Progress on Heat Stress of Rice at Flowering Stage. *Rice Science*, 26(1): 1–10. See [https:// www.sciencedirect.com/ science/ article/ pii/ S1672630818300829](https://www.sciencedirect.com/science/article/pii/S1672630818300829).

rainfall experienced during the previous two months). However, NDVI values for the 2018 cropping season rebound after July, closely tracking the ten-year average from August through November.

As noted above, rice farmers in the ZOI produced an area-weighted total of 486,352 metric tons of rice in the season preceding the survey. A total of 220,545 hectares were cultivated, for an average area-weighted yield of 2.2 metric tons per hectare. The average production per farmer was 0.9 metric tons cultivated on an average 0.3 hectares, for an average yield per farmer of 4.5 metric tons per hectare. A 2020 publication from the Government of Nepal Ministry of Agriculture and Livestock Development<sup>177</sup> reported the national total production for rice as 5,151,925 metric tons cultivated on 1,469,545 hectares in 2017/2018 for a total area-weighted yield of 3.5 metric tons per hectare. The same source reported 5,610,011 metric tons cultivated on 1,491,744 hectares in 2018/2019 for a total area-weighted yield of 3.8 metric tons per hectare. Despite an area-weighted yield in the ZOI lower than the national data (2.2 compared to 3.8), the average per farmer yield (4.5) is comparable to per farmer yields reported in similar studies (4.7).<sup>178</sup> Differences in yield values may be due in part to differing methods of measurement: as described in Section 7.2.5 above, the sample size for direct plot measurements was significantly reduced due to low response rates and issues merging the data between CSPro and the area measurement software. Accordingly, all yield estimates in this report are based on self-reported areas of all plots up to 8 for each of the farmers interviewed in the household.

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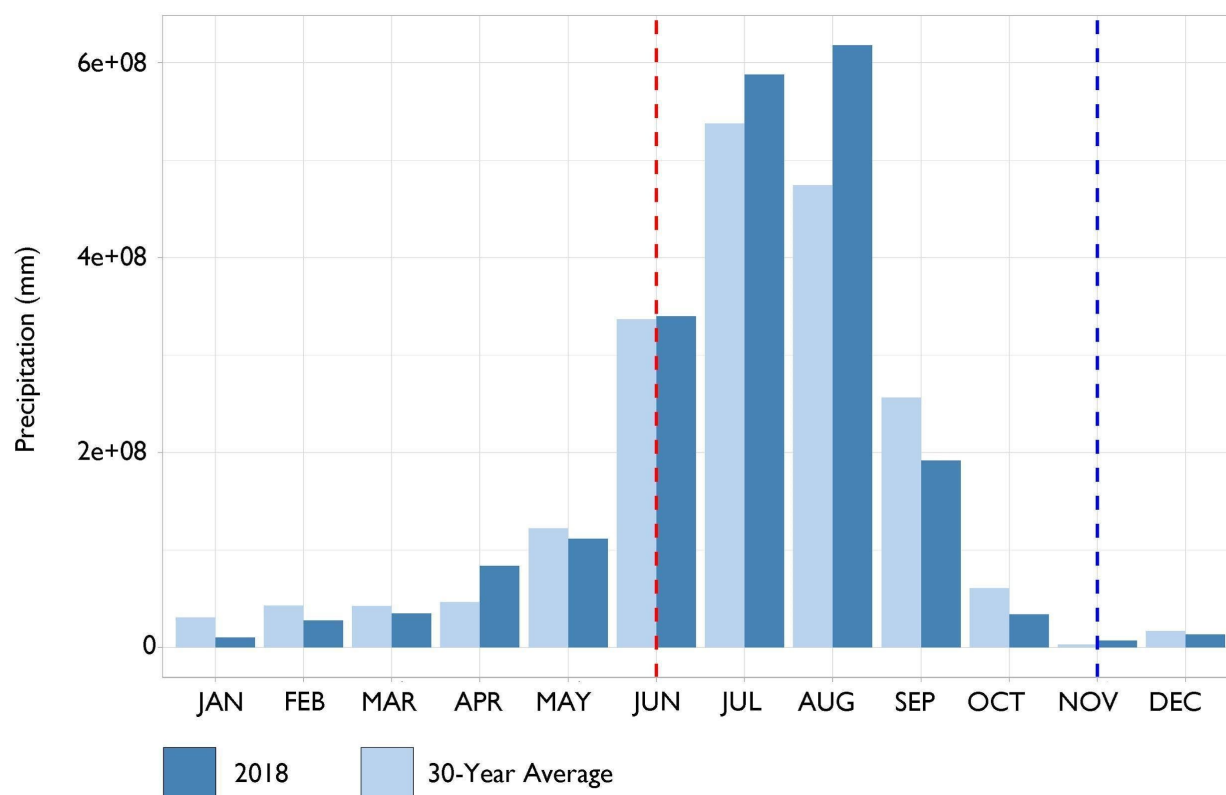
<sup>177</sup> See <https://s3-ap-southeast-1.amazonaws.com/prod-gov-agriculture/server-assets/publication-1595229368881-0dc12.pdf>

<sup>178</sup> See <https://www.frontiersin.org/articles/10.3389/fsufs.2021.740546/full>



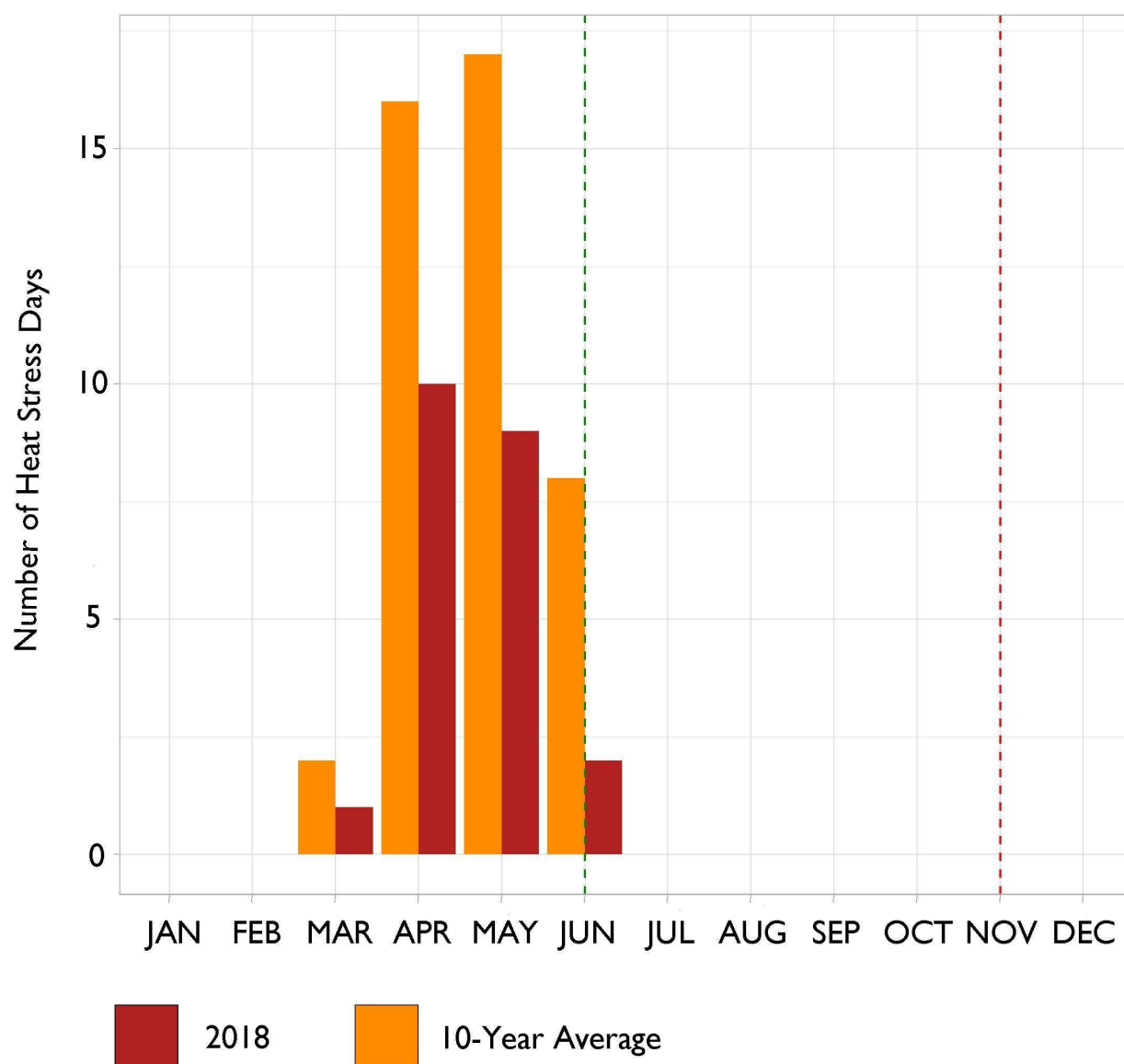
**Figure 7.1a-c: Trends in rainfall, temperature, and greenness indicators for the Nepal ZOI in 2018**

**Figure 7.1a: Rainfall (SPI) for the Nepal ZOI during the 2018 growing season relative to the 30-year average**



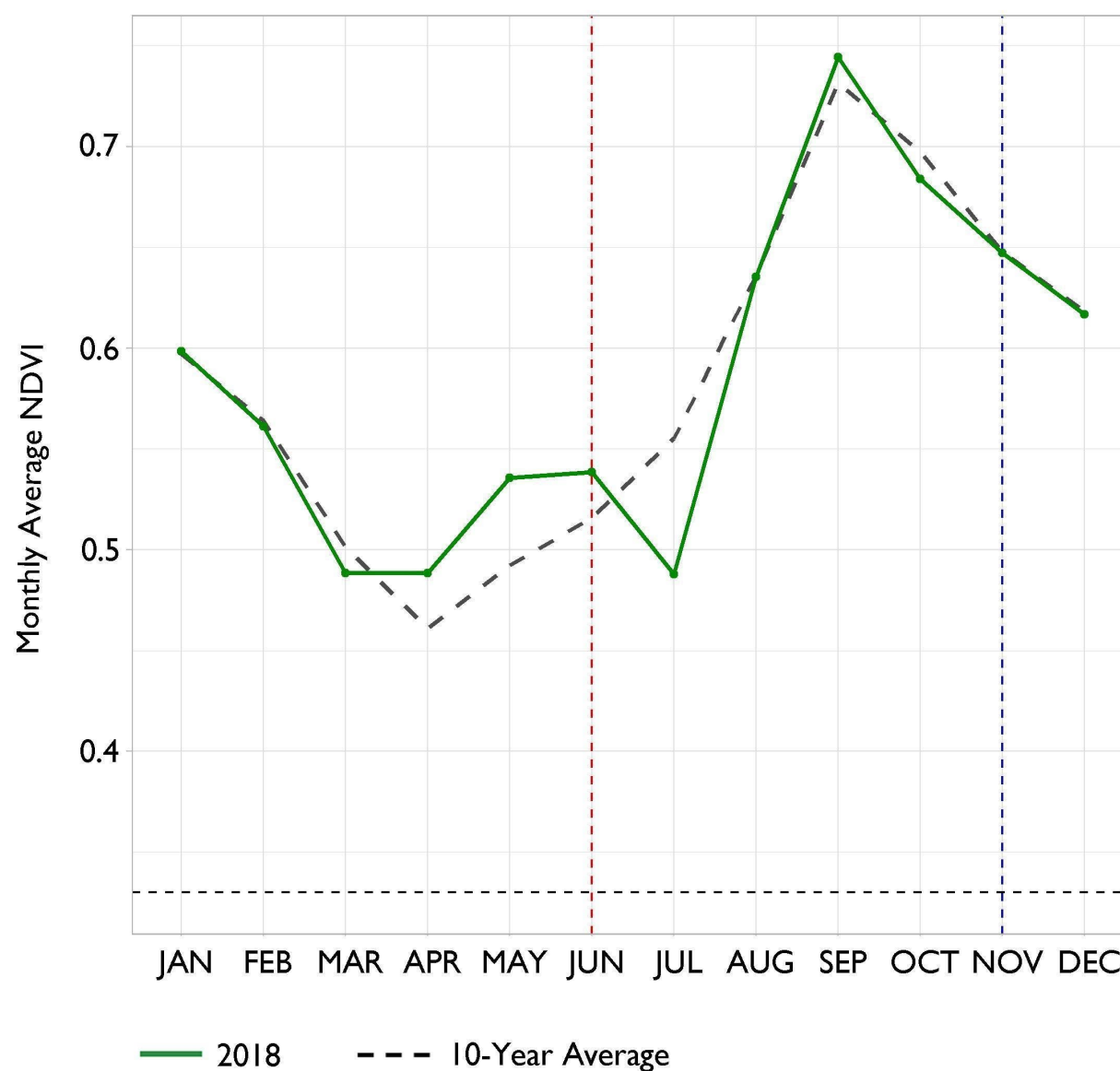
Precipitation data source: [https://developers.google.com/earth-engine/datasets/catalog/UCSB-CHG\\_CHIRPS\\_DAILY](https://developers.google.com/earth-engine/datasets/catalog/UCSB-CHG_CHIRPS_DAILY).

**Figure 7.1b: Temperature (total number of heat stress days above 30°C) for the Nepal ZOI during the 2018 growing season relative to the ten-year average**



Temperature data source: [https://developers.google.com/earth-engine/datasets/catalog/MODIS\\_006\\_MODI1A1](https://developers.google.com/earth-engine/datasets/catalog/MODIS_006_MODI1A1).

**Figure 7.1c: NDVI values for the Nepal ZOI in 2018 relative to the ten-year average**



NDVI data source: [https://developers.google.com/earth-engine/datasets/catalog/MODIS\\_006\\_MOD13A2](https://developers.google.com/earth-engine/datasets/catalog/MODIS_006_MOD13A2)

## 8. FOOD INSECURITY AND DIETARY INTAKE

This chapter presents findings related to household food insecurity in the ZOI, as well as women's and young children's dietary intake. The food insecurity and dietary indicators complement each other. When used together, they offer a more comprehensive understanding of the causes and consequences of food insecurity in the ZOI.

### 8.1 Food insecurity

The experience of food insecurity is characterized by uncertainty and anxiety regarding food access and changes in the *quality* of the diet (i.e., less balanced and more monotonous diets). As food insecurity becomes severe, the *quantity* of food consumed by the household decreases as the portion sizes are reduced and meals are skipped. When food insecurity is most severe, individuals are forced to go without eating. Research shows that the experience of food insecurity appears to be common across cultures.<sup>179</sup>

For the ZOI Surveys, the prevalence of moderate and severe food insecurity indicator is based on the FIES, which measures the percentage of individuals in the population that experienced food insecurity at moderate or severe levels during the 12 months preceding the survey. FIES is a scale established by the United Nations' Food and Agriculture Organization that is used to estimate the probability that each household or individual belongs to a specific category of food insecurity severity.<sup>180</sup> The difficulty in accessing food due to *lack of money or other resources* is measured from answers to a set of eight questions covering a range of severity of food insecurity in the 12 months preceding the survey. The population surveyed is assigned a probability of being in one of three categories: little to no food insecurity, moderate food insecurity, and severe food security. The moderate and severe food insecurity category is the cumulative probability of being in two categories of moderate and severe food insecurity, and the prevalence of moderate and severe food insecurity is also used for monitoring progress on SDG Indicator 2.1.2. Although data collection for the survey took place in the post-harvest season, from May to August 2019, a 12-month reference period for the FIES was used to avoid the influence of seasonal variations.

According to the *State of Food Security and Nutrition in the World: 2019*, food insecurity in Nepal was impacted by the global financial crisis and high food prices, reducing households' food security by five percent.<sup>181</sup>

**Table 8.1.1** presents estimates of food insecurity in the ZOI population, as well as by household characteristics, including gendered household type, educational attainment, wealth quintile, poverty status, severity of shock exposure, and ecological zone. Overall, 10.7 percent of the population experienced moderate to severe food insecurity during the 12 months preceding the survey. Gendered household type, education, wealth quintile, poverty status, and shock exposure were significantly associated with the prevalence of food insecurity. MNF households experienced the highest prevalence of food insecurity (19.8 percent), followed by FNM households (13.1 percent) and M&F households

<sup>179</sup> Coates, 2006.

<sup>180</sup> Food and Agriculture Organization of the United Nations, 2019; Cafiero, Viviani, & Nord, 2018; Ballard, 2013.

<sup>181</sup> State of Food Security and Nutrition in the World, World Food Programme, 2019.

(10.2 percent). 21.4 percent of households with less than a primary education experienced moderate or severe food insecurity, while 17.1 percent with no education experienced this. 9.9 percent of households that completed a primary education experienced food insecurity, while just 6.1 percent of those that completed a secondary education experienced food insecurity. The lowest wealth quintile had the highest prevalence of food insecurity (19.1 percent), while the highest wealth quintile had the lowest prevalence (6.1 percent). Whereas 20.9 percent of poor households experienced moderate to severe food insecurity, 9.6 percent of non-poor households experienced this. As expected, a higher shock exposure is associated with a higher prevalence of food insecurity.

**Table 8.1.1: Prevalence of food insecurity in the ZOI population by severity, in total and by selected household characteristics**

| Household characteristic <sup>a</sup> | Little to no (%) | Moderate (%) | Severe (%) | Moderate or severe |                   | Number of households <sup>c</sup> |
|---------------------------------------|------------------|--------------|------------|--------------------|-------------------|-----------------------------------|
|                                       |                  |              |            | (%)                | Sig. <sup>b</sup> |                                   |
| <b>All households</b>                 | 89.4             | 8.8          | 1.9        | 10.7               |                   | 2,439                             |
| <b>Gendered household type</b>        |                  |              |            |                    | *                 | 2,439                             |
| Male and female adults                | 89.8             | 8.4          | 1.8        | 10.2               |                   | 1,910                             |
| Female adults only                    | 86.9             | 10.6         | 2.5        | 13.1               |                   | 467                               |
| Male adults only                      | 80.2             | 14.3         | 5.5        | 19.8               |                   | 52                                |
| Children only, no adults              | -                | -            | -          | -                  |                   | 10                                |
| <b>Household education</b>            |                  |              |            |                    | ***               | 2,439                             |
| No education                          | 82.9             | 12.0         | 5.1        | 17.1               |                   | 153                               |
| Less than primary                     | 78.6             | 16.7         | 4.8        | 21.4               |                   | 527                               |
| Completed primary                     | 90.1             | 8.5          | 1.4        | 9.9                |                   | 1,112                             |
| Completed secondary                   | 93.9             | 5.7          | 0.4        | 6.1                |                   | 336                               |
| Higher                                | -                | -            | -          | -                  |                   | 311                               |
| <b>Wealth quintile</b>                |                  |              |            |                    | ***               | 2,439                             |
| Highest (wealthiest)                  | 93.9             | 4.7          | 1.4        | 6.1                |                   | 484                               |
| Fourth                                | 92.0             | 6.6          | 1.4        | 8.0                |                   | 491                               |
| Middle                                | 89.2             | 8.3          | 2.6        | 10.8               |                   | 479                               |
| Second                                | 90.1             | 8.4          | 1.5        | 9.9                |                   | 492                               |
| Lowest (poorest)                      | 80.9             | 16.5         | 2.6        | 19.1               |                   | 493                               |
| <b>Poverty status</b>                 |                  |              |            |                    | ***               | 2,383                             |
| Poor                                  | 79.1             | 17.9         | 3.1        | 20.9               |                   | 204                               |
| Non-poor                              | 90.4             | 7.8          | 1.8        | 9.6                |                   | 2,179                             |
| <b>Shock exposure index</b>           |                  |              |            |                    | ***               | 2,438                             |
| Did not experience any shocks         | -                | -            | -          | -                  |                   | 571                               |
| Low                                   | 96.6             | 3.3          | 0.2        | 3.4                |                   | 707                               |
| Moderate                              | 88.5             | 9.6          | 1.9        | 11.5               |                   | 561                               |
| High                                  | 75.3             | 20.0         | 4.7        | 24.7               |                   | 599                               |
| <b>Ecological zone</b>                |                  |              |            |                    | n/s               | 2,439                             |
| Hill                                  | 90.1             | 8.4          | 1.6        | 9.9                |                   | 1,335                             |
| Terai                                 | 88.2             | 9.5          | 2.3        | 11.8               |                   | 1,017                             |
| Mountain                              | 95.6             | 4.4          | 0.0        | 4.4                |                   | 87                                |

<sup>a</sup> Because of low sample size or variation in food insecurity, the model cannot be run for some disaggregation values. These disaggregation values are excluded and marked as missing.

<sup>b</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>c</sup> Records missing information for the disaggregate variables have been excluded from the disaggregated estimates. The unweighted sample size reflects this loss in observations; therefore, the sum of disaggregate sample sizes may not equal the overall sample size.

Note: Estimates are based on de jure household members.

Source: Feed the Future Nepal ZOI Survey 2019

**Table 8.1.2** presents estimates of food insecurity in the ZOI population by agriculture-related household characteristics, including household ownership of agricultural land, ownership of livestock, and cultivation of targeted crop commodities. Overall, households that own land or produce crop commodities have a lower prevalence of moderate to severe food insecurity. Of households that do not own land, 17.9 percent experienced food insecurity, compared to 8.9 percent of households that owned less than five hectares of land. Compared to households that do not produce any VCC crops (14.6 percent), households that produce maize and rice have lower prevalence of food insecurity, at 9.5 percent and 8.9 percent, respectively.

**Table 8.1.2: Prevalence of food insecurity in the ZOI population by severity, in total and by selected household agricultural characteristics**

| Household characteristic                            | Little to no (%) | Moderate (%) | Severe (%) | Moderate or severe |                   | Number of households <sup>b</sup> |
|-----------------------------------------------------|------------------|--------------|------------|--------------------|-------------------|-----------------------------------|
|                                                     |                  |              |            | (%)                | Sig. <sup>a</sup> |                                   |
| <b>All households</b>                               | 89.4             | 8.8          | 1.9        | 10.6               |                   | 2,439                             |
| <b>Household ownership of agricultural land</b>     |                  |              |            |                    | ***               | 2,439                             |
| None                                                | 82.1             | 14.5         | 3.4        | 17.9               |                   | 515                               |
| Less than 5 hectares                                | 91.1             | 7.4          | 1.5        | 8.9                |                   | 1,920                             |
| 5–9 hectares                                        | -                | -            | -          | -                  |                   | 3                                 |
| 10 or more hectares                                 | -                | -            | -          | -                  |                   | 1                                 |
| <b>Household ownership of livestock<sup>c</sup></b> |                  |              |            |                    | n/s               | 2,439                             |
| None <sup>d</sup>                                   | 88.4             | 9.0          | 2.6        | 11.6               |                   | 442                               |
| Cows or bulls                                       | 89.6             | 9.0          | 1.4        | 10.4               |                   | 1,159                             |
| Goats or sheep                                      | 89.6             | 8.6          | 1.8        | 10.4               |                   | 1,471                             |
| Chickens                                            | 89.8             | 8.6          | 1.7        | 10.2               |                   | 1,138                             |
| <b>Household crop VCC production<sup>c</sup></b>    |                  |              |            |                    | **                | 2,439                             |
| None                                                | 85.4             | 11.0         | 3.6        | 14.6               |                   | 455                               |
| Maize                                               | 90.5             | 8.2          | 1.3        | 9.5                |                   | 1,395                             |
| Rice                                                | 91.1             | 7.7          | 1.2        | 8.9                |                   | 1,423                             |
| Cauliflower                                         | -                | -            | -          | -                  |                   | 74                                |
| Tomato                                              | -                | -            | -          | -                  |                   | 50                                |

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ ; n/s=not significant.

<sup>b</sup> Records missing information for the disaggregate variables have been excluded from the disaggregated estimates. The unweighted sample size reflects this loss in observations; therefore, the sum of disaggregate sample sizes may not equal the overall sample size.

<sup>c</sup> Sub-categories will not sum to 100 percent because a household may have owned multiple types of livestock or produced multiple VCCs.

<sup>d</sup> None means that the household does not own any of the livestock animals included in the table (cows or bulls, goats, sheep, or chickens) but may own other agricultural animals, including other cattle, horses, mules, donkeys, or fish.

Note: Estimates are based on de jure household members.

Source: Feed the Future Nepal ZOI Survey 2019

## 8.2 Women's minimum dietary diversity

This section presents information on the dietary diversity of women of reproductive age in the ZOI. Women of reproductive age (15-49 years) are at risk of multiple micronutrient deficiencies, which can jeopardize their health and their ability to care for their children and participate in income-generating activities.<sup>182</sup> The Feed the Future women's dietary diversity indicator is a proxy for the micronutrient adequacy of women's diets. The dietary diversity indicator reports the mean number of food groups consumed in the previous day by women of reproductive age.

The women's minimum dietary diversity indicator uses the following ten food groups: (1) grains, roots, and tubers; (2) legumes and beans; (3) nuts and seeds; (4) dairy products; (5) eggs; (6) flesh foods, including organ meat and miscellaneous small animal protein; (7) vitamin A-rich dark green leafy vegetables; (8) other vitamin A-rich vegetables and fruits; (9) other fruits; and (10) other vegetables. Achievement of women's minimum dietary diversity is defined as having consumed foods from at least five of the ten food groups in the 24 hours preceding the survey. Thus, this indicator is a dichotomous variable, and the measure is reported as the percentage of women who achieve minimum dietary diversity.

**Table 8.2.1** shows the percentage of all women of reproductive age in the ZOI who have achieved minimum dietary diversity by individual-level and household-level characteristics. Household-level characteristics include gendered household type, wealth quintile, poverty status, severity of shock exposure, and ecological zone. Individual-level characteristics include women's age, educational attainment, and pregnancy status.

Overall, 48.2 percent of women of reproductive age achieved minimum dietary diversity. Significantly fewer women of reproductive age with no education (35.8 percent) achieve minimum dietary diversity than those with higher education (69.8 percent). Significantly more women of reproductive age who are in the highest wealth quintile achieve minimum dietary diversity (62.4 percent) than those in the lowest quintile (34.9 percent). Similarly, significantly more women who are non-poor achieve minimum dietary diversity (50.0 percent) than those in poverty (22.0 percent). More women who did not experience any shocks or experienced low shock exposure achieve minimum dietary diversity (53.9 and 54.0 percent, respectively) than those with moderate or high exposure (41.4 and 43.3 percent, respectively).

**Table 8.2.1: Percent of women of reproductive age in the ZOI achieving minimum dietary diversity, in total and by selected woman and household characteristics**

| Characteristic                       | Percent | Sig. <sup>a</sup> | Number of women <sup>b</sup> |
|--------------------------------------|---------|-------------------|------------------------------|
| <b>All women of reproductive age</b> | 48.2    |                   | 1,999                        |
| <b>Age</b>                           |         | n/s               | 1,999                        |
| 15–19                                | 48.9    |                   | 296                          |
| 20–24                                | 50.0    |                   | 329                          |
| 25–29                                | 53.5    |                   | 371                          |
| 30–34                                | 41.4    |                   | 330                          |
| 35–39                                | 47.1    |                   | 292                          |
| 40–44                                | 50.0    |                   | 210                          |

<sup>182</sup> Darnton-Hill, 2005.

| Characteristic                      | Percent | Sig. <sup>a</sup> | Number of women <sup>b</sup> |
|-------------------------------------|---------|-------------------|------------------------------|
| 45–49                               | 42.2    |                   | 171                          |
| <b>Education</b>                    |         | ***               | 1,997                        |
| No education                        | 35.8    |                   | 667                          |
| Less than primary                   | 45.2    |                   | 416                          |
| Completed primary                   | 52.1    |                   | 641                          |
| Completed secondary                 | 66.8    |                   | 164                          |
| Higher                              | 69.8    |                   | 109                          |
| <b>Pregnancy status<sup>c</sup></b> |         | n/s               | 1,974                        |
| Pregnant                            | 59.0    |                   | 107                          |
| Not pregnant                        | 47.4    |                   | 1,867                        |
| <b>Gendered household type</b>      |         | n/s               | 1,999                        |
| Male and female adults              | 48.5    |                   | 1,611                        |
| Female adults only                  | 46.3    |                   | 379                          |
| Male adults only                    | ^       |                   | 7                            |
| Children only, no adults            | -       |                   | 0                            |
| <b>Wealth quintile</b>              |         | ***               | 1,999                        |
| Highest (wealthiest)                | 62.4    |                   | 396                          |
| Fourth                              | 48.3    |                   | 405                          |
| Middle                              | 42.3    |                   | 406                          |
| Second                              | 49.8    |                   | 390                          |
| Lowest (poorest)                    | 34.9    |                   | 402                          |
| <b>Poverty status</b>               |         | ***               | 1,958                        |
| Poor                                | 22.0    |                   | 170                          |
| Non-poor                            | 50.0    |                   | 1,788                        |
| <b>Shock exposure index</b>         |         | **                | 1,991                        |
| Did not experience any shocks       | 53.9    |                   | 442                          |
| Low                                 | 54.0    |                   | 580                          |
| Moderate                            | 41.4    |                   | 459                          |
| High                                | 43.3    |                   | 510                          |
| <b>Ecological zone</b>              |         | n/s               | 1,999                        |
| Hill                                | 50.8    |                   | 1,072                        |
| Terai                               | 44.8    |                   | 877                          |
| Mountain                            | 61.3    |                   | 50                           |

<sup>a</sup> Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Records missing information for the disaggregate variables have been excluded from the disaggregated estimates. The unweighted sample size reflects this loss in observations; therefore, the sum of disaggregate sample sizes may not equal the overall sample size.

<sup>c</sup> Validated cut-offs for adequate dietary diversity for pregnant women do not exist. These estimates reflect the established adequate dietary diversity cut-off for women of reproductive age generally.

Note: Estimates are based on de facto household members.

Source: Feed the Future Nepal ZOI Survey 2019

**Table 8.2.2** shows the percentage of all women of reproductive age in the ZOI who have achieved minimum dietary diversity by household-level agricultural characteristics. Household-level agricultural characteristics include ownership of agricultural land, ownership of livestock, cultivation of targeted crop commodities, and cultivation of any crop.

More women of reproductive age who do not own livestock achieve minimum dietary diversity (59.0 percent) than those who do, irrespective of the type of livestock (between 44.5 and 47.1 percent).



Similarly, more women of reproductive age who do not produce any of the four target VCCs achieve minimum dietary diversity (62.1 percent) than those who do, irrespective of the type of crop (between 44.7 and 55.6 percent). This trend is similar outside the VCC crops: the prevalence of women of reproductive age achieving minimum dietary diversity is greater among households reporting that they cultivated no crops in the past year (58.7 percent) when compared to households reporting that they cultivated any crops in the past year (45.4 percent).

**Table 8.2.2: Percent of women of reproductive age in the ZOI achieving minimum dietary diversity, in total and by selected household agricultural characteristics**

| Household characteristic                            | Percent | Sig. <sup>a</sup> | Number of women <sup>b</sup> |
|-----------------------------------------------------|---------|-------------------|------------------------------|
| <b>Household ownership of agricultural land</b>     |         | n/s               | 1,999                        |
| None                                                | 48.9    |                   | 428                          |
| Less than 5 hectares                                | 48.0    |                   | 1,568                        |
| 5–9 hectares                                        | ^       |                   | 3                            |
| 10 or more hectares                                 | ^       |                   | 0                            |
| <b>Household ownership of livestock<sup>c</sup></b> |         | **                | 1,999                        |
| None <sup>d</sup>                                   | 59.0    |                   | 320                          |
| Cows or bulls                                       | 46.4    |                   | 989                          |
| Goats or sheep                                      | 47.1    |                   | 1,249                        |
| Chickens                                            | 44.5    |                   | 969                          |
| <b>Household crop VCC production<sup>c</sup></b>    |         | ***               | 1,999                        |
| None                                                | 62.1    |                   | 337                          |
| Rice                                                | 46.1    |                   | 1,237                        |
| Maize                                               | 46.9    |                   | 1,140                        |
| Cauliflower                                         | 44.7    |                   | 64                           |
| Tomatoes                                            | 55.6    |                   | 46                           |
| <b>Household cultivates any crop</b>                |         | ***               | 1,999                        |
| Yes                                                 | 45.4    |                   | 1,666                        |
| No                                                  | 58.7    |                   | 333                          |

<sup>a</sup> Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Records missing information for the disaggregate variables have been excluded from the disaggregated estimates. The unweighted sample size reflects this loss in observations; therefore, the sum of disaggregate sample sizes may not equal the overall sample size.

<sup>c</sup> Sub-categories will not sum to 100 percent because a household may have owned multiple types of livestock or produced multiple targeted VCCs.

<sup>d</sup> None means that the household does not own any of the livestock animals included in the table (cows or bulls, goats, sheep, or chickens) but may own other agricultural animals, including other cattle, horses, mules, donkeys, or fish.

Note: Estimates are based on de facto household members.

Source: Feed the Future Nepal ZOI Survey 2019

**Table 8.2.3** shows the percentage of women 15–49 years of age who consumed each of the ten food groups overall and by dietary diversity achievement status. The most consumed food groups were grains, roots, and tubers (99.7 percent), other vegetables (81.2 percent), and legumes and beans (79.4 percent). Roughly one-third to one-quarter of women of reproductive age consumed dairy products, meat and organ meats, vitamin-A rich vegetables, and other fruits. Relatively few women of reproductive age (less than 12 percent) consumed nuts and seeds or eggs. When disaggregated by women who did and did not achieve minimum dietary diversity, for all food groups, more women who achieved minimum dietary diversity consumed something from that food group than those that did not. For all food groups except for grains, roots, and tubers, this difference is statistically significant.

**Table 8.2.3: Percent of women of reproductive age in the ZOI who consumed foods in each food group during the 24 hours preceding the survey, in total and by achievement of minimum dietary diversity status**

| Food group                                 | Total        | Dietary diversity achievement status |                 |                   |
|--------------------------------------------|--------------|--------------------------------------|-----------------|-------------------|
|                                            |              | Achieved                             | Did not achieve | Sig. <sup>a</sup> |
| Grains, roots, and tubers                  | 99.7         | 100.0                                | 99.4            | n/s               |
| Legumes and beans                          | 79.4         | 92.4                                 | 67.4            | ***               |
| Nuts and seeds                             | 10.2         | 18.1                                 | 2.6             | ***               |
| Dairy products                             | 36.8         | 55.3                                 | 19.7            | ***               |
| Meat and organ meats                       | 28.1         | 42.4                                 | 15.1            | ***               |
| Eggs                                       | 11.8         | 20.3                                 | 3.9             | ***               |
| Vitamin A-rich dark green leafy vegetables | 36.2         | 50.6                                 | 22.7            | ***               |
| Other vitamin A-rich vegetables and fruits | 32.4         | 49.8                                 | 16.2            | ***               |
| Other fruits                               | 29.8         | 49.6                                 | 11.3            | ***               |
| Other vegetables                           | 81.2         | 93.1                                 | 69.9            | ***               |
| <b>Number of women of reproductive age</b> | <b>1,999</b> | <b>946</b>                           | <b>1,053</b>    |                   |

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

Note: Estimates are based on de facto household members.

Source: Feed the Future Nepal ZOI Survey 2019

### 8.3 Infant and young child feeding

This section presents young children's dietary intake measures, including the Feed the Future indicators of exclusive breastfeeding among children 0–5 months of age and MAD among children 6–23 months of age.

#### 8.3.1 Exclusive breastfeeding

Exclusive breastfeeding provides children with significant health and nutrition benefits, including protection from gastrointestinal infections and reduced risk of mortality due to infectious disease.<sup>183</sup> Exclusive breastfeeding means that the infant received breast milk, including expressed breast milk or breast milk from a wet nurse. The infant may also have received oral rehydration salts, vitamins, minerals, or medicines, but did not receive any other food or liquid. This indicator measures the percentage of children 0–5 months of age who were exclusively breastfed the day preceding the survey.

**Table 8.3.1** shows the prevalence of exclusive breastfeeding among children 0–5 months of age in the ZOI. Estimates are shown for all children and by child's sex, educational attainment of the child's primary caregiver, wealth quintile, household poverty status, severity of shock exposure, and ecological zone. These data are collected from the self-identified primary caregiver and not strictly from the biological mother, although this is often the same person.

Overall, 64.0 percent of children 0–5 months of age were exclusively breastfed the day preceding the survey. Of the disaggregates with sufficient sample size for significance testing, child sex, caregiver education and shock exposure were not significantly associated with exclusive breastfeeding. Ecological

<sup>183</sup> WHO, 2018b.

zone is significantly associated; 79.3 percent of children in the hill zone were exclusively breastfed in the day preceding the survey compared to just 47.7 percent in the terai zone.

**Table 8.3.1: Prevalence of exclusive breastfeeding among children 0–5 months of age in the ZOI, in total and by selected child, caregiver, and household characteristics**

| Characteristic                         | Percent | Sig. <sup>a</sup> | Number of children <sup>b</sup> |
|----------------------------------------|---------|-------------------|---------------------------------|
| <b>All children 0–5 months of age</b>  | 64.0    |                   | 105                             |
| <b>Child sex</b>                       |         | n/s               | 105                             |
| Male                                   | 63.7    |                   | 55                              |
| Female                                 | 64.4    |                   | 50                              |
| <b>Caregiver education<sup>c</sup></b> |         | n/s               | 105                             |
| No education                           | 49.4    |                   | 31                              |
| Less than primary                      | ^       |                   | 23                              |
| Completed primary                      | 71.4    |                   | 35                              |
| Completed secondary                    | ^       |                   | 11                              |
| Higher                                 | ^       |                   | 5                               |
| <b>Wealth quintile</b>                 |         | -                 | 105                             |
| Highest (wealthiest)                   | ^       |                   | 15                              |
| Fourth                                 | ^       |                   | 16                              |
| Middle                                 | ^       |                   | 24                              |
| Second                                 | ^       |                   | 18                              |
| Lowest (poorest)                       | 85.4    |                   | 32                              |
| <b>Poverty status</b>                  |         | -                 | 103                             |
| Poor                                   | ^       |                   | 17                              |
| Non-poor                               | 61.4    |                   | 86                              |
| <b>Shock exposure index</b>            |         | n/s               | 104                             |
| Did not experience any shocks          | ^       |                   | 17                              |
| Low                                    | 60.4    |                   | 35                              |
| Moderate                               | ^       |                   | 21                              |
| High                                   | 76.6    |                   | 31                              |
| <b>Ecological zone</b>                 |         | **                | 105                             |
| Hill                                   | 79.3    |                   | 56                              |
| Terai                                  | 47.7    |                   | 48                              |
| Mountain                               | ^       |                   | 1                               |

<sup>a</sup> Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Records missing information for the disaggregate variables have been excluded from the disaggregated estimates. The unweighted sample size reflects this loss in observations; therefore, the sum of disaggregate sample sizes may not equal the overall sample size.

<sup>c</sup> The ZOI Survey identifies the primary caregiver of each age-eligible child. This person is likely, but not necessarily, the child's biological mother.

Note: Estimates are based on de facto household members.

Source: Feed the Future Nepal ZOI Survey 2019

### 8.3.2 Minimum acceptable diet

MAD is one of the eight core indicators for assessing infant and young child feeding practices among children 6–23 months of age. The MAD indicator captures multiple dimensions of feeding, is calculated separately for breastfed and non-breastfed children, and includes information on two components: minimum dietary diversity and minimum meal frequency.

The indicator is calculated by combining the minimum dietary diversity and minimum meal frequency information for breastfed and non-breastfed children 6–23 months of age. Children who meet both the minimum dietary diversity and the minimum meal frequency criteria during the day preceding the survey meet the MAD criteria. Breastfed children 6–23 months of age must have consumed foods from at least four of seven food groups to meet the minimum dietary diversity criteria, and eaten solid, semi-solid, or soft foods at least two times if they were 6–8 months of age or at least three times if they were 9–23 months of age to meet the minimum meal frequency criteria.<sup>184</sup> Non-breastfed children 6–23 months of age must have consumed foods from at least four of six food groups to meet the minimum dietary diversity criteria; received at least two milk feedings; and eaten solid, semi-solid, or soft foods at least four times to meet the minimum meal frequency criteria.<sup>185</sup> As recommended by WHO, the ZOI Survey disaggregates the MAD indicator for the following age groups: 6–11 months, 12–17 months, and 18–23 months.<sup>186</sup>

**Table 8.3.2** presents the MAD indicator for children 6–23 months in the ZOI. Estimates are shown for all children, as well as by child sex and age categories, primary caregiver’s educational attainment, gendered household type, wealth quintile, poverty status, and severity of shock exposure.

Overall, 38.1 percent of children 6–23 months of age received a MAD. There is not a large difference in receiving a MAD between male and female children. More older children received a MAD (48.6 percent for children 18–23 months) than younger children (22.0 percent for 6–11 months). The share of children receiving a MAD is significantly associated with their caregiver’s educational status: 40.8 percent of children with caregivers that completed primary education received a MAD while just 23.7 percent of children received a MAD with caregivers that have no education. More children from M&F households (39.0 percent) received a MAD than from FNM households (32.2 percent). More children in non-poor households received a MAD (42.2 percent) than those in poor households (10.4 percent). Finally, SEI was significantly associated with MAD. 56.7 percent of children in households that did not experience shocks received a MAD compared to 30.2 percent of children in households with high severity of shock exposure.

The strongest associations between children receiving a MAD and child, caregiver, and household characteristics are child age, poverty status, caregiver education and SEI score, followed by wealth quintile.

**Table 8.3.2: Percent of children 6–23 months of age in the ZOI who received a minimum acceptable diet, in total and by selected child, caregiver, and household characteristics**

| Characteristic                         | Percent | Sig. <sup>a</sup> | Number of children <sup>b</sup> |
|----------------------------------------|---------|-------------------|---------------------------------|
| <b>All children 6–23 months of age</b> | 38.1    |                   | 284                             |
| <b>Child sex</b>                       |         | n/s               | 284                             |
| Male                                   | 38.3    |                   | 154                             |

<sup>184</sup> The seven food groups for breastfed children are as follows: (1) grains, roots, and tubers; (2) legumes and nuts; (3) dairy products (milk, yogurt, cheese); (4) flesh foods (meat, fish, poultry, and liver or organ meats); (5) eggs; (6) vitamin-A rich fruits and vegetables; and (7) other fruits and vegetables.

<sup>185</sup> The six food groups for non-breastfed children are the same as for breastfed children, excluding dairy products (milk, yogurt, cheese).

<sup>186</sup> WHO, 2018c.

| Characteristic                         | Percent | Sig. <sup>a</sup> | Number of children <sup>b</sup> |
|----------------------------------------|---------|-------------------|---------------------------------|
| Female                                 | 37.8    |                   | 130                             |
| <b>Child age</b>                       |         | **                | 284                             |
| 6–11 months                            | 22.0    |                   | 90                              |
| 12–17 months                           | 40.6    |                   | 75                              |
| 18–23 months                           | 48.6    |                   | 119                             |
| <b>Child breastfeeding status</b>      |         | -                 | 268                             |
| Breastfed                              | 40.4    |                   | 268                             |
| Not breastfed                          | -       |                   | 0                               |
| <b>Caregiver education<sup>c</sup></b> |         | **                | 284                             |
| No education                           | 23.7    |                   | 64                              |
| Less than primary                      | 28.7    |                   | 67                              |
| Completed primary                      | 40.8    |                   | 108                             |
| Completed secondary                    | ^       |                   | 29                              |
| Higher                                 | ^       |                   | 16                              |
| <b>Gendered household type</b>         |         | n/s               | 284                             |
| Male and female adults                 | 39.0    |                   | 245                             |
| Female adults only                     | 32.2    |                   | 39                              |
| Male adults only                       | -       |                   | 0                               |
| Children only, no adults               | -       |                   | 0                               |
| <b>Wealth quintile</b>                 |         | *                 | 284                             |
| Highest (wealthiest)                   | 49.2    |                   | 47                              |
| Fourth                                 | 47.3    |                   | 60                              |
| Middle                                 | 30.8    |                   | 60                              |
| Second                                 | 43.8    |                   | 45                              |
| Lowest (poorest)                       | 23.6    |                   | 72                              |
| <b>Poverty status</b>                  |         | **                | 278                             |
| Poor                                   | 10.4    |                   | 39                              |
| Non-poor                               | 42.2    |                   | 239                             |
| <b>Shock exposure index</b>            |         | **                | 284                             |
| Did not experience any shocks          | 56.7    |                   | 65                              |
| Low                                    | 44.1    |                   | 84                              |
| Moderate                               | 19.0    |                   | 70                              |
| High                                   | 30.2    |                   | 65                              |
| <b>Ecological zone</b>                 |         | n/s               | 284                             |
| Hill                                   | 38.6    |                   | 157                             |
| Terai                                  | 38.7    |                   | 124                             |
| Mountain                               | ^       |                   | 3                               |

^ Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Records missing information for the disaggregate variables have been excluded from the disaggregated estimates. The unweighted sample size reflects this loss in observations; therefore, the sum of disaggregate sample sizes may not equal the overall sample size.

<sup>c</sup> The ZOI Survey identifies the primary caregiver of each age-eligible child. This person is likely, but not necessarily, the child's biological mother.

Note: Estimates are based on de facto household members.

Source: Feed the Future Nepal ZOI Survey 2019

**Table 8.3.3** presents the percentage of children achieving the components of a MAD (minimum meal frequency and minimum dietary diversity) and consuming each of the food groups included in the minimum dietary diversity indicator. Estimates are shown for all children, as well as by age categories, and are presented separately for breastfed and non-breastfed children.

Non-breastfed children were considered to have met minimum dietary diversity standards if they met the following requirements:

- 1) Consumed foods from at least four of the six applicable food groups (grains, roots, and tubers; legumes and nuts; flesh foods; eggs; vitamin-A rich fruits and vegetables; other fruits and vegetables); and
- 2) Met minimum meal frequency criteria, defined as four or more feedings of solid, semi-solid, soft food, or milk feeds for children 6–23 months of age, and at least two of these feedings must have been milk feeds.

Overall, 78.7 percent of children 6–23 months of age achieved minimum meal frequency and 41.6 percent achieved minimum dietary diversity. A majority of children consumed grains, roots, and tubers, legumes and nuts, and dairy products. Less than 50 percent of children consumed vitamin-A rich fruits and vegetables and other fruits and vegetables. Relatively few children (less than 20 percent) consumed flesh foods or eggs. This pattern is generally consistent across age groups, with older children achieving greater dietary diversity overall than younger children. 22.0 percent of children 6–11 months of age achieved minimum dietary diversity, compared to 54.9 percent of children 18–23 months of age. When disaggregated by breastfeeding status, there is a small increase in the percentage of children 6–23 months of age that achieved minimum meal frequency (83.4 percent) or achieved minimum dietary diversity (44.2 percent) if they were breastfed, compared to all children. Values for non-breastfed children are not reported due to the small sample size.

**Table 8.3.3: Percent of children 6–23 months of age in the ZOI achieving minimum feeding frequency, dietary diversity, and consuming foods from each of the food groups in the minimum acceptable diet indicator, in total and by breastfeeding status and age**

| Breastfeeding status and food group consumed <sup>187</sup> | All children | Child age (months) |       |       |                   |
|-------------------------------------------------------------|--------------|--------------------|-------|-------|-------------------|
|                                                             |              | 6–11               | 12–17 | 18–23 | Sig. <sup>a</sup> |
| All children 6–23 months of age                             |              |                    |       |       |                   |
| Achieving minimum meal frequency                            | 78.7         | 76.2               | 82.4  | 78.3  | n/s               |
| Achieving minimum dietary diversity                         | 41.6         | 22.0               | 44.1  | 54.9  | ***               |
| Consuming:                                                  |              |                    |       |       |                   |
| Grains, roots, and tubers                                   | 94.7         | 89.6               | 93.9  | 98.9  | n/s               |
| Legumes and nuts                                            | 72.9         | 61.0               | 74.9  | 79.8  | *                 |
| Dairy products                                              | 52.6         | 47.1               | 52.8  | 56.5  | n/s               |
| Flesh foods <sup>b</sup>                                    | 18.4         | 12.9               | 14.1  | 24.8  | n/s               |
| Eggs                                                        | 15.8         | 11.1               | 10.6  | 22.1  | n/s               |
| Vitamin A-rich fruits and vegetables                        | 43.5         | 26.3               | 49.7  | 51.6  | **                |
| Other fruits and vegetables                                 | 46.5         | 31.1               | 47.8  | 56.3  | **                |
| Number of children                                          | 284          | 90                 | 75    | 119   |                   |
| Breastfed children                                          |              |                    |       |       |                   |
| Achieving minimum meal frequency                            | 83.4         | 76.2               | 86.4  | 87.5  | n/a               |
| Achieving minimum dietary diversity                         | 44.2         | 22.0               | 46.3  | 61.4  | ***               |
| Consuming:                                                  |              |                    |       |       |                   |
| Grains, roots, and tubers                                   | 94.4         | 89.6               | 93.6  | 98.8  | n/s               |

<sup>187</sup> Non-breastfed children are not included in this table, as there were none in the sample.

| Breastfeeding status and food group consumed <sup>187</sup> | All children | Child age (months) |           |            |                   |
|-------------------------------------------------------------|--------------|--------------------|-----------|------------|-------------------|
|                                                             |              | 6–11               | 12–17     | 18–23      | Sig. <sup>a</sup> |
| Legumes and nuts                                            | 72.7         | 61.0               | 76.3      | 79.5       | *                 |
| Dairy products                                              | 50.8         | 47.1               | 50.5      | 54.2       | n/s               |
| Flesh foods <sup>b</sup>                                    | 18.0         | 12.9               | 14.9      | 24.0       | n/s               |
| Eggs                                                        | 16.2         | 11.1               | 9.9       | 24.0       | *                 |
| Vitamin A-rich fruits and vegetables                        | 43.4         | 26.3               | 48.3      | 53.5       | **                |
| Other fruits and vegetables                                 | 46.3         | 31.1               | 47.6      | 57.1       | *                 |
| <b>Number of breastfed children</b>                         | <b>268</b>   | <b>90</b>          | <b>72</b> | <b>106</b> |                   |

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables.

Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> This category may include organ meats and insects.

Note: Estimates are based on de facto household members.

Source: Feed the Future Nepal ZOI Survey 2019

## 9. NUTRITIONAL STATUS OF WOMEN AND CHILDREN

This chapter presents findings for the Feed the Future ZOI indicators related to the nutrition of women and children: the percentage of women of reproductive age who are underweight, and the percentages of children under five years of age who are stunted or wasted, and who are of healthy weight.

### 9.1 Body mass index of women age 15–49 years

Body mass index (BMI) is a calculation used to understand nutritional status, particularly of adults. BMI is the weight of the individual in kilograms divided by their height in meters squared:  $\text{weight (kg)} / \text{height (m)}^2$ . BMI is an inexpensive and easy-to-perform method of screening for weight category: underweight, normal or healthy weight, overweight, and obese. BMI is interpreted directly using categories with specific cut-off points, which is useful when assessing the nutritional status of adults. A high BMI can be an indicator of high body fat, but BMI is not a diagnostic for body fat or the health of an individual. To determine whether a high BMI is a health risk, a healthcare provider would need to perform further assessments.

**Table 9.1** presents women's mean BMI and the percentage of women who fall into each BMI category: underweight ( $\text{BMI} < 18.5$ ), normal weight ( $18.5 \leq \text{BMI} < 25.0$ ), overweight ( $25.0 \leq \text{BMI} < 30.0$ ), and obese ( $\text{BMI} \geq 30.0$ ). Estimates are shown for all non-pregnant women of reproductive age (15–49 years of age), as well as disaggregated by individual and household-level characteristics. Individual characteristics include age and educational attainment. Household characteristics include gendered household type, household educational attainment, wealth quintile, poverty status, and severity of shock exposure.

The average BMI for all women is 22.1, which falls in the normal weight range. 17.6 percent of women are underweight, 61.0 percent of women are normal weight, 17.3 percent of women are overweight, and 4.1 percent of women are obese. Women 35 to 39 years of age have the highest average BMI (23.9), while women aged 15 to 19 have the lowest average BMI (20.0). Age is significantly associated with underweight status: 31.3 percent of women aged 15 to 19 are underweight, which is a significantly higher percentage than all other age groups. Most women, regardless of age, are normal weight. More women aged 35 to 39 are overweight or obese than any other age range (27.8 and 9.8 percent, respectively).

BMI is fairly stable across women of varied education levels and education is not significantly associated with underweight status. Most women at each education level are normal weight. More women with less than a primary school education are overweight than compared to any other education level (22.9 percent).

BMI does not significantly differ for women in FNM households than for women in M&F households, and gendered household type is not significantly associated with underweight status. The majority of women, regardless of gendered household type, are at a normal weight. More women in FNM households are overweight or obese than any other gendered household type (18.8 and 5.2 percent, respectively).

Wealth quintile and poverty status are also not significantly associated with underweight status. More non-poor women are overweight or obese than poor women. 17.6 percent of non-poor women are



overweight, while only 11.1 percent of poor women are overweight. 4.4 percent of non-poor women are obese, while no poor women in the sample are obese.

Shock exposure is significantly associated with underweight status. More women who experienced moderate or high shocks are underweight (23.2 and 21.3 percent, respectively) than are women who did not experience any shocks or experienced a low number of shocks (12.4 and 14.3 percent, respectively). Average BMI is directly related to experiences with shocks, with the highest average BMI occurring among women who did not experience any shocks (23.1) and the lowest average BMI among women who experienced the highest number of shocks (21.3). More women who did not experience any shocks or experienced a low number of shocks are overweight (21.2 and 17.5 percent, respectively) or obese (6.3 and 5.0 percent, respectively) than are women who experienced moderate or high shocks.

Lastly, ecological zone is also significantly associated with underweight status: 22.0 percent of women in the terai zones are underweight, compared to 14.0 percent in the hill zones and 6.5 percent in the mountain zones. 31.2 percent of women in the mountain zones are overweight, compared to just 17.4 percent in the terai zones and 16.4 percent in the hill zones. The prevalence of obese women is relatively low across all three zones.

**Table 9.1: Mean BMI and prevalence of underweight, normal weight, overweight, and obese women of reproductive age in the ZOI, in total and by selected woman and household characteristics**

| Characteristic                             | Mean BMI | BMI category    |                   |                   |                 | Number of women <sup>b</sup> |           |
|--------------------------------------------|----------|-----------------|-------------------|-------------------|-----------------|------------------------------|-----------|
|                                            |          | Underweight (%) | Sig. <sup>a</sup> | Normal weight (%) | Over-weight (%) |                              | Obese (%) |
| All non-pregnant women of reproductive age | 22.1     | 17.6            |                   | 61.0              | 17.3            | 4.1                          | 1,906     |
| Age                                        |          |                 | ***               |                   |                 |                              | 1,906     |
| 15–19                                      | 20.0     | 31.3            |                   | 64.7              | 3.4             | 0.7                          | 283       |
| 20–24                                      | 21.1     | 24.0            |                   | 61.5              | 12.1            | 2.5                          | 294       |
| 25–29                                      | 22.5     | 14.3            |                   | 63.4              | 18.3            | 3.9                          | 341       |
| 30–34                                      | 22.9     | 9.5             |                   | 64.3              | 22.0            | 4.1                          | 328       |
| 35–39                                      | 23.9     | 9.0             |                   | 53.4              | 27.8            | 9.8                          | 286       |
| 40–44                                      | 22.9     | 10.2            |                   | 59.3              | 24.7            | 5.7                          | 208       |
| 45–49                                      | 22.7     | 16.6            |                   | 56.6              | 23.1            | 3.7                          | 166       |
| Education                                  |          |                 | n/s               |                   |                 |                              | 1,904     |
| No education                               | 22.0     | 16.2            |                   | 63.9              | 16.3            | 3.6                          | 647       |
| Less than primary                          | 22.6     | 17.1            |                   | 54.4              | 22.9            | 5.6                          | 393       |
| Completed primary                          | 21.8     | 20.1            |                   | 59.8              | 16.8            | 3.3                          | 609       |
| Completed secondary                        | 22.0     | 14.6            |                   | 67.2              | 13.7            | 4.4                          | 148       |
| Higher                                     | 22.4     | 17.0            |                   | 65.2              | 11.9            | 5.9                          | 107       |
| Gendered household type                    |          |                 | n/s               |                   |                 |                              | 1,906     |
| Male and female adults                     | 22.0     | 17.7            |                   | 61.4              | 17.0            | 3.9                          | 1,524     |
| Female adults only                         | 22.4     | 17.4            |                   | 58.7              | 18.8            | 5.2                          | 375       |
| Male adults only                           | ^        | ^               |                   | ^                 | ^               | ^                            | 5         |
| Children only, no adults                   | ^        | ^               |                   | ^                 | ^               | ^                            | 2         |
| Wealth quintile                            |          |                 | n/s               |                   |                 |                              | 1,906     |

| Characteristic                | Mean BMI | BMI category    |                   |                   |                 |           | Number of women <sup>b</sup> |
|-------------------------------|----------|-----------------|-------------------|-------------------|-----------------|-----------|------------------------------|
|                               |          | Underweight (%) | Sig. <sup>a</sup> | Normal weight (%) | Over-weight (%) | Obese (%) |                              |
| Highest (wealthiest)          | 23.3     | 13.9            |                   | 53.0              | 25.3            | 7.9       | 386                          |
| Fourth                        | 22.2     | 19.2            |                   | 57.9              | 19.0            | 3.8       | 387                          |
| Middle                        | 21.7     | 20.7            |                   | 60.6              | 14.6            | 4.1       | 388                          |
| Second                        | 21.8     | 14.7            |                   | 66.3              | 16.8            | 2.2       | 363                          |
| Lowest (poorest)              | 20.9     | 19.7            |                   | 71.0              | 8.1             | 1.2       | 382                          |
| Poverty status                |          |                 | n/s               |                   |                 |           | 1,867                        |
| Poor                          | 20.8     | 22.1            |                   | 66.8              | 11.1            | 0.0       | 162                          |
| Non-poor                      | 22.2     | 17.3            |                   | 60.7              | 17.6            | 4.4       | 1,705                        |
| Shock exposure index          |          |                 | **                |                   |                 |           | 1,898                        |
| Did not experience any shocks | 23.1     | 12.4            |                   | 60.2              | 21.2            | 6.3       | 430                          |
| Low                           | 22.4     | 14.3            |                   | 63.3              | 17.5            | 5.0       | 554                          |
| Moderate                      | 21.4     | 23.2            |                   | 58.0              | 15.6            | 3.2       | 439                          |
| High                          | 21.3     | 21.3            |                   | 61.9              | 15.2            | 1.7       | 475                          |
| Ecological zone               |          |                 | ***               |                   |                 |           | 1,906                        |
| Hill                          | 22.2     | 14.0            |                   | 65.1              | 16.4            | 4.5       | 1,028                        |
| Terai                         | 21.8     | 22.0            |                   | 57.1              | 17.4            | 3.6       | 827                          |
| Mountain                      | 23.5     | 6.5             |                   | 56.7              | 31.2            | 5.7       | 51                           |

<sup>a</sup> Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Records missing information for the disaggregate variables have been excluded from the disaggregated estimates. The unweighted sample size reflects this loss in observations; therefore, the sum of disaggregate sample sizes may not equal the overall sample size.

Note: Estimates are based on de facto household members.

Source: Feed the Future Nepal ZOI Survey 2019

## 9.2 Stunting, wasting, and healthy weight among children under 5 years of age

This section reports on three anthropometric measurements of nutrition among children under five years of age in the ZOI: stunting (low height-for-age), wasting (low weight-for-height), and healthy weight (appropriate weight-for-height) children.

### 9.2.1 Stunting (low height-for-age)

Stunting, or linear growth retardation, is a consequence of an inadequate growth environment. Reducing the prevalence of stunting among children, particularly children 0–23 months of age, is important because linear growth retardation is causally linked to difficult birth and poor birth outcomes and is associated with, but may not cause, delayed child development, reduced earnings in adulthood, and chronic diseases.<sup>188</sup> Stunting is a height-for-age measurement that reflects chronic undernutrition. This indicator measures the percentage of children 0–59 months of age with a height-for-age z-score more than two standard deviations (SDs) below the median of the 2006 WHO Child Growth Standard.<sup>189</sup>

**Table 9.2.1** shows the prevalence of severe stunting (<-3 SD) and stunting (<-2 SD) and mean height-for-age z-scores for children under five years of age in the ZOI. Estimates are presented for all children

<sup>188</sup> Leroy & Frongillo, 2019.

<sup>189</sup> WHO, 2006.

and by child, caregiver, and household characteristics. Children's characteristics include sex and age. Caregivers' characteristics include educational attainment. Household characteristics include gendered household type, wealth quintile, poverty status, severity of shock exposure, and ecological zone.

On average, 7.0 percent of children under five are severely stunted, and 26.7 percent are stunted. Children under five have a mean z-score of -1.1. Child sex is not significantly associated with stunting.

Child age is significantly associated with stunting: 33.4 percent of children aged 48 to 59 months are stunted; 32.7 percent of children aged 36 to 47 months are stunted; 30.6 percent of children aged 24 to 35 months are stunted; 27.9 percent of children aged 12 to 23 months old are stunted; and only 6.5 percent of children aged 0 to 11 months old are stunted. Similarly, average z-scores decrease as age increases.

Caregiver education is also significantly associated with stunting. More caregivers with no education have children who are severely stunted or stunted (12.1 and 35.9 percent, respectively) than caregivers with a higher education status (3.7 and 24.5 percent). While children of caregivers with no education and less than a primary school education have the lowest z-scores, the scores become more mixed as the level of education increases. Children of caregivers who completed primary school and caregivers with a higher education have z-scores of -1.0 and -1.1, respectively.

Wealth quintiles are significantly associated with stunting. A higher percentage of the poorest households have children who are severely stunted or stunted (10.8 and 35.0 percent, respectively) than those in higher wealth quintiles. Similarly, the average z-score is significantly lower for children in households in the lowest wealth quintile. The average z-score for children in the lowest wealth quintile is 0.3 less than the overall average. Poverty status is also significantly associated with stunting. 13.1 percent of children in poor households are stunted, compared to 6.3 percent in non-poor households. Children from poor households also have a lower average z-score than children from non-poor households.

Lastly, shock severity is associated with stunting as well: households that experienced moderate or high shocks are more likely to have stunted or severely stunted children than households who experienced no or low shocks. Higher numbers of shocks are also associated with lower z-scores. Households who experienced the highest number of shocks have an average z-score of -1.4, while households who experienced no or low shocks have an average z-score of -0.9.

**Table 9.2.1: Prevalence of stunting and mean height-for-age z-scores among children under five years of age in the ZOI, in total and by selected child, caregiver, and household characteristics**

| Characteristic                              | Severely stunted (<-3 SD) (%) | Stunted (<-2 SD) |                   |                | Mean z-score |                |
|---------------------------------------------|-------------------------------|------------------|-------------------|----------------|--------------|----------------|
|                                             |                               | (%)              | Sig. <sup>a</sup> | n <sup>b</sup> | Est.         | n <sup>c</sup> |
| <b>All children under five years of age</b> | 7.0                           | 26.7             |                   | 1,016          | -1.1         | 1,016          |
| <b>Child sex</b>                            |                               |                  | n/s               | 1,016          |              | 1,016          |
| Male                                        | 8.6                           | 28.2             |                   | 533            | -1.1         | 533            |
| Female                                      | 5.3                           | 25.0             |                   | 483            | -1.1         | 483            |
| <b>Child age</b>                            |                               |                  | ***               | 1,016          |              | 1,016          |
| 0–11 months                                 | 2.2                           | 6.5              |                   | 190            | 0.0          | 190            |
| 12–23 months                                | 4.6                           | 27.9             |                   | 193            | -1.1         | 193            |
| 24–35 months                                | 11.3                          | 30.6             |                   | 209            | -1.3         | 209            |
| 36–47 months                                | 9.3                           | 32.7             |                   | 213            | -1.5         | 213            |
| 48–59 months                                | 6.9                           | 33.4             |                   | 211            | -1.5         | 211            |
| <b>Caregiver education<sup>d</sup></b>      |                               |                  | ***               | 1,016          |              | 1,016          |
| No education                                | 12.1                          | 35.9             |                   | 289            | -1.3         | 289            |
| Less than primary                           | 7.7                           | 28.8             |                   | 237            | -1.2         | 237            |
| Completed primary                           | 4.2                           | 20.3             |                   | 354            | -1.0         | 354            |
| Completed secondary                         | 3.5                           | 21.2             |                   | 82             | -0.7         | 82             |
| Higher                                      | 3.7                           | 24.5             |                   | 54             | -1.1         | 54             |
| <b>Gendered household type</b>              |                               |                  | n/s               | 1,016          |              | 1,016          |
| Male and female adults                      | 7.0                           | 25.8             |                   | 847            | -1.0         | 847            |
| Female adults only                          | 6.7                           | 31.1             |                   | 166            | -1.4         | 166            |
| Male adults only                            | ^                             | ^                |                   | 3              | ^            | 3              |
| Children only, no adults                    | -                             | -                |                   | 0              | -            | 0              |
| <b>Wealth quintile</b>                      |                               |                  | *                 | 1,016          |              | 1,016          |
| Highest (wealthiest)                        | 3.4                           | 19.9             |                   | 165            | -0.8         | 165            |
| Fourth                                      | 8.4                           | 25.3             |                   | 196            | -1.1         | 196            |
| Middle                                      | 7.8                           | 25.0             |                   | 207            | -1.1         | 207            |
| Second                                      | 3.1                           | 26.1             |                   | 185            | -1.0         | 185            |
| Lowest (poorest)                            | 10.8                          | 35.0             |                   | 263            | -1.4         | 263            |
| <b>Poverty status</b>                       |                               |                  | **                | 995            |              | 995            |
| Poor                                        | 13.1                          | 38.6             |                   | 151            | -1.4         | 151            |
| Non-poor                                    | 6.3                           | 24.9             |                   | 844            | -1.1         | 844            |
| <b>Shock exposure index</b>                 |                               |                  | ***               | 1,015          |              | 1,015          |
| Did not experience any shocks               | 4.0                           | 22.4             |                   | 223            | -0.9         | 223            |
| Low                                         | 3.8                           | 18.7             |                   | 274            | -0.9         | 274            |
| Moderate                                    | 8.2                           | 29.2             |                   | 246            | -1.2         | 246            |
| High                                        | 12.1                          | 36.8             |                   | 272            | -1.4         | 272            |
| <b>Ecological zone</b>                      |                               |                  | n/s               | 1,016          |              | 1,016          |
| Hill                                        | 7.0                           | 28.1             |                   | 563            | -1.2         | 563            |
| Terai                                       | 7.2                           | 25.4             |                   | 432            | -1.0         | 432            |
| Mountain                                    | ^                             | ^                |                   | 21             | ^            | 21             |

^ Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Prevalence of stunting excludes children with z-score measured at more than six SDs from the mean.

<sup>c</sup> Records missing information for the disaggregate variables have been excluded from the disaggregated estimates. The unweighted sample size reflects this loss in observations; therefore, the sum of disaggregate sample sizes may not equal the overall sample size.

<sup>d</sup> The ZOI Survey identifies the primary caregiver of each age-eligible child. This person is likely, but not necessarily, the child's biological mother.

Note: Estimates are based on de facto household members.

Source: Feed the Future Nepal ZOI Survey 2019

### 9.2.2 Wasting (low weight-for-height) and healthy weight

Wasting is an indicator of acute malnutrition. Children who are wasted are too thin for their height and have a much greater risk of dying than children who are not wasted. The wasting ZOI indicator measures the percentage of children 0–59 months of age who are acutely malnourished, as defined by a weight-for-height z-score more than two SDs below the median of the 2006 WHO Child Growth Standard, in the ZOI.<sup>190</sup> The z-score indicates how many SDs the child is from the median weight-for-height for a child of the same sex and age using the 2006 WHO Child Growth Standards.<sup>191</sup>

A complementary indicator to the wasting indicator is the healthy weight indicator, which measures the percentage of children 0–59 months who are neither wasted nor overweight, as defined by a weight-for-height z-score between two SDs below the median and two SDs above the median of the 2006 WHO Child Growth Standard. Prevalence of children with a healthy weight is a measure of a well-nourished population, which is essential to enhance human potential, health, and productivity.

**Table 9.2.2** shows the prevalence of severe wasting ( $<-3$  SD), wasting ( $<-2$  SD), healthy weight ( $\geq -2$  SD and  $\leq +2$  SD), overweight ( $>+2$  SD), and obesity ( $>+3$  SD), and mean weight-for-height z-scores for children under five years of age in the ZOI. Estimates are presented for all children and by child, caregiver, and household characteristics. Children's characteristics include sex and age. Caregivers' characteristics include educational attainment. Household characteristics include gendered household type, wealth quintile, poverty status, severity of shock exposure, and ecological zone.

The vast majority of children (86.6 percent) are at a healthy weight. There are no statistically significant differences between male and female children among all weight groups or age categories.

12.5 percent of children are wasted. The relationship between wasting and education of the caregiver is mixed, and there is no significant association between either wasting or healthy weight status and caregiver education. Gendered household type, poverty status, and shock exposure do not show significant association with wasting or healthy weight status.

Ecological zone is significantly associated with both wasting and healthy weight status. 19.3 percent of children in terai zones are wasted, compared to just 7.0 percent in hill zones. Conversely, 80.4 percent of children in terai zones are of healthy weight, compared to 91.7 percent in hill zones.

<sup>190</sup> A weight-for-length z-score is calculated for children 0–23 months of age and any other children who are measured lying down. A weight-for-height z-score is calculated for children 24–59 months of age who are measured standing up.

<sup>191</sup> WHO, 2006.

**Table 9.2.2: Prevalence of wasting and healthy weight and mean weight-for-height z-scores among children under five years of age in the ZOI, in total and by selected child, caregiver, and household characteristics**

| Characteristic                              | Severely wasted<br>( $<-3$ SD) (%) | Wasted<br>( $<-2$ SD)<br>(%) | Sig. <sup>a</sup> | Healthy weight<br>( $-2$ to $+2$ SD)<br>(%) | Sig. <sup>a</sup> | Overweight<br>( $> +2$ SD)<br>(%) | Obese<br>( $> +3$ SD)<br>(%) | Mean<br>z-score | Number<br>of children <sup>b</sup> |
|---------------------------------------------|------------------------------------|------------------------------|-------------------|---------------------------------------------|-------------------|-----------------------------------|------------------------------|-----------------|------------------------------------|
| <b>All children under five years of age</b> | 2.7                                | 12.5                         |                   | 86.6                                        |                   | 0.9                               | 0.3                          | -0.8            | 1,009                              |
| <b>Child sex</b>                            |                                    |                              | n/s               |                                             | n/s               |                                   |                              |                 | 1,009                              |
| Male                                        | 2.3                                | 12.3                         |                   | 86.2                                        |                   | 1.5                               | 0.5                          | -0.8            | 528                                |
| Female                                      | 3.0                                | 12.7                         |                   | 87.1                                        |                   | 0.2                               | 0.0                          | -0.9            | 481                                |
| <b>Child age</b>                            |                                    |                              | n/s               |                                             | n/s               |                                   |                              |                 | 1,009                              |
| 0–11 months                                 | 3.9                                | 14.5                         |                   | 83.5                                        |                   | 2.0                               | 1.5                          | -0.6            | 184                                |
| 12–23 months                                | 4.7                                | 16.5                         |                   | 83.5                                        |                   | 0.0                               | 0.0                          | -1.1            | 194                                |
| 24–35 months                                | 3.1                                | 14.2                         |                   | 84.8                                        |                   | 1.0                               | 0.0                          | -0.9            | 208                                |
| 36–47 months                                | 0.5                                | 7.0                          |                   | 92.0                                        |                   | 1.0                               | 0.0                          | -0.8            | 212                                |
| 48–59 months                                | 1.4                                | 10.8                         |                   | 88.7                                        |                   | 0.5                               | 0.0                          | -0.9            | 211                                |
| <b>Caregiver education<sup>c</sup></b>      |                                    |                              | n/s               |                                             | n/s               |                                   |                              |                 | 1,009                              |
| No education                                | 3.8                                | 13.1                         |                   | 86.9                                        |                   | 0.0                               | 0.0                          | -1.0            | 287                                |
| Less than primary                           | 2.9                                | 16.1                         |                   | 83.3                                        |                   | 0.5                               | 0.0                          | -0.9            | 235                                |
| Completed primary                           | 1.5                                | 9.7                          |                   | 89.6                                        |                   | 0.7                               | 0.2                          | -0.8            | 353                                |
| Completed secondary                         | 3.8                                | 14.5                         |                   | 81.0                                        |                   | 4.5                               | 0.9                          | -0.7            | 81                                 |
| Higher                                      | 1.5                                | 9.5                          |                   | 88.6                                        |                   | 2.0                               | 2.0                          | -0.5            | 53                                 |
| <b>Gendered household type</b>              |                                    |                              | n/s               |                                             | n/s               |                                   |                              |                 | 1,009                              |
| Male and female adults                      | 2.8                                | 12.9                         |                   | 86.0                                        |                   | 1.1                               | 0.3                          | -0.8            | 840                                |
| Female adults only                          | 1.9                                | 9.8                          |                   | 90.2                                        |                   | 0.0                               | 0.0                          | -0.9            | 166                                |
| Male adults only                            | ^                                  | ^                            |                   | ^                                           |                   | ^                                 | ^                            | ^               | 3                                  |
| Children only, no adults                    | ^                                  | ^                            |                   | ^                                           |                   | ^                                 | ^                            | ^               | 0                                  |
| <b>Poverty status</b>                       |                                    |                              | n/s               |                                             | n/s               |                                   |                              |                 | 988                                |
| Poor                                        | 1.9                                | 10.2                         |                   | 89.8                                        |                   | 0.0                               | 0.0                          | -0.9            | 149                                |
| Non-poor                                    | 2.8                                | 12.8                         |                   | 86.2                                        |                   | 1.0                               | 0.3                          | -0.8            | 839                                |
| <b>Wealth quintile</b>                      |                                    |                              | n/s               |                                             | *                 |                                   |                              |                 | 1,009                              |
| Highest (wealthiest)                        | 5.0                                | 14.5                         |                   | 84.5                                        |                   | 1.0                               | 0.0                          | -1.0            | 164                                |
| Fourth                                      | 1.9                                | 15.5                         |                   | 84.0                                        |                   | 0.5                               | 0.5                          | -1.0            | 193                                |
| Middle                                      | 2.4                                | 15.6                         |                   | 82.0                                        |                   | 2.5                               | 0.4                          | -0.9            | 205                                |

| Characteristic                | Severely wasted<br>(<-3 SD) (%) | Wasted<br>(<-2 SD) |                   | Healthy weight<br>(-2 to +2 SD) |                   | Overweight<br>(> +2SD)<br>(%) | Obese<br>(> +3SD)<br>(%) | Mean<br>z-score | Number<br>of children <sup>b</sup> |
|-------------------------------|---------------------------------|--------------------|-------------------|---------------------------------|-------------------|-------------------------------|--------------------------|-----------------|------------------------------------|
|                               |                                 | (%)                | Sig. <sup>a</sup> | (%)                             | Sig. <sup>a</sup> |                               |                          |                 |                                    |
| Second                        | 3.2                             | 9.2                |                   | 90.8                            |                   | 0.0                           | 0.0                      | -0.7            | 186                                |
| Lowest (poorest)              | 1.4                             | 8.0                |                   | 91.7                            |                   | 0.3                           | 0.3                      | -0.7            | 261                                |
| <b>Shock exposure index</b>   |                                 |                    | n/s               |                                 | n/s               |                               |                          |                 | 1,008                              |
| Did not experience any shocks | 2.2                             | 7.7                |                   | 90.0                            |                   | 2.4                           | 0.5                      | -0.6            | 224                                |
| Low                           | 2.9                             | 12.7               |                   | 86.4                            |                   | 0.9                           | 0.3                      | -0.8            | 272                                |
| Moderate                      | 2.8                             | 15.8               |                   | 84.2                            |                   | 0.0                           | 0.0                      | -1.1            | 243                                |
| High                          | 2.6                             | 13.6               |                   | 86.1                            |                   | 0.3                           | 0.3                      | -0.9            | 269                                |
| <b>Ecological zone</b>        |                                 |                    | ***               |                                 | ***               |                               |                          |                 | 1,009                              |
| Hill                          | 1.7                             | 7.0                |                   | 91.7                            |                   | 1.3                           | 0.4                      | -0.6            | 561                                |
| Terai                         | 3.6                             | 19.3               |                   | 80.4                            |                   | 0.4                           | 0.2                      | -1.1            | 427                                |
| Mountain                      | ^                               | ^                  |                   | ^                               |                   | ^                             | ^                        | ^               | 21                                 |

^ Results not statistically reliable, n<30

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Records missing information for the disaggregate variables have been excluded from the disaggregated estimates. The unweighted sample size reflects this loss in observations; therefore, the sum of disaggregate sample sizes may not equal the overall sample size.

<sup>c</sup> The ZOI Survey identifies the primary caregiver of each age-eligible child. This person is likely, but not necessarily, the child's biological mother.

Note: Estimates are based on de facto household members.

Source: Feed the Future Nepal ZOI Survey 2019

## SUMMARY AND CONCLUSIONS

This report presents the findings of the 2019 Feed the Future Nepal ZOI Survey (Phase 2 Baseline), implemented by Social Impact. The report establishes baseline values for 20 goal-level performance indicators measuring hunger, malnutrition, poverty, resilience and shock exposure, and agricultural production. The report also establishes baseline values for a suite of Nepal-specific indicators measuring migration and remittances, access to markets, water use and management, education, and food security linkages with forests. In Nepal, a local research organization, New ERA, conducted the ZOI Survey fieldwork, with direction and oversight from Social Impact. The fieldwork took place from May through August of 2019, with a total of 2,481 households interviewed.

### Demographic characteristics in the ZOI

At baseline, the average household size was 4.4 individuals. Gendered household type was significantly associated with household size, with M&F households having substantially more individuals on average than other household types. Within households, 60 percent of adults were female and 40 percent were male. Approximately three-quarters of households were considered small, with between one and five members, and roughly two-thirds of households had completed primary education or above.

Gender was significantly associated with the age of primary adult decision-makers. Female primary decision-makers were slightly younger than male primary decision-makers. Over 90 percent of both female and male decision-makers were married at baseline. Men were more educated than women, and gender was significantly associated with educational attainment. Finally, significantly more women than men participated in some form of economic activity, at 90.3 percent and 87.2 percent, respectively.

Most children and youth aged five to 24 were not attending school at the time of the survey, likely because data collection coincided with school holidays. Completion of primary education among individuals ten years of age or older ranged from about two to 26 percent, based on age group. Sex was significantly associated with attendance and completion rates.

71.9 percent of households used solid cooking fuel at baseline, and 56.1 percent had access to electricity. The mean number of persons per sleeping room was 2.0, and a plurality of households had finished roofs, natural walls, and natural floors. These values varied significantly by residence. 78.4 percent of households had a regularly available improved water source, and only 16.6 percent of households used correct water treatment practices or technologies. 73.5 percent of households had access to a basic sanitation service, while 6.4 percent of households practiced open defecation. Finally, only slightly more than half of households had soap and water at a handwashing station within their homes.

### Household economic status

The survey measured monetary poverty in Nepal according to the prevalence of poverty, the depth of poverty, the prevalence of “near-poor” households, and wealth indices. When measured at the \$1.90 2011 PPP poverty threshold, 9.2 percent of households lived below the poverty line. Additionally, the depth of poverty of the poor was 19.9 percent of the poverty line. Thus, the average poor person in the ZOI lives at 80.1 percent of the poverty line, and his or her average consumption is \$1.52 per day (2011



PPP).<sup>192</sup> Lastly, 10.9 percent of individuals in the ZOI lived at or above the \$1.90 poverty threshold but below 125 percent of that threshold (\$2.38 per day in 2011 PPP).

Trends are similar for these indicators as measured at the national poverty threshold of Rs. 19,262. 11.9 percent of individuals in the ZOI lived below the national poverty line. The depth of poverty of the poor in the ZOI was 20.7 percent of this poverty line, meaning the average poor person in the ZOI lived at 79.3 percent of the national poverty line, and his or her average consumption was Rs. 15,275.<sup>193</sup> Finally, 12.5 percent of individuals in the ZOI lived at or above the Rs. 19,262 national poverty threshold but below 125 percent of that threshold (Rs. 24,078).

According to the Nepal asset-based wealth index, at baseline, 18.3 percent of households fell into the lowest wealth quintile, while 21.9 percent of households fell into the highest wealth quintile. Education, poverty status, SEI score, and ecological zone were significantly associated with asset-based wealth quintile. On the CWI, 7.9 percent of households fell into the lowest wealth quintile, while 14.4 percent fell in the highest. The plurality of households fell into the second wealth quintile (44.8 percent). Education, poverty status, SEI score, and ecological zone were significantly associated with comparative wealth quintile.

## Resilience

Household resilience, or the ability of a household to mitigate, adapt to, and recover from shocks and stresses, was measured according to four key indicators, as detailed below. Shocks and stressors that affect the highest percentage of households include pests affecting crops (39.0 percent), disease affecting crops (35.3 percent), severe illness in the family (30.0 percent), and a sharp increase in food prices (27.1 percent). In general, households perceived the impact of any given shock on both income and food consumption as somewhat severe. On average, households in the ZOI experienced between two and three shocks, which is considered a low number of shocks according to SEI scores.

In the ZOI, 5.2 was the average ARSSI score, a proxy indicator that captures a household's self-perceived ability to recover from shocks and stresses. Gendered household type, household educational attainment, poverty status, and ecological zone were all significantly associated with ARSSI scores. Across the board, a majority of households believed that their ability to meet their food needs both at the time of the survey and over the next year would be worse than before exposure to a shock.

The survey assessed three additional resilience capacities: local government response, participation in group-based financial programs, and social capital. Overall, 84.3 percent of respondents believed that local government would help the community cope with future shocks and stressors. Household education, poverty status, and shock exposure status were significantly correlated with this belief. 41.7 percent of households participated in group savings, micro-finance, or lending programs. Gendered household type, household educational attainment, wealth quintile, and poverty status were significantly associated with participation. Finally, on average, households scored 0.71 on the social capital index, 0.81

<sup>192</sup> The average value of consumption of a poor person is calculated as follows:  $(80.5 \div 100) * \$1.90/\text{day} = \$1.53/\text{day}$ .

<sup>193</sup> The average value of consumption of a poor person is calculated as follows:  $(79.6 \div 100) * \text{Rs. } 19,262/\text{day} = \text{Rs. } 15,332/\text{day}$ .

on the bonding sub-index, and 0.60 on the bridging sub-index. These results suggest that households' reciprocal obligation networks were stronger within their community versus outside of their community.

## **Women's empowerment in agriculture**

At baseline, women's average A-WEAI score was 0.86. Men and women had similar SDE scores of 0.86 and 0.85, respectively. Women's average GPI score was 0.95, and 73.5 percent of women achieved gender parity. The average empowerment gap for women was 0.21. 58.9 percent of women and 61.6 percent of men were empowered. Though the gender difference was not significant, education and poverty status were significant determinants of empowerment.

25.4 percent of women and 24.3 percent of men were disempowered and achieved adequacy across the six A-WEAI indicators. Of the six A-WEAI indicators, ownership of assets, input in productive decisions, and control over income contributed the most to empowerment for both men and women, while workload, group membership, and access to and decisions on credit were the biggest constraints. Men aged 18–29 had significantly greater achievement than women in workload: 21.1 percent of men achieved adequacy, compared to 9.6 percent of women. Women had significantly greater achievement than men in group membership, with 7.5 percent of women achieving adequacy, compared to 3.5 percent of men.

All men and women participated in some form of economic activity, with the vast majority of men and women having input into decisions regarding at least one activity. Food crop farming was the most prevalent activity for both genders, and fishing or fishpond culture was the least common. 63.1 percent of women and 63.8 percent of men took out a loan of any variety. Both genders most frequently borrowed from friends and relatives or group-based microfinance and least frequently from NGOs. Most men and women expressed that they have input into decision-making on both income and expenditures. 38.3 percent of men were active members of a group, compared to 50.4 percent of women, a statistically significant difference. Finally, time allocation varied significantly by gender. Men spent significantly more time than women engaging in a variety of activities, including work as employed, own business work, travel and commuting, watching TV, radio and reading, exercising, and social activities and hobbies. Conversely, women spent significantly more time than men on cooking, domestic work, and caring for children and adults.

## **Targeted agriculture value chains**

### **Maize**

At baseline, 50.7 percent of maize farmers were male, and 49.3 percent were female. Age and educational attainment were significant determinants of whether an individual was a maize farmer. A majority of maize farmers (86.8 percent) cultivated maize for consumption. Close to all maize farmers practiced some form of land preparation, with plowing being the most common (98.7 percent). Most maize farmers rotated their crops (91.8 percent), but a majority did not practice any form of soil or water management (63.0 percent) or irrigation (86.2 percent). Most farmers (69.2 percent) used traditional varieties of seeds, usually seeds that they had saved themselves or received from friends or relatives (71.9 percent). A majority of maize farmers (92.8 percent) applied fertilizer, usually soil-based

organic (95.9 percent), and applied it during planting (92.7 percent). Most maize farmers (95.6 percent) applied animal manure to their fields, usually from their own animals and almost exclusively by hand. A majority of farmers (91.1 percent) practiced no form of chemical pest management and weeded with a hoe (93.6 percent). Harvesting was almost exclusively performed by hand (99.4 percent). A majority of maize farmers (77.4 percent) dried their crops on tarpaulins and shucked their crops by hand (92.0 percent). Most farmers harvested and fed their post-harvest maize stalks and husks to their own animals (89.6 percent and 91.4 percent), and most used their maize cobs as fuel for fire (97.8 percent). Most farmers stored their maize in bags (89.8 percent) in residential houses (97.7 percent). Less than four percent of maize farmers reported receiving agricultural training. Rather, most farmers (82.8 percent) received information from a friend or neighbor. More than two-thirds of female maize farmers made key production decisions alone, whereas about half of male farmers did the same. Male maize farmers were also approximately twice as likely to make decisions together with a partner than were female farmers.

38.9 percent of maize farmers in the ZOI applied at least one promoted improved management practice or technology. The most commonly implemented categories were improved climate adaptations (33.9 percent) and crop genetics (30.6 percent). The majority of farmers (61.2 percent) did not use any of the promoted improved management practices or technologies, followed by 27.0 percent of farmers applying two practices.

Overall, maize farmers in the ZOI produced a total of 344 thousand mt of maize in the season preceding the survey, with an average yield per farmer of 2.7 mt/ha. Maize farmers consumed most of the maize they produced. An average of 315.2 kg of maize were consumed by the maize farmer's own household, and 265.0 kg were sold by those farmers that sold maize. Overall, 44.0 percent of maize buyers were the maize farmers' own relatives or friends. Analysis of maize plot soil samples revealed that at shallower depths, the greatest proportion of soil samples consisted of sandy clay loam, and at deeper depths the greatest proportion of samples consisted of sandy loam. The greatest proportions of maize plots across depths consisted of 0 to 15 percent rock fragments. The greatest proportion of maize plots (33.6 percent) were categorized as plots with soil with severe limitations that reduce the choice of plants, require special conservation practices, or both. Finally, LCC criteria reveal that soil depth was the greatest limitation that 44.9 percent of maize farmers face.

## **Rice**

At baseline, 57.1 percent of rice farmers were male, and 42.9 percent were female. Age and educational attainment were significantly associated with likelihood of an individual being a rice farmer. A majority of rice farmers (79.6 percent) cultivated rice for consumption; gender and age were also associated with the likelihood of cultivating rice for consumption. Most farmers (97.9 percent) practiced plowing, and 87.6 percent practiced hand weeding. Only 0.2 percent of rice farmers practiced zero tillage. A majority of rice farmers practiced crop rotation (89.5 percent), terracing (86.7 percent), and used canals for irrigation (55.4 percent). Slightly more than half of rice farmers used modern varieties of seeds, and slightly less than half used traditional varieties, practices that varied significantly based on gender. Rice farmers most commonly sourced their seeds from their own stores or from a friend or relative (46.9 percent), followed by an agricultural dealer (40.0 percent). A majority of rice farmers (93.6 percent) used fertilizer, and men were significantly more likely to do so than women. Soil-based inorganic fertilizer was most commonly used (81.67 percent) and was most frequently applied at the planting stage

(92.4 percent). A majority of rice farmers applied animal manure (70.8 percent), usually from their own animals and almost exclusively by hand. Most farmers (77.6 percent) did not use any form of chemical pest management, although men were significantly more likely to do so than women. Most rice farmers used some form of weed management, and hand weeding was most common (91.7 percent). A majority of farmers (77.2 percent) dried their rice grains by laying it on tarpaulins, and farmers most commonly threshed their rice by beating it with sticks (48.8 percent) or with a motorized thresher (41.2 percent). The majority of rice farmers (82.8 percent) reused rice straw post-harvest by feeding it to their own animals. Nearly all rice farmers stored their harvested rice in bags, and most frequently stored rice in residential households (98.4 percent). Fewer than five percent of rice farmers reported receiving any agricultural training. Just under one-third of female rice farmers made independent decisions about which type of seed to plant and whether to use fertilizer, while just over one-third of male rice farmers made these same decisions independently.

92.0 percent of farmers applied at least one promoted improved management practice or technology. Among these farmers, cultural practices were most commonly applied (91.1 percent), followed by climate adaptation or climate risk management (59.5 percent) and crop genetics (53.3 percent). The greatest proportion of rice farmers (47.2 percent) applied three practices, followed by one practice (32.2 percent). Men were significantly more likely to apply a greater number of practices than women, and older farmers were also significantly more likely to apply a greater number of practices than younger farmers.

Overall, rice farmers in the ZOI produced a total of 486 thousand mt of rice in the season preceding the survey, with an average yield per farmer of 4.5 mt/ha. Rice farmers consumed an average of 979.8 kg of rice and sold an average of 1,736.0 kg when they sold rice. Overall, 30.9 percent of rice buyers were the rice farmers' own relatives or friends. Analysis of rice plot soil samples revealed that irrespective of the soil sample's depth, the greatest proportion of soil samples consisted of silty clay loam. Soil samples from rice plots contained very low levels of rock fragments. Across depths, over 75 percent of soil samples contained less than one percent rock fragments. The greatest proportion of rice plots (59.0 percent) were categorized as plots with soil with severe limitations that reduce the choice of plants, require special conservation practices, or both. Finally, LCC criteria reveal that for a majority of rice farmers (56.4 percent), soil depth was the greatest limitation to their plot's soil.

### **Cauliflower**

At baseline, 62.6 percent of cauliflower farmers were male and 37.4 percent were female. Over half of cauliflower farmers weeded by hand, and a majority rotated their crops (87.3 percent) and used soil bands or trenches (76.3 percent). Just under 80 percent of cauliflower farmers practiced some form of irrigation, with irrigation by hand the most common (33.6 percent). A majority of farmers (82.9 percent) used modern seeds, which were most frequently procured from a market or non-agricultural dealer (76.7 percent). Nearly all cauliflower farmers (98.1 percent) applied fertilizer, most commonly soil-based organic fertilizer (91.1 percent). Fertilizer was most commonly applied during the early growth stage (78.1 percent) and the pre-planting stage (60.2 percent). Most cauliflower farmers (92.4 percent) applied animal manure to their crops, usually from their own animals and always by hand. Slightly more than half of cauliflower farmers used some form of chemical pest management, and nearly all (98.8 percent) practiced weeding with a hoe. Cauliflower farmers most commonly used post-harvest cauliflower stems

as feed for their own animals (64.8 percent) and either cooked their cauliflower (91.8 percent) or sold it directly (73.6 percent). A majority (81.7 percent) of cauliflower farmers usually sold their crop the day of harvest, and most (69.6 percent) sold their produce before it became soft, most commonly in the market (51.7 percent). Overall, fewer than 11 percent of farmers received agricultural training; instead, most farmers (62.6 percent) received information from a friend or neighbor.

93.3 percent of cauliflower farmers applied at least one improved management practice or technology. The most frequently applied practices were crop genetics and climate adaptation, each of which was applied by 82.9 percent of farmers. Nearly half of cauliflower farmers (47.8 percent) applied four out of five promoted improved practices or technologies.

Due to the small sample size of cauliflower farmers, the yield estimates for cauliflower are statistically unreliable. Cauliflower farmers sold most of the cauliflower they cultivated: an average of 102.5 kg of cauliflower were consumed by the cauliflower farmer's own household, and an average of 397.4 kg were sold by the farmer when the farmer sold cauliflower. Analysis of cauliflower plot soil samples revealed that for most depths, the greatest proportion of soil samples consisted of silty clay loam. Soil samples from cauliflower plots contained very low levels of rock fragments. Over 60 percent of soil samples across depths contained less than one percent rock fragments. The greatest proportion of cauliflower plots (37.4 percent) were categorized as plots with soil with severe limitations that reduce the choice of plants, require special conservation practices, or both. Finally, LCC criteria reveal that for a majority of cauliflower farmers (56.3 percent), soil water storage capacity was the greatest limitation to their plot's soil.

## **Tomato**

Due to the small number of tomato farmers, limited data were available. Overall, 61.5 percent of tomato farmers were male, and 38.5 percent were female. A majority of tomato farmers engaged in some form of land preparation, practiced crop rotation, and practiced irrigation. Approximately 95 percent of tomato farmers practiced soil and water management of some sort. Nearly all tomato farmers (89.9 percent) used modern seeds, and most of these farmers (71.7 percent) sourced their seeds from an agricultural dealer. Most tomato farmers (93.9 percent) applied fertilizer to their crops, and nearly all of these farmers (95.4 percent) used soil-based organic fertilizer. Fertilizer was most commonly applied during the early growth stage (74.0 percent) and pre-planting stage (69.3 percent). Nearly all tomato farmers (95.7 percent) applied animal manure to their crops, usually from their own animals, and all applied it by hand. Chemical pesticide was most commonly (52.5 percent) used in response to an attack, and nearly all tomato farmers (97.1 percent) managed their weeds with a hoe. Tomato farmers most commonly incorporated tomato stems back into their soil post-harvest (54.0 percent) and either cooked their tomatoes (83.5 percent) or sold them (71.6 percent). A majority of tomato farmers (84.4 percent) usually sold their crop the day of harvest, and most farmers (55.8 percent) always sold their produce before it became soft, most commonly in the market (47.6 percent). Overall, fewer than 15 percent of tomato farmers received agricultural training. Rather, most farmers (74.5 percent) received agricultural information from a friend or neighbor.

Most tomato farmers applied at least one promoted improved management practice or technology, most commonly crop genetics and climate adaptation (89.9 percent each). Just over half of tomato

farmers applied four out of the five promoted improved practices and technologies, and less than one percent applied all five.

Due to the small sample size of tomato farmers, the yield estimates for tomato are statistically unreliable. Tomato farmers sold most of the tomatoes they cultivated: an average of 224.1 kg of tomatoes were consumed by the tomato farmer's own household, and an average of 568.0 kg were sold by the farmer when the farmer sold tomatoes. Analysis of tomato plot soil samples revealed that the greatest proportion of plots across depths consisted of silty clay loam. Soil samples from tomato plots contained low levels of rock fragments. The greatest proportion of tomato plots (35.4 percent) were categorized as plots with soil with severe limitations that reduce the choice of plants, require special conservation practices, or both. Finally, LCC criteria reveal that for a majority of tomato farmers (54.7 percent), soil water storage capacity was the greatest limitation to their plot's soil.

Across all crops, 77.7 percent of farmers applied at least one promoted improved management practice or technology. Cultural practices were the most applied (90.9 percent), followed by climate adaptation or climate risk management (56.1 percent) and crop genetics (51.9 percent). 13.0 percent of farmers applied a promoted pest and disease management practice. Only 0.1 percent of farmers applied a promoted post-harvest, handling and storage practice, and no farmers applied a promoted irrigation practice. Males were significantly more likely than females to apply one or more promoted practice. A majority of farmers (60.1 percent) applied one, two or three practices across crops.

### **Food insecurity and dietary intake**

According to the food insecurity index, at baseline, 10.7 percent of the population experienced moderate to severe food insecurity during the 12 months preceding the survey. Prevalence of food insecurity is highest for single adult member households, households with little to no education, and households in poverty. When examined in terms of agricultural characteristics, households that own land, own livestock, or produce crop commodities have a lower prevalence of moderate to severe food insecurity.

48.2 percent of women of reproductive age achieved minimum dietary diversity. Women who were more highly educated, wealthier, and with a lower degree of shock exposure were more likely to achieve minimum dietary diversity. There was no significant association between agricultural land ownership and achieving minimum dietary diversity, although livestock ownership and crop commodity production were significantly associated with likelihood of achieving a diet of minimum diversity.

Overall, 64.0 percent of children 0–5 months of age were exclusively breastfed the day preceding the survey. Ecological zone was associated with likelihood of exclusive breastfeeding: 79.3 percent of children in hill zones were breastfed compared to just 47.7 percent of children in terai zones. 38.1 percent of children 6–23 months of age received a minimally acceptable diet. Older children, children with caregivers who had higher levels of educational attainment, children in wealthier homes, and children in homes that were exposed to a fewer number of shocks were more likely to be consuming a minimally acceptable diet. Finally, 78.7 percent of children 6–23 months of age achieved minimum meal frequency, and 41.6 percent achieved minimum dietary diversity.

### **Nutritional status of women and children**



Findings regarding the nutritional status of women and children illustrate that a majority of individuals were a healthy weight and height. The average BMI for women overall was 22.1. 17.6 percent of women were underweight, 61.0 percent of women were a normal weight, 17.3 percent of women were overweight, and 4.1 percent of women were obese. A woman's age, level of shock exposure, and ecological zone were significantly associated with BMI.

Children were more likely to be stunted than wasted. On average, 7.0 percent of children under five years old were severely stunted, and 26.7 percent were stunted. Older children, children whose caregivers had low levels of educational attainment, children in poorer households, and children in households that experienced a higher number of shocks were more likely to be stunted. 2.7 percent of children were severely wasted. 12.5 percent of children were wasted, 86.6 percent of children were a healthy weight, 0.9 percent of children were overweight, and 0.3 percent of children were obese. Though most disaggregate variables did not show significant association with wasting, there was a significant association between ecological zone and wasting: 7.0 percent of children in hill zones were wasted compared to 19.3 percent in terai zones.

## **Nepal-specific indicators**

### ***Migration and remittances***

In 2019, 28 percent of households received remittances, receiving on average 58 percent of their income from remittances. Gendered household type was a statistically significant determinant of both likelihood to receive remittances and amount received. Most households reported that their primary use of remittances was basic/essential household supplies (84 percent), followed by investment in the future (60 percent).

### ***Resilience and shock exposure***

Households experienced an average of 2.5 shocks in the year prior to the survey. Shocks and stressors that affect the highest percentage of households include pests affecting crops (39.0 percent), disease affecting crops (35.3 percent), severe illness in the family (30.0 percent), and a sharp increase in food prices (27.1 percent). Households engaged in approximately three different livelihood activities, on average. Finally, access to information differed widely by topic. Households most commonly received information on equal rights for all ethnic groups (46 percent), gender equality/gender-based violence (46 percent), and disease prevention (45 percent), and least commonly received information on business and investment opportunities (12 percent), natural resource management for this community (12 percent), and safe migration opportunities (9 percent).

### ***Access to markets, agriculture, and nutrition extension services***

16 percent of households accessed agricultural services and 15 percent accessed nutrition extension services during the year prior to the survey, most frequently from civil society organizations (CSOs), NGOs, or from the GoN. 12 percent of households who accessed agriculture services accessed them from the private sector, and only one percent of households accessing nutrition services received them from the private sector. On average, households accessed nutrition services from the GoN three times per year, and households accessed nutrition services from CSOs/NGOs about four times per year.

Overall, 37 percent of households sold produce, most commonly at markets (52 percent). 53 percent of households transported goods to a market, spending on average one hour and 15 minutes in transit and paying on average 95 Rs. to get to and from the market. On average, households were 5.7 kilometers from the nearest market for selling agricultural products; 84 percent of households lived within ten kilometers of a market.

### ***Water use and management***

Overall, 47 percent of households reported that they had access to water for irrigation at the time of the survey, and 37 percent of households reported always having access to water when needed. Of the households that did not always have access to water for irrigation when needed, the most frequently cited reason was that water levels were low at the time. For households that grew crops on land using irrigation, 42 percent of their agricultural landholdings were irrigated. Gendered household type was significantly associated with all of these indicators.

### ***Education***

In 2019, 60 percent of households typically spoke Nepali in the home. Additionally, 44 percent of households with children in school used the same language for instruction as the language spoken in the home. Gendered household type was significantly associated with both of these indicators. Finally, only ten percent of households had any children who participated in school feeding programs.

### ***Linkage between forests and food security***

Overall, 36 percent of households belonged to a community forest user group in 2019. 17 percent of households had access to irrigation from the forest, and 48 percent of households had collected forest products to eat at home in the 12 months preceding the survey. Finally, 73 percent of households believed that forests have an important impact on irrigated areas, and 48 percent believed that their livelihood is dependent on the forest. Gendered household type was significantly associated with these beliefs.



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## APPENDIX I. SUPPLEMENTARY DATA

### AI.1. Feed the Future ZOI Survey indicator estimates and module response rates

Table AI.1: Feed the Future ZOI Survey indicator estimates, by key disaggregates, Nepal 2019

| Feed the Future indicator                                                                                                                                          | Estimate | SD | 95% CI      | Sig. <sup>a</sup> | DEFF | Non-response rate <sup>b</sup> | Weighted number | Unweighted number <sup>c</sup> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----|-------------|-------------------|------|--------------------------------|-----------------|--------------------------------|
| <b>Prevalence of poverty: Percent of people living on less than \$1.90 per day, 2011 PPP (84.76 Rs)</b>                                                            |          |    |             |                   |      |                                |                 |                                |
| <b>All households</b>                                                                                                                                              | 9.2      |    | 7.6 – 11.0  |                   | 2.1  | 2.8                            | 2,413           | 2,407                          |
| <b>Gendered household type</b>                                                                                                                                     | -        | -  | -           | n/s               | -    | -                              | -               | -                              |
| Male and female adults                                                                                                                                             | 9.0      |    | 7.3 – 11.0  |                   | 2.2  | 2.7                            | 2,087           | 1,891                          |
| Female adults only                                                                                                                                                 | 11.0     |    | 7.8 – 15.3  |                   | 1.1  | 3.0                            | 306             | 459                            |
| Male adults only                                                                                                                                                   | 2.0      |    | 0.3 – 13.6  |                   | 0.4  | 1.9                            | 20              | 53                             |
| Children only, no adults                                                                                                                                           | ^        |    | ^           |                   | -    | -                              | -               | 4                              |
| <b>Depth of poverty of the poor: Mean percent shortfall of the poor relative to \$1.90 per day, 2011 PPP poverty line (84.76 Rs)</b>                               |          |    |             |                   |      |                                |                 |                                |
| <b>All households</b>                                                                                                                                              | 19.9     |    | 17.5 – 22.3 |                   | 1.2  | 0.0                            | 221             | 205                            |
| <b>Gendered household type</b>                                                                                                                                     | -        | -  | -           | **                | -    | -                              | -               | -                              |
| Male and female adults                                                                                                                                             | 20.1     |    | 17.5 – 22.7 |                   | 1.3  | 0.0                            | 187             | 160                            |
| Female adults only                                                                                                                                                 | 19.1     |    | 14.4 – 23.9 |                   | 0.7  | 0.0                            | 34              | 44                             |
| Male adults only                                                                                                                                                   | ^        |    | ^           |                   | -    | -                              | -               | 1                              |
| Children only, no adults                                                                                                                                           | ^        |    | ^           |                   | -    | -                              | -               | 0                              |
| <b>Percent of people who are “near-poor,” living on 100 percent to less than 125 percent of the \$1.90 per day, 2011 PPP poverty line (84.76 to &lt;105.95 Rs)</b> |          |    |             |                   |      |                                |                 |                                |
| <b>All households</b>                                                                                                                                              | 10.9     |    | 9.5 – 12.6  |                   | 1.5  | 2.8                            | 2,413           | 2,407                          |
| <b>Gendered household type</b>                                                                                                                                     | -        | -  | -           | n/s               | -    | -                              | -               | -                              |
| Male and female adults                                                                                                                                             | 10.6     |    | 9.1 – 12.4  |                   | 1.5  | 2.7                            | 2,087           | 1,891                          |
| Female adults only                                                                                                                                                 | 13.6     |    | 10.3 – 17.8 |                   | 0.9  | 3.0                            | 306             | 459                            |
| Male adults only                                                                                                                                                   | 3.8      |    | 0.9 – 14.6  |                   | 0.4  | 1.9                            | 20              | 53                             |
| Children only, no adults                                                                                                                                           | ^        |    | ^           |                   | -    | -                              | -               | 4                              |
| <b>Percent of households below the comparative threshold for the poorest quintile of the asset-based comparative wealth index</b>                                  |          |    |             |                   |      |                                |                 |                                |
| <b>All households</b>                                                                                                                                              | 7.9      |    | 6.3 – 9.8   |                   | 2.7  | 0.0                            | 2,481           | 2,481                          |
| <b>Gendered household type</b>                                                                                                                                     | -        | -  | -           | n/s               | -    | -                              | -               | -                              |
| Male and female adults                                                                                                                                             | 8.0      |    | 6.4 – 10.1  |                   | 2.3  | 0.0                            | 1,931           | 1,944                          |
| Female adults only                                                                                                                                                 | 7.7      |    | 5.5 – 10.8  |                   | 1.2  | 0.0                            | 479             | 473                            |
| Male adults only                                                                                                                                                   | 6.4      |    | 2.6 – 14.6  |                   | 0.8  | 0.0                            | 59              | 54                             |

| Feed the Future indicator                                                                                         | Estimate | SD   | 95% CI      | Sig. <sup>a</sup> | DEFF | Non-response rate <sup>b</sup> | Weighted number | Unweighted number <sup>c</sup> |
|-------------------------------------------------------------------------------------------------------------------|----------|------|-------------|-------------------|------|--------------------------------|-----------------|--------------------------------|
| Children only, no adults                                                                                          | ^        |      | ^           |                   | -    | -                              | -               | 10                             |
| <b>Ability to recover from shocks and stresses index</b>                                                          |          |      |             |                   |      |                                |                 |                                |
| <b>All households</b>                                                                                             | 5.2      | 1.0  | 5.1 – 5.3   |                   | 3.0  | 36.9                           | 1,537           | 1,566                          |
| <b>Gendered household type</b>                                                                                    | -        | -    | -           | ***               | -    | -                              | -               | -                              |
| Male and female adults                                                                                            | 5.3      | 1.0  | 5.2 – 5.3   |                   | 2.5  | 35.9                           | 1,221           | 1,247                          |
| Female adults only                                                                                                | 5.0      | 1.0  | 4.9 – 5.2   |                   | 1.5  | 39.7                           | 289             | 290                            |
| Male adults only                                                                                                  | ^        | ^    | ^           |                   | -    | -                              | -               | 25                             |
| Children only, no adults                                                                                          | ^        | ^    | ^           |                   | -    | -                              | -               | 4                              |
| <b>Index of social capital at the household level</b>                                                             |          |      |             |                   |      |                                |                 |                                |
| <b>Overall index</b>                                                                                              | -        | -    | -           |                   | -    | -                              | -               | -                              |
| <b>All households</b>                                                                                             | 0.71     | 0.28 | 0.68 – 0.73 |                   | 4.0  | 1.7                            | 2,438           | 2,439                          |
| <b>Gendered household type</b>                                                                                    | -        | -    | -           | n/s               | -    | -                              | -               | -                              |
| Male and female adults                                                                                            | 0.71     | 0.29 | 0.68 – 0.73 |                   | 3.5  | 1.7                            | 1,898           | 1,910                          |
| Female adults only                                                                                                | 0.70     | 0.27 | 0.66 – 0.73 |                   | 2.0  | 1.3                            | 471             | 467                            |
| Male adults only                                                                                                  | 0.75     | 0.24 | 0.68 – 0.81 |                   | 1.1  | 3.7                            | 57              | 52                             |
| Children only, no adults                                                                                          | ^        | ^    | ^           |                   | -    | -                              | -               | 10                             |
| <b>Bonding sub-index</b>                                                                                          | -        | -    | -           |                   | -    | -                              | -               | -                              |
| <b>All households</b>                                                                                             | 0.81     | 0.31 | 0.79 – 0.84 |                   | 3.4  | 1.7                            | 2,438           | 2,439                          |
| <b>Gendered household type</b>                                                                                    | -        | -    | -           | n/s               | -    | -                              | -               | -                              |
| Male and female adults                                                                                            | 0.81     | 0.32 | 0.79 – 0.84 |                   | 3.0  | 1.7                            | 1,898           | 1,910                          |
| Female adults only                                                                                                | 0.81     | 0.30 | 0.78 – 0.85 |                   | 1.8  | 1.3                            | 471             | 467                            |
| Male adults only                                                                                                  | 0.84     | 0.28 | 0.76 – 0.92 |                   | 1.1  | 3.7                            | 57              | 52                             |
| Children only, no adults                                                                                          | ^        | ^    | ^           |                   | -    | -                              | -               | 10                             |
| <b>Bridging sub-index</b>                                                                                         | -        | -    | -           |                   | -    | -                              | -               | -                              |
| <b>All households</b>                                                                                             | 0.60     | 0.32 | 0.57 – 0.62 |                   | 4.1  | 1.7                            | 2,438           | 2,439                          |
| <b>Gendered household type</b>                                                                                    | -        | -    | -           | n/s               | -    | -                              | -               | -                              |
| Male and female adults                                                                                            | 0.60     | 0.33 | 0.57 – 0.63 |                   | 3.5  | 1.7                            | 1,898           | 1,910                          |
| Female adults only                                                                                                | 0.58     | 0.31 | 0.54 – 0.62 |                   | 2.0  | 1.3                            | 471             | 467                            |
| Male adults only                                                                                                  | 0.65     | 0.28 | 0.56 – 0.74 |                   | 1.3  | 3.7                            | 57              | 52                             |
| Children only, no adults                                                                                          | ^        | ^    | ^           |                   | -    | -                              | -               | 10                             |
| <b>Percent of households that believe local government will respond effectively to future shocks and stresses</b> |          |      |             |                   |      |                                |                 |                                |
| <b>All households</b>                                                                                             | 84.3     |      | 81.4 – 87.1 |                   | 3.7  | 6.0                            | 2,330           | 2,332                          |
| <b>Gendered household type</b>                                                                                    | -        | -    | -           | n/s               | -    | -                              | -               | -                              |

| Feed the Future indicator                                                                                             | Estimate | SD | 95% CI       | Sig. <sup>a</sup> | DEFF | Non-response rate <sup>b</sup> | Weighted number | Unweighted number <sup>c</sup> |
|-----------------------------------------------------------------------------------------------------------------------|----------|----|--------------|-------------------|------|--------------------------------|-----------------|--------------------------------|
| Male and female adults                                                                                                | 83.7     |    | 80.6 – 86.7  |                   | 3.2  | 6.1                            | 1,814           | 1,825                          |
| Female adults only                                                                                                    | 85.3     |    | 81.0 – 89.6  |                   | 1.7  | 5.7                            | 449             | 446                            |
| Male adults only                                                                                                      | 93.3     |    | 85.0 – 100.0 |                   | 1.6  | 3.7                            | 57              | 52                             |
| Children only, no adults                                                                                              | ^        |    | ^            |                   | -    | -                              | -               | 9                              |
| <b>Percent of households participating in group-based savings, micro-finance, or lending programs</b>                 |          |    |              |                   |      |                                |                 |                                |
| <b>All households</b>                                                                                                 | 41.7     |    | 37.0 – 46.5  |                   | 5.8  | 1.3                            | 2,446           | 2,449                          |
| <b>Gendered household type</b>                                                                                        | -        | -  | -            | ***               | -    | -                              | -               | -                              |
| Male and female adults                                                                                                | 44.5     |    | 39.6 – 49.4  |                   | 4.8  | 0.6                            | 1,918           | 1,932                          |
| Female adults only                                                                                                    | 34.3     |    | 27.8 – 40.9  |                   | 2.3  | 2.3                            | 466             | 462                            |
| Male adults only                                                                                                      | 11.0     |    | 2.2 – 19.8   |                   | 1.4  | 5.6                            | 57              | 51                             |
| Children only, no adults                                                                                              | ^        |    | ^            |                   | -    | -                              | -               | 4                              |
| <b>Abbreviated Women's Empowerment in Agriculture Index (A-WEAI)</b>                                                  |          |    |              |                   |      |                                |                 |                                |
| <b>All women</b>                                                                                                      | 0.86     |    | 0.84 - 0.88  |                   | -    | 60.7                           | 1,360           | 918                            |
| <b>Women's age</b>                                                                                                    | -        | -  | -            | n/s               | -    | -                              | -               | -                              |
| 18–29 years                                                                                                           | 0.84     |    | 0.81 - 0.88  |                   | -    | -                              | 227             | 805                            |
| 30 years and older                                                                                                    | 0.86     |    | 0.85 - 0.88  |                   | -    | -                              | 1,133           | 113                            |
| <b>Percent of women achieving adequacy across the six indicators of the A-WEAI</b>                                    |          |    |              |                   |      |                                |                 |                                |
| <b>All women</b>                                                                                                      | 25.4     |    | 22.9 – 27.9  |                   | 2.2  | 41.9                           | 1,360           | 1,358                          |
| <b>Women's age</b>                                                                                                    | -        | -  | -            | n/s               | -    | -                              | -               | -                              |
| 18–29 years                                                                                                           | 26.3     |    | 21.6 – 31.0  |                   | 1.3  | -                              | 227             | 220                            |
| 30 years and older                                                                                                    | 25.2     |    | 22.6 – 27.9  |                   | 2.1  | -                              | 1,133           | 1,138                          |
| <b>Percent of producers who have applied targeted improved management practices or technologies in targeted areas</b> |          |    |              |                   |      |                                |                 |                                |
| <b>All producers</b>                                                                                                  | 77.7     |    | 74.1 – 81.2  |                   | 3.5  | 0.7                            | 1,836           | 1,874                          |
| <b>Farmers' sex</b>                                                                                                   | -        | -  | -            | ***               | -    | -                              | -               | -                              |
| Male                                                                                                                  | 83.8     |    | 80.8 – 86.8  |                   | 1.7  | 0.8                            | 961             | 985                            |
| Female                                                                                                                | 71.0     |    | 65.7 – 76.2  |                   | 3.1  | 0.7                            | 875             | 889                            |
| <b>Farmers' age</b>                                                                                                   | -        | -  | -            | **                | -    | -                              | -               | -                              |
| 15–29 years                                                                                                           | 69.2     |    | 61.7 – 76.7  |                   | 1.8  | 1.9                            | 256             | 256                            |
| 30 years and older                                                                                                    | 79.1     |    | 75.6 – 82.5  |                   | 2.9  | 0.6                            | 1,580           | 1,618                          |
| <b>Commodity</b>                                                                                                      | -        | -  | -            | -                 | -    | -                              | -               | -                              |
| Maize                                                                                                                 | 38.9     |    | 33.8 – 44.2  |                   | 3.7  | 0.6                            | 1,238           | 1,275                          |
| Paddy rice                                                                                                            | 92.0     |    | 88.0 – 94.7  |                   | 5.0  | 0.8                            | 1,315           | 1,346                          |
| Cauliflower                                                                                                           | 93.3     |    | 84.4 – 97.3  |                   | 0.9  | 0.0                            | 69              | 67                             |

| Feed the Future indicator                                             | Estimate | SD  | 95% CI      | Sig. <sup>a</sup> | DEFF | Non-response rate <sup>b</sup> | Weighted number | Unweighted number <sup>c</sup> |
|-----------------------------------------------------------------------|----------|-----|-------------|-------------------|------|--------------------------------|-----------------|--------------------------------|
| Tomatoes                                                              | 95.6     |     | 83.4 – 98.9 |                   | 0.9  | 0.0                            | 46              | 46                             |
| <b>Management practice or technology type</b>                         | -        | -   | -           | -                 | -    | -                              | -               | -                              |
| Climate adaptation, climate risk management                           | 56.1     |     | 51.7 – 60.6 |                   | 3.9  | 0.7                            | 1,836           | 1,874                          |
| Crop genetics                                                         | 51.9     |     | 47.5 – 56.3 |                   | 3.7  | 0.7                            | 1,836           | 1,874                          |
| Cultural practices                                                    | 90.9     |     | 87.5 – 94.2 |                   | 4.8  | 0.8                            | 1,350           | 1,380                          |
| Pest and disease management                                           | 13.0     |     | 10.3 – 15.8 |                   | 3.3  | 0.7                            | 1,836           | 1,874                          |
| Irrigation                                                            | 0.0      |     | 0.0 – 0.1   |                   | 0.4  | 0.6                            | 1,255           | 1,295                          |
| Post-harvest handling and storage                                     | 0.1      |     | 0.1 – 0.3   |                   | 1.2  | 0.0                            | 1,238           | 1,276                          |
| <b>Yield of targeted agricultural commodities within target areas</b> |          |     |             |                   |      |                                |                 |                                |
| <b>Maize (mt/ha)</b>                                                  |          |     |             |                   |      |                                |                 |                                |
| <b>Farm size</b>                                                      | -        | -   | -           |                   | -    | -                              | -               | -                              |
| <b>Smallholder</b>                                                    | 2.7      | 2.8 | 2.4 – 3.1   |                   | 3.4  | 40.2 <sup>c</sup>              | 815             | 830                            |
| <b>Farmers' sex</b>                                                   | -        | -   | -           | **                | -    | -                              | -               | -                              |
| Male                                                                  | 3.0      | 3.1 | 2.5 – 3.5   |                   | 2.7  | 31.2                           | 437             | 439                            |
| Female                                                                | 2.4      | 2.4 | 2.1 – 2.7   |                   | 1.6  | 35.5                           | 378             | 391                            |
| <b>Farmers' age</b>                                                   | -        | -   | -           | **                | -    | -                              | -               | -                              |
| 15–29 years                                                           | 2.1      | 2.9 | 1.7 – 2.4   |                   | 1.1  | 32.1                           | 106             | 106                            |
| 30 years and older                                                    | 2.8      | 1.9 | 2.4 – 3.2   |                   | 3.4  | 33.5                           | 709             | 724                            |
| <b>Non-smallholder</b>                                                | ^        | ^   | ^           |                   | -    | -                              | -               | 8                              |
| <b>Farmers' sex</b>                                                   | -        | -   | -           | -                 | -    | -                              | -               | -                              |
| Male                                                                  | ^        | ^   | ^           |                   | -    | -                              | -               | 3                              |
| Female                                                                | ^        | ^   | ^           |                   | -    | -                              | -               | 5                              |
| <b>Farmers' age</b>                                                   | -        | -   | -           | -                 | -    | -                              | -               | -                              |
| 15–29 years                                                           | ^        | ^   | ^           |                   | -    | -                              | -               | 2                              |
| 30 years and older                                                    | ^        | ^   | ^           |                   | -    | -                              | -               | 6                              |
| <b>Paddy Rice (mt/ha)</b>                                             |          |     |             |                   |      |                                |                 |                                |
| <b>Farm size</b>                                                      | -        | -   | -           |                   | -    | -                              | -               | -                              |
| <b>Smallholder</b>                                                    | 4.5      | 3.2 | 4.0 – 4.9   |                   | 3.4  | 53.8                           | 656             | 662                            |
| <b>Farmers' sex</b>                                                   | -        | -   | -           | **                | -    | -                              | -               | -                              |
| Male                                                                  | 4.9      | 3.3 | 4.4 – 5.5   |                   | 2.6  | 54.4                           | 347             | 349                            |
| Female                                                                | 4.0      | 3.0 | 3.5 – 4.6   |                   | 2.4  | 43.9                           | 309             | 313                            |
| <b>Farmers' age</b>                                                   | -        | -   | -           | **                | -    | -                              | -               | -                              |

| Feed the Future indicator  | Estimate | SD  | 95% CI    | Sig. <sup>a</sup> | DEFF | Non-response rate <sup>b</sup> | Weighted number | Unweighted number <sup>c</sup> |
|----------------------------|----------|-----|-----------|-------------------|------|--------------------------------|-----------------|--------------------------------|
| 15–29 years                | 3.5      | 2.7 | 2.8 – 4.2 |                   | 1.4  | 44.6                           | 91              | 92                             |
| 30 years and older         | 4.7      | 3.2 | 4.2 – 5.2 |                   | 3.3  | 50.8                           | 565             | 570                            |
| <b>Non-smallholder</b>     | ^        | ^   | ^         |                   | -    | -                              | 2               | 2                              |
| <b>Farmers' sex</b>        | -        | -   | -         | -                 | -    | -                              | -               | -                              |
| Male                       | ^        | ^   | ^         |                   | -    | -                              | 2               | 2                              |
| Female                     | ^        | ^   | ^         |                   | -    | -                              | 0               | 0                              |
| <b>Farmers' age</b>        | -        | -   | -         | -                 | -    | -                              | -               | -                              |
| 15–29 years                | ^        | ^   | ^         |                   | -    | -                              | 0               | 0                              |
| 30 years and older         | ^        | ^   | ^         |                   | -    | -                              | 2               | 2                              |
| <b>Cauliflower (mt/ha)</b> |          |     |           |                   |      |                                |                 |                                |
| <b>Farm size</b>           | -        | -   | -         | -                 | -    | -                              | -               | -                              |
| <b>Smallholder</b>         | ^        | ^   | ^         |                   | -    | -                              | -               | 21                             |
| <b>Farmers' sex</b>        | -        | -   | -         | -                 | -    | -                              | -               | -                              |
| Male                       | ^        | ^   | ^         |                   | -    | -                              | -               | 13                             |
| Female                     | ^        | ^   | ^         |                   | -    | -                              | -               | 8                              |
| <b>Farmers' age</b>        | -        | -   | -         | -                 | -    | -                              | -               | -                              |
| 15–29 years                | ^        | ^   | ^         |                   | -    | -                              | -               | 2                              |
| 30 years and older         | ^        | ^   | ^         |                   | -    | -                              | -               | 19                             |
| <b>Non-smallholder</b>     | ^        | ^   | ^         | -                 | -    | -                              | -               | 0                              |
| <b>Farmers' sex</b>        | -        | -   | -         | -                 | -    | -                              | -               | -                              |
| Male                       | ^        | ^   | ^         |                   | -    | -                              | -               | 0                              |
| Female                     | ^        | ^   | ^         | -                 | -    | -                              | -               | 0                              |
| <b>Farmers' age</b>        | -        | -   | -         | -                 | -    | -                              | -               | -                              |
| 15–29 years                | ^        | ^   | ^         |                   | -    | -                              | -               | 0                              |
| 30 years and older         | ^        | ^   | ^         |                   | -    | -                              | -               | 0                              |
| <b>Tomato (mt/ha)</b>      |          |     |           |                   |      |                                |                 |                                |
| <b>Farm size</b>           | -        | -   | -         | -                 | -    | -                              | -               | -                              |
| <b>Smallholder</b>         | ^        | ^   | ^         | -                 | -    | -                              | -               | 5                              |
| <b>Farmers' sex</b>        | -        | -   | -         | -                 | -    | -                              | -               | -                              |
| Male                       | ^        | ^   | ^         |                   | -    | -                              | -               | 2                              |
| Female                     | ^        | ^   | ^         |                   | -    | -                              | -               | 3                              |
| <b>Farmers' age</b>        | -        | -   | -         | -                 | -    | -                              | -               | -                              |
| 15–29 years                | ^        | ^   | ^         |                   | -    | -                              | -               | 0                              |

| Feed the Future indicator                                                                                                                   | Estimate | SD | 95% CI      | Sig. <sup>a</sup> | DEFF | Non-response rate <sup>b</sup> | Weighted number | Unweighted number <sup>c</sup> |
|---------------------------------------------------------------------------------------------------------------------------------------------|----------|----|-------------|-------------------|------|--------------------------------|-----------------|--------------------------------|
| 30 years and older                                                                                                                          | ^        | ^  | ^           |                   | -    | -                              | -               | 5                              |
| <b>Non-smallholder</b>                                                                                                                      | ^        | ^  | ^           | -                 | -    | -                              | -               | 0                              |
| <b>Farmers' sex</b>                                                                                                                         | -        | -  | -           | -                 | -    | -                              | -               | -                              |
| Male                                                                                                                                        | ^        | ^  | ^           |                   | -    | -                              | -               | 0                              |
| Female                                                                                                                                      | ^        | ^  | ^           |                   | -    | -                              | -               | 0                              |
| <b>Farmers' age</b>                                                                                                                         | -        | -  | -           | -                 | -    | -                              | -               | -                              |
| 15–29 years                                                                                                                                 | ^        | ^  | ^           |                   | -    | -                              | -               | 0                              |
| 30 years and older                                                                                                                          | ^        | ^  | ^           |                   | -    | -                              | -               | 0                              |
| <b>Prevalence of moderate and severe food insecurity in the population, based on the Food Insecurity Experience Scale<sup>194</sup> (%)</b> |          |    |             |                   |      |                                |                 |                                |
| <b>All households</b>                                                                                                                       | 10.7     |    | 8.9 – 12.4  |                   | -    | 1.7                            | 2,438           | 2,439                          |
| <b>Gendered household type</b>                                                                                                              | -        | -  | -           | n/s               | -    | -                              | -               | -                              |
| Male and female adults                                                                                                                      | 10.2     |    | 8.0 – 12.4  |                   | -    | 1.7                            | 1,898           | 1,910                          |
| Female adults only                                                                                                                          | 13.1     |    | 9.3 – 16.9  |                   | -    | 1.3                            | 471             | 467                            |
| Male adults only                                                                                                                            | 19.8     |    | 7.4 – 32.1  |                   | -    | 3.7                            | 57              | 52                             |
| Children only, no adults                                                                                                                    | ^        |    | ^           |                   | -    | -                              | 12              | 10                             |
| <b>Severity</b>                                                                                                                             | -        | -  | -           | -                 | -    | -                              | -               | -                              |
| Moderate                                                                                                                                    | 8.8      |    | n/a         |                   | -    | 1.7                            | 2,438           | 2,439                          |
| Severe                                                                                                                                      | 1.9      |    | 1.3 – 2.4   |                   | -    | 1.7                            | 2,438           | 2,439                          |
| <b>Prevalence of exclusive breastfeeding among children under six months of age<sup>e,f</sup></b>                                           |          |    |             |                   |      |                                |                 |                                |
| <b>All children</b>                                                                                                                         | 64.0     |    | 54.0 – 74.0 |                   | 1.1  | -                              | 92              | 105                            |
| <b>Children's sex</b>                                                                                                                       | -        | -  | -           | n/s               | -    | -                              | -               | -                              |
| Male                                                                                                                                        | 63.7     |    | 50.0 – 77.3 |                   | 1.1  | -                              | 49              | 55                             |
| Female                                                                                                                                      | 64.4     |    | 49.6 – 79.2 |                   | 1.2  | -                              | 43              | 50                             |
| <b>Percent of children 6–23 months of age receiving a minimum acceptable diet<sup>e,f</sup></b>                                             |          |    |             |                   |      |                                |                 |                                |
| <b>All children</b>                                                                                                                         | 38.1     |    | 30.3 – 44.0 |                   | 1.5  | -                              | 276             | 284                            |
| <b>Children's sex</b>                                                                                                                       | -        | -  | -           | n/s               | -    | -                              | -               | -                              |
| Male                                                                                                                                        | 38.3     |    | 29.1 – 45.1 |                   | 1.4  | -                              | 150             | 154                            |
| Female                                                                                                                                      | 37.8     |    | 28.1 – 47.6 |                   | 1.3  | -                              | 128             | 130                            |
| <b>Percent of women of reproductive age consuming a diet of minimum diversity<sup>e, g</sup></b>                                            |          |    |             |                   |      |                                |                 |                                |
| <b>All women</b>                                                                                                                            | 48.2     |    | 44.3 – 52.1 |                   | 3.1  | 6.2                            | 2,132           | 1,999                          |
| <b>Women's age</b>                                                                                                                          | -        | -  | -           | *                 | -    | -                              | -               | -                              |

<sup>194</sup> Empty items are not generated by the program.

| Feed the Future indicator                                                        | Estimate | SD | 95% CI      | Sig. <sup>a</sup> | DEFF | Non-response rate <sup>b</sup> | Weighted number | Unweighted number <sup>c</sup> |
|----------------------------------------------------------------------------------|----------|----|-------------|-------------------|------|--------------------------------|-----------------|--------------------------------|
| 15–18                                                                            | 47.6     |    | 39.1 – 56.2 |                   | 2.3  | -                              | 332             | 232                            |
| 19–49                                                                            | 48.3     |    | 44.4 – 52.2 |                   | 2.6  | -                              | 1,800           | 1,767                          |
| <b>Prevalence of stunted children under five years of age<sup>e</sup></b>        |          |    |             |                   |      |                                |                 |                                |
| <b>All children</b>                                                              | 26.7     |    | 23.4 – 30.0 |                   | 1.5  | 23.8                           | 966             | 1,016                          |
| <b>Children's sex</b>                                                            | -        | -  | -           | n/s               | -    | -                              | -               | -                              |
| Male                                                                             | 28.2     |    | 24.0 – 32.5 |                   | 1.3  | 18.5                           | 514             | 533                            |
| Female                                                                           | 25.0     |    | 20.6 – 29.4 |                   | 1.3  | 16.4                           | 452             | 483                            |
| <b>Children's age</b>                                                            | -        | -  | -           | ***               | -    | -                              | -               | -                              |
| 0–11 months                                                                      | 6.5      |    | 2.9 – 10.1  |                   | 1.0  | 2.6                            | 176             | 190                            |
| 12–23 months                                                                     | 27.9     |    | 20.9 – 35.0 |                   | 1.2  | 5.2                            | 188             | 193                            |
| 24–35 months                                                                     | 30.6     |    | 23.4 – 37.8 |                   | 1.3  | 1.9                            | 199             | 209                            |
| 36–47 months                                                                     | 32.7     |    | 25.7 – 39.7 |                   | 1.2  | 2.3                            | 202             | 213                            |
| 48–59 months                                                                     | 33.4     |    | 27.0 – 39.8 |                   | 1.0  | 0.9                            | 202             | 211                            |
| <b>Prevalence of wasted children under five years of age<sup>e</sup></b>         |          |    |             |                   |      |                                |                 |                                |
| <b>All children</b>                                                              | 12.5     |    | 10.1 – 14.9 |                   | 1.4  | 27.8                           | 961             | 1,009                          |
| <b>Children's sex</b>                                                            | -        | -  | -           | n/s               | -    | -                              | -               | -                              |
| Male                                                                             | 12.3     |    | 9.3 – 15.3  |                   | 1.2  | 26.0                           | 510             | 528                            |
| Female                                                                           | 12.7     |    | 9.3 – 16.1  |                   | 1.2  | 24.4                           | 451             | 481                            |
| <b>Children's age</b>                                                            | -        | -  | -           | n/s               | -    | -                              | -               | -                              |
| 0–11 months                                                                      | 14.5     |    | 8.7 – 20.2  |                   | 1.2  | 5.8                            | 172             | 184                            |
| 12–23 months                                                                     | 16.5     |    | 10.7 – 22.4 |                   | 1.3  | 0.0                            | 189             | 194                            |
| 24–35 months                                                                     | 14.2     |    | 9.0 – 19.4  |                   | 1.2  | 2.3                            | 198             | 208                            |
| 36–47 months                                                                     | 7.0      |    | 3.5 – 10.6  |                   | 1.1  | 2.8                            | 201             | 212                            |
| 48–59 months                                                                     | 10.8     |    | 6.4 – 15.3  |                   | 1.1  | 0.9                            | 202             | 211                            |
| <b>Prevalence of healthy weight children under five years of age<sup>e</sup></b> |          |    |             |                   |      |                                |                 |                                |
| <b>All children</b>                                                              | 86.6     |    | 84.1 – 89.1 |                   | 1.4  | 27.8                           | 961             | 1,009                          |
| <b>Children's sex</b>                                                            | -        | -  | -           | n/s               | -    | -                              | -               | -                              |
| Male                                                                             | 86.2     |    | 83.1 – 89.4 |                   | 1.1  | 26.0                           | 510             | 528                            |
| Female                                                                           | 87.1     |    | 83.7 – 90.5 |                   | 1.2  | 24.4                           | 451             | 481                            |
| <b>Children's age</b>                                                            | -        | -  | -           | n/s               | -    | -                              | -               | -                              |
| 0–11 months                                                                      | 83.5     |    | 77.6 – 89.5 |                   | 1.2  | 5.8                            | 172             | 184                            |
| 12–23 months                                                                     | 83.5     |    | 77.6 – 89.3 |                   | 1.3  | 0.0                            | 189             | 194                            |
| 24–35 months                                                                     | 84.8     |    | 79.4 – 90.2 |                   | 1.2  | 2.3                            | 198             | 208                            |



| Feed the Future indicator                                                           | Estimate | SD | 95% CI      | Sig. <sup>a</sup> | DEFF | Non-response rate <sup>b</sup> | Weighted number | Unweighted number <sup>c</sup> |
|-------------------------------------------------------------------------------------|----------|----|-------------|-------------------|------|--------------------------------|-----------------|--------------------------------|
| 36–47 months                                                                        | 92.0     |    | 88.1 – 95.8 |                   | 1.1  | 2.8                            | 201             | 212                            |
| 48–59 months                                                                        | 88.7     |    | 84.2 – 93.3 |                   | 1.1  | 0.9                            | 202             | 211                            |
| <b>Prevalence of underweight women of reproductive age<sup>e,g</sup></b>            |          |    |             |                   |      |                                |                 |                                |
| <b>All non-pregnant women 15–49 years</b>                                           | 17.6     |    | 15.5 – 19.8 |                   | 1.6  | -                              | 1,902           | 1,906                          |
| <b>Women's age</b>                                                                  | -        | -  | -           | ***               | -    | -                              | -               | -                              |
| 15–18 years                                                                         | 32.3     |    | 26.1 – 39.1 |                   | 1.5  | -                              | 299             | 220                            |
| 19–49 years                                                                         | 14.9     |    | 12.9 – 17.2 |                   | 1.5  | -                              | 1,589           | 1,673                          |
| <b>Percent of households with access to basic sanitation service</b>                |          |    |             |                   |      |                                |                 |                                |
| <b>All households</b>                                                               | 73.5     |    | 70.7 – 76.1 |                   | 2.4  | 0.0                            | 2,481           | 2,481                          |
| <b>Gendered household type</b>                                                      | -        | -  | -           | ***               | -    | -                              | -               | -                              |
| Male and female adults                                                              | 76.8     |    | 74.2 – 79.3 |                   | 1.8  | 0.0                            | 1,931           | 1,944                          |
| Female adults only                                                                  | 62.6     |    | 56.2 – 68.6 |                   | 2.0  | 0.0                            | 479             | 473                            |
| Male adults only                                                                    | 59.2     |    | 43.8 – 73.1 |                   | 1.4  | 0.0                            | 59              | 54                             |
| Children only, no adults                                                            | ^        |    | ^           |                   | -    | -                              | 12              | 10                             |
| <b>Residence</b>                                                                    | -        | -  | -           | n/s               | -    | -                              | -               | -                              |
| Urban                                                                               | 71.9     |    | 67.7 – 75.8 |                   | 3.0  | 0.0                            | 1,401           | 1,351                          |
| Rural                                                                               | 75.5     |    | 72.2 – 78.5 |                   | 1.5  | 0.0                            | 1,080           | 1,130                          |
| <b>Percent of households with soap and water at handwashing station on premises</b> |          |    |             |                   |      |                                |                 |                                |
| <b>All households</b>                                                               | 51.1     |    | 47.2 – 54.9 |                   | 3.8  | 0.0                            | 2,481           | 2,481                          |
| <b>Gendered household type</b>                                                      | -        | -  | -           | n/s               | -    | -                              | -               | -                              |
| Male and female adults                                                              | 51.5     |    | 47.6 – 55.4 |                   | 3.0  | 0.0                            | 1,931           | 1,944                          |
| Female adults only                                                                  | 49.7     |    | 43.5 – 55.8 |                   | 1.9  | 0.0                            | 479             | 473                            |
| Male adults only                                                                    | 43.3     |    | 27.3 – 60.8 |                   | 1.9  | 0.0                            | 59              | 54                             |
| Children only, no adults                                                            | ^        |    | ^           |                   | -    | -                              | 12              | 10                             |
| <b>Residence</b>                                                                    | -        | -  | -           | ***               | -    | -                              | -               | -                              |
| Urban                                                                               | 58.3     |    | 52.6 – 63.7 |                   | 4.5  | 0.0                            | 1,401           | 1,351                          |
| Rural                                                                               | 41.7     |    | 36.8 – 46.8 |                   | 2.8  | 0.0                            | 1,080           | 1,130                          |

^ Results not statistically reliable, n<30

SD=standard deviation, CI=confidence interval, DEFF=design effect, PPP=purchasing power parity, n/a=not available

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001; n/s=not significant.

<sup>b</sup> Non-response rate is defined as: (Number of eligible individuals or households – Number of individuals or households included in the reported indicator)/Number of eligible individuals or households.

<sup>c</sup> Number of units (individuals, households) in the sample.

<sup>d</sup> Non-response rate is high for yields due to two factors: first, variables used to calculate yield are pulled from two different modules (production and area), increasing the likelihood of missing values across the two modules. Second, plot area is asked generally 'in the last season' whereas production is asked by crop in the last season for each crop. Crop seasons do not necessarily overlap, thus it is possible that some farmers do not plant all crops in all seasons, generating differences in the response rates between the agricultural practices, production, and area questions.

<sup>e</sup> Estimates are based on de facto household members.

<sup>f</sup> Age data were not collected at the month level in the household roster, thus true response rates cannot be calculated for these indicators.

<sup>g</sup> Response rates for age disaggregates unreported since one woman of reproductive age was selected for this module at random from each household.

Note: Estimates are based on de jure household members, except where noted.

Source: Feed the Future Nepal ZOI Survey 2019

**Table A1.2: Response rates by survey module, Feed the Future Nepal ZOI Survey 2019**

| <b>Response rate<sup>a</sup></b>                            | <b>Value</b> |
|-------------------------------------------------------------|--------------|
| <b>Module 1: Household roster</b>                           |              |
| Number of households selected (including buffer households) | 3,425        |
| Number of households occupied                               | 2,747        |
| Number of households interviewed                            | 2,481        |
| Household response rate (%)                                 | 90.3%        |
| <b>Module 2: Dwelling characteristics</b>                   |              |
| Number of eligible households                               | 2,481        |
| Number of eligible households interviewed                   | 2,481        |
| Module 2 response rate (%)                                  | 100%         |
| <b>Module 3: Resilience and food security</b>               |              |
| Number of eligible households                               | 2,481        |
| Number of eligible households interviewed                   | 2,454        |
| Module 3 response rate (%)                                  | 98.9%        |
| <b>Module 4: Women's nutrition</b>                          |              |
| Number of eligible women (15–49 years of age)               | 2,132        |
| Number of eligible women interviewed                        | 2,049        |
| Module 4 response rate (%)                                  | 96.1%        |
| <b>Module 4A: Women's anthropometry<sup>b</sup></b>         |              |
| Number of eligible women (15–49 years of age, non-pregnant) | -            |
| Number of eligible women interviewed                        | 1,911        |
| Module 4A response rate (%)                                 | -            |
| <b>Module 5: Children's nutrition</b>                       |              |
| Number of eligible children (0–59 months of age)            | 1,333        |
| Number of caregivers of eligible children interviewed       | 1,023        |
| Module 5 response rate (%) <sup>b</sup>                     | 76.7%        |
| <b>Module 5A: Children's anthropometry<sup>c</sup></b>      |              |
| Number of eligible children (0–59 months of age)            | 1,333        |
| Number of caregivers of eligible children interviewed       | 1,011        |
| Module 5A response rate (%)                                 | 75.8%        |
| <b>Module 6A: A-WEAI, women</b>                             |              |
| Number of eligible women                                    | 2,406        |
| Number of eligible women interviewed                        | 1,681        |
| Module 6A response rate (%)                                 | 69.9%        |
| <b>Module 6B: A-WEAI, men</b>                               |              |
| Number of eligible men                                      | 1,916        |
| Number of eligible men interviewed                          | 1,430        |
| Module 6B response rate (%)                                 | 74.6%        |
| <b>Module 7.1: Maize farmers</b>                            |              |
| Number of eligible farmers                                  | 1,431        |
| Number of eligible farmers interviewed                      | 1,276        |
| Module 7.1 response rate (%)                                | 89.2%        |
| <b>Module 7.2: Paddy Rice</b>                               |              |
| Number of eligible farmers                                  | 1,474        |
| Number of eligible farmers interviewed                      | 1,347        |
| Module 7.2 response rate (%)                                | 91.4%        |
| <b>Module 7.3: Cauliflower</b>                              |              |
| Number of eligible farmers                                  | 80           |
| Number of eligible farmers interviewed                      | 67           |
| Module 7.3 response rate (%)                                | 83.8%        |
| <b>Module 7.4: Tomato</b>                                   |              |

| Response rate <sup>a</sup>                | Value |
|-------------------------------------------|-------|
| Number of eligible farmers                | 53    |
| Number of eligible farmers interviewed    | 46    |
| Module 7.4 response rate (%)              | 86.8% |
| <b>Module 7.91: Plot area</b>             |       |
| Number of eligible farmers                | 3,038 |
| Number of eligible farmers interviewed    | 2,543 |
| Module 7.91 response rate (%)             | 83.7% |
| <b>Module 7.92: Crop yield</b>            |       |
| Number of eligible farmers                | 3,038 |
| Number of eligible farmers interviewed    | 2,724 |
| Module 7.92 response rate (%)             | 89.7% |
| <b>Module 8: Consumption expenditures</b> |       |
| Number of eligible households             | 2,481 |
| Number of eligible households interviewed | 2,411 |
| Module 8 response rate (%)                | 97.2% |
| <b>Module 9: Nepal-specific module</b>    |       |
| Number of eligible households             | 2,481 |
| Number of eligible households interviewed | 2,432 |
| Module 9 response rate (%)                | 98.0% |

<sup>a</sup> Module response rates are calculated based on the module outcome codes, except where otherwise noted. The response rates are defined as the number of eligible individuals or households interviewed divided by the number of eligible individuals or households. All occupied households are eligible for Modules 1, 2, 3, and 8. Eligibility determination for Modules 4, 4A, 5, 5A, and 6 is initiated in the household roster and confirmed in the respective module. Eligibility determination for sections of Module 7 is initiated in the Module 2 and confirmed in the respective sections of Module 7. Note that for Module 5, the primary caregivers of the children served as the respondents, not the children directly.

<sup>b</sup> Module 4A does not include an outcome code, so the module is complete if the currently pregnant field is complete and the height and weight fields have values less than 999.4.

<sup>c</sup> Module 5A does not include an outcome code, so the module is considered to be complete if the length or height field is complete, the height field has a value less than 999.4, and the weight field has a value less than 99.94.

Sources: Feed the Future Nepal ZOI Survey 2019

## AI.2. A-WEAI results for indicators that compose the 5DE, using uncensored headcount ratios

**Table AI.3: Percent of Primary Adult Decision-makers with Adequate Achievement in Each A-WEAI Indicator Using Uncensored Headcount Ratios, by Sex and Age**

| A-WEAI indicator                         | Female  |       | Male    |       | Sig. <sup>a</sup> |
|------------------------------------------|---------|-------|---------|-------|-------------------|
|                                          | Percent | n     | Percent | n     |                   |
| <b>Input in productive decisions</b>     | 99.58   | 1,358 | 99.52   | 1,107 | n/s               |
| 18–29                                    | 99.39   | 220   | 98.20   | 122   | n/s               |
| 30+                                      | 99.61   | 1,138 | 99.69   | 985   | n/s               |
| <b>Ownership of assets</b>               | 99.87   | 1,358 | 99.93   | 1,107 | n/s               |
| 18–29                                    | 99.62   | 220   | 100.0   | 122   | -                 |
| 30+                                      | 99.91   | 1,138 | 99.92   | 985   | n/s               |
| <b>Access to and decisions on credit</b> | 63.59   | 1,358 | 67.50   | 1,107 | n/s               |
| 18–29                                    | 66.72   | 220   | 62.58   | 122   | n/s               |
| 30+                                      | 62.97   | 1,138 | 68.13   | 985   | *                 |
| <b>Control over income</b>               | 96.63   | 1,358 | 98.42   | 1,107 | *                 |
| 18–29                                    | 95.84   | 220   | 98.34   | 122   | n/s               |
| 30+                                      | 96.79   | 1,138 | 98.43   | 985   | *                 |
| <b>Group membership</b>                  | 54.09   | 1,358 | 41.01   | 1,107 | ***               |
| 18–29                                    | 52.23   | 220   | 29.88   | 122   | ***               |
| 30+                                      | 54.46   | 1,138 | 42.43   | 985   | ***               |
| <b>Workload</b>                          | 53.95   | 1,358 | 64.39   | 1,107 | ***               |
| 18–29                                    | 47.27   | 220   | 66.72   | 122   | **                |
| 30+                                      | 55.29   | 1,138 | 64.09   | 985   | ***               |

<sup>a</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and primary adult decision-makers' sex. Associations found to be statistically significant are indicated by level: \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ ; n/s=not significant.

Note: Estimates are based on primary adult decision-makers who are de jure household members.

Source: Feed the Future Nepal ZOI Survey 2019

### AI.3. Poverty indicators at the \$1.25 (2005 PPP) per person per day threshold

**Table AI.4: Poverty Indicators at the \$1.25 (2005 PPP) per person per day threshold in the ZOI (83.43 Rs), in total and by selected household characteristics**

| Household characteristic       | Prevalence of poverty <sup>a</sup> |                   | Prevalence of “near-poor” <sup>c</sup> |                   | Number of households <sup>d</sup> | Depth of poverty of the poor <sup>e</sup> |                   | Number of households <sup>d</sup> |
|--------------------------------|------------------------------------|-------------------|----------------------------------------|-------------------|-----------------------------------|-------------------------------------------|-------------------|-----------------------------------|
|                                | Percent                            | Sig. <sup>b</sup> | Percent                                | Sig. <sup>b</sup> |                                   | Percent of poverty line                   | Sig. <sup>b</sup> |                                   |
| <b>All households</b>          | 8.5                                |                   | 10.9                                   |                   | <b>2,407</b>                      | 20.1                                      |                   | <b>195</b>                        |
| <b>Gendered household type</b> |                                    | ***               |                                        | n/s               |                                   |                                           | ***               |                                   |
| Male and female adults         | 8.3                                |                   | 10.6                                   |                   | 1,891                             | 20.3                                      |                   | 149                               |
| Female adults only             | 10.4                               |                   | 13.6                                   |                   | 459                               | 18.9                                      |                   | 41                                |
| Male adults only               | 2.0                                |                   | 3.8                                    |                   | 53                                | ^                                         |                   | 1                                 |
| Children only, no adults       | ^                                  |                   | ^                                      |                   | 4                                 | ^                                         |                   | 0                                 |
| <b>Household education</b>     |                                    | ***               |                                        | ***               |                                   |                                           | n/s               |                                   |
| No education                   | 10.2                               |                   | 13.8                                   |                   | 150                               | ^                                         |                   | 14                                |
| Less than primary              | 16.6                               |                   | 18.8                                   |                   | 521                               | 21.3                                      |                   | 68                                |
| Completed primary              | 8.4                                |                   | 10.7                                   |                   | 1,100                             | 19.0                                      |                   | 81                                |
| Completed secondary            | 3.9                                |                   | 8.6                                    |                   | 334                               | ^                                         |                   | 10                                |
| Higher                         | 2.9                                |                   | 3.5                                    |                   | 302                               | ^                                         |                   | 8                                 |
| <b>Wealth quintile</b>         |                                    | ***               |                                        | ***               |                                   |                                           | n/s               |                                   |
| Highest (wealthiest)           | 0.7                                |                   | 1.9                                    |                   | 472                               | ^                                         |                   | 3                                 |
| Fourth                         | 4.8                                |                   | 6.1                                    |                   | 483                               | ^                                         |                   | 21                                |
| Middle                         | 8.5                                |                   | 12.5                                   |                   | 481                               | 18.1                                      |                   | 35                                |
| Second                         | 7.2                                |                   | 15.3                                   |                   | 482                               | 21.8                                      |                   | 30                                |
| Lowest (poorest)               | 22.6                               |                   | 20.7                                   |                   | 489                               | 21.8                                      |                   | 102                               |
| <b>Shock exposure index</b>    |                                    | ***               |                                        | *                 |                                   |                                           | n/s               |                                   |
| Did not experience any shocks  | 4.2                                |                   | 10.7                                   |                   | 556                               | 19.5                                      |                   | 29                                |
| Low                            | 7.4                                |                   | 7.5                                    |                   | 687                               | 16.6                                      |                   | 45                                |
| Moderate                       | 11.6                               |                   | 12.5                                   |                   | 547                               | 19.9                                      |                   | 54                                |
| High                           | 10.8                               |                   | 13.6                                   |                   | 590                               | 23.0                                      |                   | 62                                |
| <b>Ecological Zone</b>         |                                    | ***               |                                        | n/s               |                                   |                                           |                   |                                   |
| Hill                           | 10.2                               |                   | 12.1                                   |                   | 1,328                             | 21.8                                      |                   | 124                               |
| Terai                          | 7.1                                |                   | 10.0                                   |                   | 993                               | 17.7                                      |                   | 63                                |
| Mountain                       | 2.5                                |                   | 6.1                                    |                   | 86                                | ^                                         |                   | 4                                 |

^ Results not statistically reliable, n<30

<sup>a</sup> The prevalence of poverty is the percentage of individuals living below the \$1.25 2005 PPP per person per day poverty threshold.

<sup>b</sup> Significance tests were performed to determine whether an association exists between the outcome indicator and the disaggregate variables. Associations found to be statistically significant are indicated by level: \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ ; n/s=not significant.

<sup>c</sup> The prevalence of “near-poor” is the percentage of individuals living at or above the \$1.25 per person per day poverty threshold (2005 PPP) but below 125 percent of that threshold.

<sup>d</sup> Records missing information for the disaggregate variables have been excluded from the disaggregated estimates. The unweighted sample size reflects this loss in observations; therefore, the sum of disaggregate sample sizes may not equal the overall sample size.

<sup>e</sup> The depth of poverty of the poor measures, on average, how far the consumption of the poor is below the \$1.25 (2005 PPP) per person per day poverty threshold.

Note: Estimates are based on de jure household members.

Source: Feed the Future Nepal ZOI Survey 2019

## APPENDIX 2. METHODOLOGY

### A2.1 Sampling and weighting

The aim of the Feed the Future Baseline/Endline Survey 2019 is to produce sample-weighted estimates of indicators, including their standard errors and CIs, to enable a statistical test of differences to detect changes in indicators over time at the level of the respective ZOI (Phase One or Phase Two).

The final sample size of the dual-purpose Feed the Future Baseline/Endline survey is determined by two factors: (1) the required sample size for each survey, and (2) the geography of the endline Phase One ZOI and the baseline Phase Two ZOI, in particular, the proportion of each ZOI population that overlaps.<sup>195</sup>

#### Phase Two ZOI sampling strategy

The sample for the Feed the Future Nepal ZOI Survey 2019 followed a multi-stage stratified cluster sampling design. In the first stage, 165 EAs were selected from the 2011 National Census frame in 25 districts by probability proportional to size (PPS) sampling. In the second stage, households were selected from these 165 EAs for interview. This household sampling was conducted in two steps. First, 25 households per EA (4,125) were selected to cover households to be interviewed and a buffer of households to replace households that could not be interviewed, based on the sample frame from a listing operation that was fielded from March 8<sup>th</sup> through April 8<sup>th</sup>, 2019. Second, 15 households were randomly selected from the 25 per EA to form the initial sample of 2,475. During field work, 176 replacement households were used.

The Phase Two ZOI baseline sample size calculation was conducted to ensure adequate power to capture change over time. We follow the methodology of the sample size calculation for the 2019 Nepal ZOI Endline/Baseline provided in the Feed the Future sampling guidelines. Further information on sample size calculations is available in the Sampling Guide.<sup>196</sup> The required sample size is calculated in two steps: in step one, the initial sample size is calculated and in step two, the sample size is inflated to ensure enough children are reached as well as account for anticipated non-response. As per the Feed the Future ZOI Survey (2018-2019) recommendation, the sample sizes for the three goal-level indicators collected in the survey should be calculated. The largest sample size resulting from the sample sizes computed should be chosen as the overall sample size for the survey.

For the Feed the Future ZOI Survey 2019, the goal-level indicators that are recommended to be used as a basis for calculating the sample size are:

- Prevalence of stunting among children under five years of age
- Prevalence of moderate and severe food insecurity
- Prevalence of poverty at \$1.90 2011 PPP

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<sup>195</sup> For additional information about Feed the Future sampling methodology see Stukel, D.M. (2018). *Feed the Future population-based survey sampling guide*. Washington, DC: Food and Nutrition Technical Assistance Project, FHI 360. <sup>196</sup> Ibid.



Because these three high-level indicators are likely to have the smallest amount of targeted change among all Feed the Future ZOI PBS indicators, the required sample size should be large enough to capture statistically significant changes in lower-level Feed the Future ZOI PBS indicators, where the amount of change achieved should be greater and, thus, the sample size required to capture it is smaller. In other words, most other indicators likely will have a larger sample size than is required, and a statistical test of differences that is calculated over time for these indicators likely will have more power than necessary.

### Step One: Computing the initial sample size of the survey

We consider two Feed the Future goal-level indicators, hunger and malnutrition, for the Phase Two ZOI baseline sample size calculations. Hunger is represented by the prevalence of moderate or severe food insecurity in the population, based on the FIES while malnutrition is measured by the prevalence of stunted (z-score less than -2) children under five years of age. The third indicator, prevalence of poverty, generally measured as percent of people living on less than \$1.90/day (2011 PPP), is intentionally ignored since the prevalence of poverty is very low and thus would require an excessively large sample size to capture a meaningful change.<sup>197</sup> Since both indicators considered for the sample size calculation are proportions (prevalence), the formula we use to calculate the initial sample size is as follows:

$$n_{initial} = Def f * \left[ \frac{z_{1-\alpha} \sqrt{2P(1-P)}^{1st\ comp} + z_{1-\beta} \sqrt{P_1(1-P_1) + P_2(1-P_2)}^{2nd\ comp}}{[\delta]} \right]^2$$

where:

$\delta$  represents the meaningful change (minimum detectable effect size) to be achieved over the time frame ( $\delta \neq 0$ )

$P_1$  The estimated baseline prevalence value

$P_2$  is the expected ending prevalence value, equal to  $P_1 \pm \delta$

$$\underline{P} = \frac{P_1 + P_2}{2}$$

$z_{1-\alpha}$  is the value from the Normal Probability Distribution corresponding to a confidence level  $1-\alpha$ . For  $1-\alpha = 0.95$ , the corresponding value is  $z_{0.95} = 1.64$

$z_{1-\beta}$  represents the value from the Normal Probability Distribution corresponding to a confidence level  $1-\beta$  which is also known as analytical power. In our case  $(1-\beta) = 0.80$ , with the corresponding value of  $z_{0.80} = 0.84$

$Def f = 1+(n-1) * \text{intra-cluster correlation (ICC)}$  is the estimated DEFF of the survey. Note that the sample size calculations are quite sensitive to this parameter, since they depend on ICC and the number

<sup>197</sup> In alignment with RFS guidance.

of households per cluster, EAs in this case.

Following **Table A2-I** presents the calculation of the initial sample size for the two key Feed the Future ZOI PBS indicators, using the input parameters given in the table and the formula above. The baseline prevalence and average annual rate of change (AARC) of the FIES (4.1 percent) and stunting (3.4 percent) in **Table A2-I** below are obtained from Annex 2 of the Scope of Work/Request for Task Order Proposal (RFTOP) for the Nepal PBS. The RFTOP used the value of the HHS (20.2 percent) as the baseline prevalence from the Feed the Future Nepal 2015 ZOI Interim Assessment Report as the source for the calculation of the FIES.<sup>198</sup> The population weighted proportion of stunting (34.86 percent or ~35 percent) is reported to be obtained from 2016 NDHS.

To crosscheck the precision of the expected end line prevalence rates in the FIES and stunting based on their respective AARC, we calculated the level of expected change and the corresponding expected prevalence rates in the endline after six years. Starting with the estimated  $P_1$  FIES of 20.2 percent in 2015, and an AARC of -4.1 percent, we estimated a  $P_2$  FIES value of 15.7 percent after six years. Starting with an estimated  $P_1$  stunting prevalence of 34.86 percent in 2016, and an AARC of -3.4 percent, we estimated  $P_2$  stunting prevalence of 28.3 percent after six years. This results in a minimum detectable effect size, or  $\delta$  of -4.5 and -6.56 percentage points respectively for FIES and stunting. Parameter value for DEFF was taken from the RFTOP.<sup>199</sup> Note that the initial sample size based on our calculation for these two goal indicators yields slightly different numbers despite same AARC and baseline values.

**Table A2-I: Calculation of Initial Sample Size for Three Key Feed the Future ZOI PBS Indicators**

| Indicator | AARC | ( $P_1$ ) | ( $P_2$ ) | $\delta$  | ( $P$ ) | $z_{1-\alpha}$ | $z_{1-\beta}$ | DEFF | n-initial |
|-----------|------|-----------|-----------|-----------|---------|----------------|---------------|------|-----------|
| FIES      | 4.1% | 20.20%    | 15.7%     | -4.5% pt  | 17.96%  | 1.64           | 0.84          | 2.6  | 2,338     |
| Stunting  | 3.4% | 34.86%    | 28.3%     | -6.55% pt | 31.59%  | 1.64           | 0.84          | 1.6  | 995       |

Note: Social Impact uses the AARC and ( $P_1$ ) as reported by in RFTOP to calculate ( $P_2$ ), and  $\delta$ .

## Step Two: Computing the final Phase Two ZOI baseline survey sample size

Before the survey sample size was finalized, two adjustments to these computations were made: (1) inflation for the number of households to contact and (2) inflation for anticipated household non-response.<sup>200</sup>

The final sample size, denoted by  $n_{final}$ , which is a product of the initial sample size and both adjustments, then becomes:

$$n_{final} = n_{initial} * adj_1 * adj_2 = n_{adj_1} * adj_2$$

*Adjustment 1: Inflation for the number of households to contact.*

<sup>198</sup> According to RFS guidance (also indicated in the RFTOP, pp 9 in Annex 2), the interim estimate for the HHS are refined to generate a ZOI-level FIES score by assuming that the ratio of moderate plus severe food insecurity to severe food insecurity alone under the FIES applies to the HHS.

<sup>199</sup> See Table A2-I in page 8 in the Annex of the RFTOP.

<sup>200</sup> Further descriptions and calculations on adjustments are available in the Sampling Guide (Stukel 2018).

Once the initial sample size for each indicator provides a basic sample size, the first adjustment is based on the correspondence between households and eligible members of the households for each sampling group. For example, stunting is applicable to only children under five years of age, and not all households will have children. As a result, to obtain the required number of households with children, the initial number of households needs to be adjusted to achieve the final sample size. Alternatively, since the FIES is collected at the household level, the sample size derived from this indicator does not need to be inflated or adjusted. Following the Feed the Future ZOI Survey Methods and Sampling Guide, we used the following formula for the adjustment of sample size derived from stunting:

$$Adj_1 = \left[ A \frac{1}{(1-e^{-\lambda})} \right] + 0.5 \left[ (1-A) \frac{1}{(1-e^{-\lambda})} \right]$$

Where  $A=(1+\lambda)*e^{-\lambda}$  and  $\lambda$  is the average number of children in a household.

We used the Nepal Feed the Future FEEDBACK baseline data to calculate the average number of children in a household ( $\lambda$ ).<sup>201</sup>

*Adjustment 1: Inflation for the number of households to contact*

|          | $\lambda$ | $e^{-\lambda}$ | A    | $\frac{1}{(1-e^{-\lambda})}$ | Adj-1 |
|----------|-----------|----------------|------|------------------------------|-------|
| Stunting | 0.70      | 0.50           | 0.84 | 1.99                         | 1.89  |

*Adjustment 2: Inflation for Non-response rate adjustment*

Since non-response can affect both indicators, this adjustment applies to both. We used a five percent non-response rate as suggested in the sampling guide for our second adjustment. We used the following formula to calculate the adjustment factor:

$$Adj_2 = \left[ \frac{1}{(1-r)} \right]$$

Where “r” refers to non-response rate.

**Table A2-2** illustrates the computation of the final sample size for two key Feed the Future ZOI PBS indicators based on the discussion above.

**Table A2-2: Calculation of Final P2-ZOI Baseline Sample Size for Two Key Feed the Future ZOI PBS Indicators**

| Indicators      | n-initial | adj-1 factor | adj-2 factor | n-final |
|-----------------|-----------|--------------|--------------|---------|
| <b>FIES</b>     | 2,338     |              | 1.05         | 2,461   |
| <b>Stunting</b> | 995       | 1.89         | 1.05         | 1,984   |

<sup>201</sup> We used NEPAL\_HHMEMBERS\_PR.dta file available at USAID open government development data library to calculate average number of children in a household. Available as Feed the Future Nepal: Baseline Household Survey, in STATA format. <https://www.usaid.gov/data/dataset/92fa242f-07b3-4ec4-9e98-84ab09e1078b>.

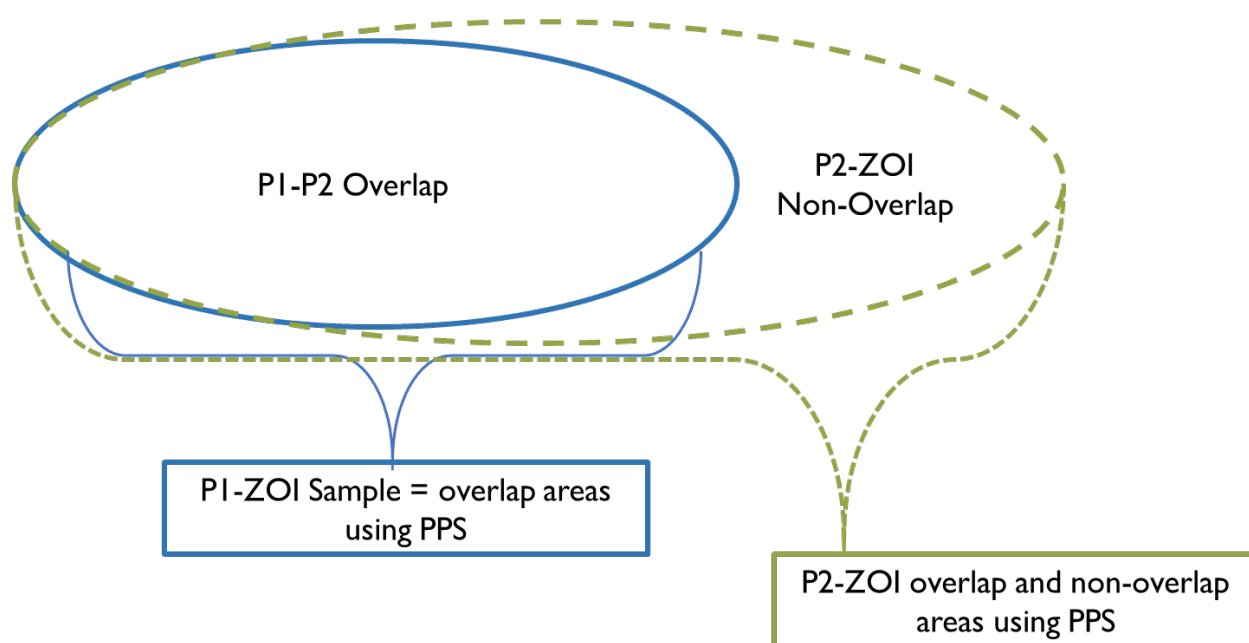
Note: Stunting is based on average number of children under five years summarized from Nepal Feed the Future FEEDBACK Baseline data.

As **Table A2-2** suggests, the FIES has the largest (2,461) final sample size requirement as compared to stunting (1,924). Therefore, the overall sample size for the Feed the Future Phase Two ZOI baseline survey will be 2,461 households. Because the largest sample size is chosen as the overall sample size for the survey, it meets and exceeds the needs of the other indicators.

## Selection Method

### Geography

For the Feed the Future Baseline/Endline assessment, the population of interest is the population contained in two ZOIs: the ZOI defined under the first phase of Feed the Future (P1-ZOI), and the ZOI defined under the second phase of the Feed the Future survey (P2-ZOI). Each ZOI was stratified into P2-ZOI only districts and P1-ZOI/P2-ZOI overlap districts. The survey conducted for the P1-ZOI includes Arghakhanchi, Gulmi, Kapilvastu, and Palpa, Banke, Bardiya, Dang, Pyuthan, Rolpa, and East Rukum in Lumbini Province; Salyan, Surkhet, Dailekh, Jajarkot, and West Rukum in Karnali Province; Achham, Baitadi, Dadeldhura, Doti, Kailali, and Kanchanpur, in Sudurpashchim Province. For the P2-ZOI, the survey covers these districts and four more districts from Bagmati Province (Kavrepalanchok, Makwanpur, Nuwakot, and Sindhupalchowk), which were added after the earthquake in Nepal in April 2015. The required sample size for each ZOI was allocated in proportion to the population in the area of the P2-ZOI that overlaps with the P1-ZOI, and the area of the P2-ZOI that does not overlap. See figure below:



### Probability Proportional to Size

Social Impact conducted the survey among a representative, random sample of the entire population living in the P1-ZOI and P2-ZOI, which used a cross-sectional, multi-stage cluster sampling design with four stages of sampling. The required sample size for P1-ZOI is 1,956, as described in the RFTOP and

Scope of Work provided by USAID. Because the P1-ZOI is fully contained within the P2-ZOI and because of the high degree of overlap in the ZOIs, a sample of 2,461 in the P2-ZOI yields a sample of 2,049 in the P1-ZOI based on the proportion of the P2-ZOI population in the P1-ZOI, without any additional sub-sampling. Accordingly, the final required sample size was set at 2,461. The sample size for each ZOI is provided in **Table A2-3**.

For survey designs where there are multiple stages of sampling, the sampling weights are calculated for each stage of sampling and then combined to generate an overall weight. The four stages of sampling, along with calculation of weights, are articulated below.

**Stage One—Selection of EAs:** Social Impact selected EAs located in Feed the Future ZOIs as part of the first phase of the survey sampling process. In this stage, Social Impact identified a random sample of 165 EAs, using PPS after allocating the EAs by stratum and accounting for stratification and the joint endline/baseline approach. Since the required P1-ZOI sample size was less than the proportion of the required P2-ZOI sample size allocated to the overlap area, the P2-ZOI overlap sample was used for the P1-ZOI sample with no sub-sampling. During the sampling phase, Social Impact allocated the sample among strata based on the proportion of total P2-ZOI population in each stratum, then selected EAs within each stratum with PPS. Each stratum is created based on their locational information, such as ZOI, province, ecological zone, and rural-urban status. Based on this information, Social Impact created 14 strata as presented in **Table A2-3**. Given this definition of strata and their share of total P2-ZOI population, the sampling weight for this stage corresponds to the probability of selection of the EA. The probability of selection of EA(i) in stratum h is— $f_{1hi} = \frac{m_h * N_{hi}}{N_h}$  where  $m_h$  is the total number of EAs to be selected from stratum h,  $N_{hi}$  is the total population in the selected EA(i) in stratum h, and  $N_h$  is the total population across all EAs in stratum h. **Table A2-3** presents the number of EAs sampled, along with the number of households and total population in each strata.

**Table A2-3: Distribution of EAs, households and total population in each stratum**

| Strata                                                | ZOI           | Province               | Terai, Hill or Mountain | Rural or Urban | Population Information |                                      |                            | Sample Information    |                                    |                                          |                          |
|-------------------------------------------------------|---------------|------------------------|-------------------------|----------------|------------------------|--------------------------------------|----------------------------|-----------------------|------------------------------------|------------------------------------------|--------------------------|
|                                                       |               |                        |                         |                | Number of Census EAs   | Total Number of households in Strata | Total Population in Strata | Number of sampled EAs | Sampled households in each stratum | Total number of households in Sample EAs | Total Pop. in Sample EAs |
| 1                                                     | P2            | Bagmati Province       | Hill                    | Rural          | 1,188                  | 109,912                              | 541,714                    | 11                    | 165                                | 1,380                                    | 7,442                    |
| 2                                                     | P2            | Bagmati Province       | Hill                    | Urban          | 577                    | 115,191                              | 521,413                    | 11                    | 165                                | 4,152                                    | 17,671                   |
| 3                                                     | P2            | Bagmati Province       | Mountain                | Rural          | 468                    | 40,029                               | 170,564                    | 4                     | 60                                 | 314                                      | 1,321                    |
| 4                                                     | P2            | Bagmati Province       | Mountain                | Urban          | 243                    | 26,606                               | 115,206                    | 2                     | 30                                 | 370                                      | 1,722                    |
| 5                                                     | PI-P2 Overlap | Lumbini Province       | Hill                    | Rural          | 2,237                  | 198,059                              | 928,638                    | 20                    | 300                                | 2,838                                    | 13,125                   |
| 6                                                     | PI-P2 Overlap | Lumbini Province       | Hill                    | Urban          | 738                    | 106,106                              | 460,997                    | 10                    | 150                                | 3,959                                    | 13,721                   |
| 7                                                     | PI-P2 Overlap | Lumbini Province       | Terai                   | Rural          | 800                    | 134,617                              | 744,498                    | 16                    | 240                                | 3,744                                    | 19,578                   |
| 8                                                     | PI-P2 Overlap | Lumbini Province       | Terai                   | Urban          | 1,004                  | 250,834                              | 1,282,252                  | 27                    | 405                                | 12,820                                   | 62,225                   |
| 9                                                     | PI-P2 Overlap | Karnali Province       | Hill                    | Rural          | 891                    | 81,102                               | 437,637                    | 9                     | 135                                | 716                                      | 3,872                    |
| 10                                                    | PI-P2 Overlap | Karnali Province       | Hill                    | Urban          | 759                    | 116,953                              | 575,382                    | 12                    | 180                                | 3,386                                    | 15,812                   |
| 11                                                    | PI-P2 Overlap | Sudurpashchim Province | Hill                    | Rural          | 1,144                  | 91,148                               | 490,361                    | 10                    | 150                                | 1,006                                    | 6,149                    |
| 12                                                    | PI-P2 Overlap | Sudurpashchim Province | Hill                    | Urban          | 728                    | 68,744                               | 353,265                    | 7                     | 105                                | 1,648                                    | 8,955                    |
| 13                                                    | PI-P2 Overlap | Sudurpashchim Province | Terai                   | Rural          | 204                    | 42,941                               | 246,785                    | 5                     | 75                                 | 1,239                                    | 6,710                    |
| 14                                                    | PI-P2 Overlap | Sudurpashchim Province | Terai                   | Urban          | 377                    | 181,606                              | 968,377                    | 21                    | 315                                | 24,335                                   | 120,253                  |
| <b>Total for PI-ZOI (from PI-P2 ZOI overlap area)</b> |               |                        |                         |                | <b>8,882</b>           | <b>1,272,110</b>                     | <b>6,488,192</b>           | <b>137</b>            | <b>2,055</b>                       | <b>55,691</b>                            | <b>270,400</b>           |
| <b>Total for P2-ZOI</b>                               |               |                        |                         |                | <b>11,358</b>          | <b>1,563,848</b>                     | <b>7,837,089</b>           | <b>165</b>            | <b>2,475</b>                       | <b>61,907</b>                            | <b>298,556</b>           |

Note: The Table is based on information available in the latest Census. The rural urban definition of EAs is updated based on the current status of the EAs.

**Stage Two—Segmentation of EAs:** In this stage Social Impact calculated the probability of selecting a particular segment for a given EA at the second stage of sampling. This corresponds to the “conditional” selection of a segment, assuming the EA in which the segment is situated has been selected at the first stage of sampling. This step is only undertaken if segmentation is necessary. As per the study guidelines, the listing team segmented EAs that contained more than 300 households. The team identified 54 of these large EAs during listing by estimating the number of households per EA. The survey team subdivided these 54 EAs into equally-sized segments with an equal distribution of 300 households to the greatest extent possible. As a result, the probability of selection of each segment, a list of these EAs, and the corresponding number of segments is provided in the Annex. The probability of selection of segment  $j$ , assuming selection of EA( $i$ ) in stratum  $h$  is completed, is as follows:  $f_{2hij} = \frac{1}{s_i}$  where  $s_i$  is total number of segments in the selected EA.

**Stage Three—“Conditional” selection of a household:** This stage assumes that the segment in which the household was situated was selected during the second stage of sampling, and that the EA in which the segment is situated was selected during the first stage of sampling. If segmentation for any EA was not undertaken at the second stage, then we assume the household was selected from the correspondingly sampled EA.

In the third stage of sampling, which was done in two steps, Social Impact first randomly sampled 25 households from each EA in Step One using fractional interval systematic sampling. The selection of 25 households instead of 15 was done because the survey was much longer than anticipated, and we anticipated much higher non-response or inaccessibility among households than assumed during sample size calculations. This approach of including replacements in each EA to ensure that we did not drop below our target sample size was agreed upon through discussion with USAID. After randomly sorting these 25 sampled households from each EA, Social Impact, in Step Two, adapted the “inaccessibility approach” for EAs, described as special scenario in the Feed the Future Survey Sampling Guide, to apply to household-level replacements. We assigned the first 15 to the “core” sample and the remaining ten to “replacements.” Because of the randomized sorting of 25 households before their allocation to two groups, the core and replacements households are listed in the randomized order (i.e., first 15 households are used for survey first and, in case of non-response, the first replacement to be used is the 16<sup>th</sup> household from the randomized sort in Step Two). Based on this approach, Social Impact adjusted the selection probability as follows:  $f_{3hijk} = \frac{(15+r_i)}{25} \times \frac{25}{N_{hij}} = \frac{(15+r_i)}{N_{hij}}$  where  $r_i$  is the number of replacements used for  $i^{\text{th}}$  EA, 25 (15 core plus ten replacements) is the total number of households randomly sampled from each EA and  $N_{hij}$  is the total number of households in the particular segment of the EA.

**Stage Four—Selection of Individuals or Plots:** In the fourth stage, not all eligible individuals within the households were selected for interviews. With oversight from Social Impact, the survey firm established a list of eligible individuals within each household. Eligible individuals included are all children under age six for stunting, wasting, and healthy weight indicators; all children under age three for feeding behaviors; primary male and female decision-makers for the AWEAI modules; and all producers of key commodities for the application of improved practices and yield indicators. However, due to concerns with the length of the survey, Social Impact randomly selected one woman of reproductive age from all

women ages 15-49 for the underweight and MDD indicators. Since Social Impact did not use a “take all” approach for women, the sampling weight needed to be adjusted for them. Due to the “take all” approach for all men and children, Social Impact did not need any further sub-sampling or weighting among eligible respondents. Likewise, for plots, two plots per VCC were selected randomly (if there were at least two plots) for plot area measurement, and one of those sampled plots was randomly sampled for soil assessment. As a result,

- For male members in a household:  $f_{4hijkl} = 1$
- For children:  $f_{4hijkl} = 1$
- For all women responding as the primary decision-maker:  $f_{4hijkl} = 1$
- For women within 15-49 years:  $f_{4hijkl} = \frac{1}{n}$  where  $n$  is the number of women within 15-49 years in the household,
- For plot area measurement:  $f_{4hijkl} = \frac{s}{n}$  where  $s$  is the number of plots sampled and  $n$  is the number of plots cultivated with a given VCC, and
- For soil assessment:  $f_{5hijkl} = \frac{1}{s}$

This step assumes that the household in which the individual resides was selected at the third stage of sampling, the segment in which the household is situated was selected at the second stage of sampling, and that the EA in which the segment is situated was selected during first stage of sampling.

### Sampling weights: Calculations

The weighting of survey data used information available from the EA frame (i.e., the first-stage sampling frame), as well as information collected during the listing and data collection processes. This information included the following: (1) measure of size of EAs; (2) measure of size of strata from which EAs were drawn; (3) measure of size of EAs at time of listing; and (4) response rates among households, women, and men. Weights were calculated for the following to account for differing levels of non-response.

To calculate the overall probabilities of selection for individuals selected into the sample, Social Impact multiplied the probability of selection at each of the four stages together as followed:

$$\text{For households: } f_{HH} = f_{3hijk} * f_{2hij} * f_{1hi}$$

$$\text{For individuals: } f_{ind} = f_{4hijkl} * f_{3hijk} * f_{2hij} * f_{1hi}$$

Based on the probability of selection for individuals and households stated above, Social Impact calculated the overall sampling weights for individuals and households that reflect their respective probabilities of selection at each stage. This is done by taking the inverse of the associated quantity calculated above:

$$\text{For households: } w_{HH} = \frac{1}{f_{HH}} = \frac{1}{f_{3hijk} * f_{2hij} * f_{1hi}}$$

$$\text{For individuals: } w_{ind} = \frac{1}{f_{ind}} = \frac{1}{f_{4hijkl} * f_{3hijk} * f_{2hij} * f_{1hi}}$$



Finally, Social Impact included two non-response adjustments that can be made to the overall sampling weights to compensate for: (1) the selected households that did not respond to the survey and (2) the eligible individuals who did not respond to the survey (or plots which were not measured) in case there is non-response.

The weight adjustment for household non-response can be calculated as:  $w_{HH\_adj} = \frac{N_h * w_{HH}}{(N_h - N_{r1}) * w_{HH}}$

where  $N_{r1}$  is non-response rate and  $N_h$  is the number of households selected for interviewing in stratum h. Social impact skipped this step since the use of replacement households resulted in 100 percent response rate.

The weight adjustment for individual or plot non-response is calculated as:  $w_{ind\_adj} = \frac{N_{ind} * w_{ind}}{(N_{ind} - N_{r2}) * w_{ind}}$

where  $N_{r2}$  is individual non-response rate and  $N_{ind}$  is the number of individuals selected for interviewing in stratum h.

## A2.2a Poverty prevalence and consumption expenditure methods

### Data source

The Feed the Future Phase I baseline poverty indicators were calculated using data from the 2011 National Living Standards Survey. For 2019 estimates, Social Impact conducted the 2019 Population-Based Survey in conjunction with its data collection partner, New ERA. Values for all 2019 indicators reported were calculated using primary data from the survey. For more details on the data sources, see Chapter 2 of the main report.

### Data preparation

#### Data excluded from analysis

Non-food, non-durable goods excluded from analysis: Consumption expenditures information for non-food, non-consumer goods was collected for different recall periods: seven days, one month, three months, and 12 months. No items were excluded from the seven-day recall period. We have excluded the following five health-related expenditures from the one-month recall period: items related to illnesses and injuries, including medicine, tests, consultation, and outpatient fees (except for hospitalization); medical care not related to an illness, such as preventative healthcare, pre-natal visits, check-ups, etc.; non-prescription medicines, such as Panadol, Fansidar, cough syrup, etc.; transportation used to access health-related services or care that did not require an overnight stay in a health facility or at a traditional healer's dwelling; and other health expenditures.

From the three-month recall period, we have excluded night's lodging in rest house or hotel (excluding school or health-related).

Finally, we have excluded infrequent and lumpy expenditures from the 12-month recall period: insurance, such as health, auto, home, life, etc.; fines or legal fees; bride wealth costs; marriage ceremony costs; funeral costs; hospitalizations or overnight stay(s) in any hospital (total cost for treatment); travel to and from a medical facility for any overnight stay(s) or hospitalization; food costs during overnight stays(s) at a medical facility or hospitalization; overnight stay(s) at a traditional healer's or faith healer's

dwelling (total costs for treatment); and food costs during overnight stay(s) at a traditional healer's or faith healer's dwelling. All items excluded from analysis were selected in accordance with the *Guide to Feed the Future Statistics*.

**Depreciation of durable goods:** We followed the *Guide to Feed the Future Statistics* to account for the depreciation of durable goods. Consumption of a durable good is calculated as the “user cost” or “annual rental equivalent” of owning the item and is approximated by multiplying the value of the item in its current shape by the sum of the real interest rate and the depreciation rate:

$$R^j = P_t^j(r_t + \delta^j)$$

Where:

$P_t^j$  = the current value of the item

$r_t$  = the real rate of interest

$\delta^j$  = the depreciation rate for the durable good.

The current value of the item ( $P_t^j$ ) is the value of the item in its current shape (second-hand) as reported by the respondent. The real rate of interest ( $r_t$ ) is a single average real rate of interest for all goods over the last ten years. Data on real interest rates for Nepal were taken from the World Bank<sup>202</sup> and averaged over the last ten years, equal to 10.413 percent. Finally, the rate of depreciation ( $\delta^j$ ) is calculated for each item as:

$$\delta^j = 1 - \left( \frac{P_t^j}{P_{t-T}^j} \right)^{\frac{1}{T}}$$

Where  $P_t^j$  is the current average price (average value as reported by the respondent) of the item,  $P_{t-T}^j$  is the average price of the item when purchased, and  $T$  is the average age of the item in years.

**Housing rental value:** We follow the *Guide to Feed the Future Statistics* to estimate housing rental values. Using reported actual monthly rent paid (from renters) and estimated monthly rental value of dwellings owned or occupied for free by the household, a hedonic regression model was used to estimate a rental equivalent for households that do not report actual or estimated rent. This model was developed by regressing available observations and estimates of rental value on a series of dwelling characteristics, including location, and then using the resulting equation to estimate a rental equivalent for the non-renting households that did not provide an estimate of rental value. A log-linear functional form was used:

$$\ln \ln (R_i) = \beta_0 + \beta_i X_i + \varepsilon_i$$

<sup>202</sup> World Bank Open Data (2018). Inflation, GDP deflator (annual %). Retrieved from: <https://data.worldbank.org/indicator/NY.GDP.DEFL.KD.ZG?locations=KH>.

Where  $R_i$  is the rent paid or rent estimate of housing unit  $i$ ,  $X_i$  is a set of characteristics or attributes of housing unit  $i$ ,  $\beta_0$  and  $\beta_i$  are the coefficients to estimate in the hedonic model, and  $\varepsilon_i$  is the error term.

There are several characteristics or attributes (the set of independent variables  $X_i$ ) of the dwelling fitted in the equation, most of which are coded as binary or dummy variables: location (province indicators, and rural/urban) and structural attributes (age of house, number of rooms for sleeping, finished roof, finished wall, improved sanitation facility, improved drinking water source, whether they cook in the house, and access to electricity). The equation with the estimated regression coefficients ( $\beta_i$ ) was applied to the characteristics of non-renting households to impute their rent equivalent.

Expenditures on repairs and household maintenance are included in housing rental value per Feed the Future guidance as well. We follow the guidance for dealing with large, infrequent expenditures on repairs and maintenance as detailed in the Guide to Feed the Future Statistics. We flagged outliers and shared this list with New ERA. New ERA then categorized outlier values as reasonable or unreasonable and provided corrections for some unreasonable values. Where values were unreasonable and there was no correction to be made, we replaced the value with the median of the smallest available geographical unit with data per the Feed the Future guidance.

### **Imputations**

We followed the *Guide to Feed the Future Statistics* regarding the general procedures for treatment of outliers applied to all categories. We checked the consumption module data for outliers for each individual item and across all items at the household and per capita levels. As a general rule, if a value is more than three SDs from its mean, it is flagged as a potential outlier and further examined for plausibility. These potential outliers were shared with New ERA, who determined whether the value was plausible and provided a correction where possible (e.g., they were able to contact the respondent and confirm the correct value or they were able to determine the enumerator had made a data entry error). If, after further examination, an observation is determined to be an outlier, it is coded as missing and then replaced with an imputed value following the general rules described below. We followed the specific procedures in the guidance for each of the four expenditure categories (food, non-food, durables, and housing) regarding additional, category-specific outlier instructions for the food consumption data.

**Procedure for imputed values:** If an observation is determined to be an outlier, it is replaced (imputed) by the median per capita value within the smallest geographic unit, starting with the EA or cluster, that has at least five observations. The steps to do this are as follows:

- Calculate the per capita daily expenditures per household at the item or total level, depending on where imputation is needed, by dividing valid consumption expenditures data by the number of household members and then by the number of days in the recall period.
- For unit value in the food consumption sub-module, sum the monetary value by total quantity consumed, using valid household-level data by item.
- If there are five or more observations in a cluster, calculate the median value at the cluster level.
- If there are less than five observations in a cluster, calculate the median value at the next highest administrative unit level.

- Use the median per capita daily value or the unit value at the lowest administrative level possible to impute a missing value or a confirmed outlier.

### Prices

The baseline and endline ZOI surveys were completed in 2013 and 2019, while poverty indicators were mostly at 2005 or 2011 prices. As a result, nominal values of per capita daily consumption in 2013 and 2019, though calculated in the current prices of those respective years, were converted to their real values at 2005 and 2011 prices. For our analysis, we considered 2014 as the base year and used respective consumer price indices (CPIs) for 2005, 2011, and 2019 to adjust values of all commodities used by households (**Table 4.1.1**). **Table A2-4** also presents the value of PPP conversion rates for 2005 and 2011 that we used to convert per capita daily consumption and poverty lines into local currency for 2005 and 2011.

**Table A2-4: Year-specific CPIs and PPP conversion rates used for analysis**

| Items                                  | Mean (Nepali Rupee) |
|----------------------------------------|---------------------|
| Nepal CPI for survey month (base=2014) | 126.3               |
| Nepal CPI for year 2014 (base=2014)    | 100                 |
| Nepal CPI for year 2011 (base=2014)    | 72.93               |
| Nepal CPI for year 2005 (base=2014)    | 50.09               |
| Nepal 2011 PPP conversion rate         | 25.759              |
| Nepal 2005 PPP conversion rate         | 26.47               |

### Other adjustments

No additional adjustments were made.

### Poverty thresholds

Below are the poverty thresholds included in this report, with the method of estimation for each:

- Prevalence of poverty at \$1.90 (2011 PPP) per person per day (84.76 Rs)
- Percent of people who are “near-poor”, living on 100 percent to less than 125 percent of the \$1.90 (2011 PPP) poverty line (84.76 to <105.95 Rs)
- Average consumption shortfall of the poor at \$1.90 (2011 PPP) per person per day (84.76 Rs)
- Prevalence of poverty at the national threshold of Rs. 19,262 per person per year
- Percent of people who are “near-poor”, living on 100 percent to less than 125 percent of the national threshold of Rs. 19,262 per person per year in 2010
- Average consumption shortfall of the poor at the national threshold of Rs. 19,262 per person per year in 2010
- Prevalence of poverty at \$1.25 (2005 PPP) per person per day (83.43 Rs)
- Percent of people who are “near-poor”, living on 100 percent to less than 125 percent of the \$1.25 (2005 PPP) poverty line (83.43 Rs to <104.29)
- Average consumption shortfall of the poor at \$1.25 (2005 PPP) per person per day (83.43 Rs)

For all poverty thresholds, with the exception of the national poverty line, we first convert the USD values into the local currency unit, Nepalese rupees (Rs.), using either the 2005 or 2011 PPP conversion factors.<sup>203</sup> For the national poverty line indicator, rather than converting a USD value to local currency, we used the Rs. value directly.

Second, we adjust the poverty line in the local currency unit for inflation to the year and month of the survey using the CPI. The formula to adjust the poverty line for inflation is the following, where TH refers to the \$1.25 or \$1.90 threshold, the subscript  $t$  refers to the month and year of the ZOI Survey, and  $x$  refers to the year of the relevant PPP (2005 for \$1.25 threshold, 2011 for \$1.90 threshold):

$$(TH\_USD)\_LCU_t = TH \times (PPP_x) \times \left(\frac{CPI_t}{CPI_x}\right)$$

For the national poverty line indicator, we use the formula below, where year of PPP in the formula above is substituted by 2011 since the national poverty line of Rs. 19,262 was set at this value in 2011.

$$(Rs.19262)\_LCU_t = 19262 \times \left(\frac{CPI_t}{CPI_{2009}}\right)$$

## A2.2b Wealth index

Asset-based wealth indices have increasingly been used as alternatives to income and consumption expenditure-based measures for several reasons, most notably because they are: (1) more stable measures of socioeconomic well-being, (2) able to better detect differences in equity, and (3) easier to collect and require shorter interviews. This section presents a short description of the methodology for calculating the wealth index. Additional details on how to prepare the data and perform the calculations for producing the wealth index are provided in the *Guide to Feed the Future Statistics*.<sup>204</sup>

The methodology for computing a wealth index using the Feed the Future ZOI Survey data is based on the approach developed by the DHS. The DHS approach to computing a wealth index assumes that wealth is an underlying unobservable variable and that a set of variables can identify the relative position of households in the underlying distribution of the wealth factor. The table below summarizes assets used to construct the wealth index for the Feed the Future Nepal ZOI Survey 2019. Principal components analysis was performed to assign weights to the assets. Each household was then assigned a wealth score equal to the sum of the weighted indicators. Wealth scores were standardized with a mean of zero and a SD of one and then categorized into quintiles based on the distribution of the household population.

### Assets used to construct the wealth index

1. Domestic servants
2. Ownership of agricultural land and size of land

<sup>203</sup> 2011 PPP is taken from the World Development Indicator database at <http://databank.worldbank.org/data/source/world-development-indicators>, and 2005 PPP is taken from the indicator reference sheet provided by USAID.

<sup>204</sup> Zalisk, K., Dupuis, G., Gauthier, M., Kaur, J., Khan, N., Swindale, A. and Johnson, K.B., 2019. *Feed the Future Zone of Influence Surveys: Guide to Feed the Future Statistics*. Washington, DC: Bureau for Food Security, United States Agency for International Development.

#### Assets used to construct the wealth index

3. Number of people per sleeping room

4. House ownership

5. Water source

6. Toilet facility

Main type of facility

Whether the facility is shared with other households

7. Floor material

8. Roof material

9. Wall material

10. Cooking fuel

11. Farm animals (type and number):

- Cows
- Other cattle
- Horses, donkeys, or mules
- Goats
- Sheep
- Chicken or other poultry
- Fish

12. Household possessions:

- Electricity
- Radio
- Television
- Computer
- Refrigerator
- Watch
- Mobile phone
- Bicycle
- Motorcycle or scooter
- Animal-drawn cart
- Car or truck
- Boat with a motor

13. Bank account

The “percentage of households below the comparative threshold for the poorest quintile of the asset-based comparative wealth index (CWI)” ZOI Survey indicator reflects the percentage of households in the ZOI that (based on asset ownership) fall below a fixed threshold that defines the poorest quintile (bottom 20 percent) in the comparative baseline wealth index used to create a cross-nationally, cross-temporally comparable asset-based wealth index, the CWI. Use of a fixed threshold across ZOIs is possible because the CWI is an index with threshold values relative to the baseline wealth index used for comparison. This means that the index scores and thresholds can be compared across ZOI Surveys and over time.

### A2.3 Criteria for achieving adequacy for Women's Empowerment in Agriculture Indicators

The below table presents the Women's Empowerment in Agriculture five dimensions of empowerment, their corresponding empowerment indicators, the survey questions used to elicit the data required to establish adequacy or inadequacy for each empowerment indicator, their corresponding variables in the ZOI Survey dataset, and how adequacy criteria are defined for each empowerment indicator. For additional details, refer to the *Feed the Future Guide to Statistics*.<sup>205</sup>

| Domain                          | Indicator name                               | Survey questions                                                                                                                                                          | ZOI Survey (2018–2019) questions | ZOI Survey (2018–2019) variables | Adequacy criteria                                                                                                                                                                                                          | Inadequacy criteria                                                                                                                                                                                                          | Weight |
|---------------------------------|----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| Decision-making over production | Indicator 1.1: Input in productive decisions | "When decisions are made regarding food crop farming, cash crop farming, livestock raising, and fishing or fishpond culture, who is it that normally takes the decision?" | Q.6202 (a, b, c, f)              | v6202_01-v6202_03, v6202_06      | For at least one activity: decides alone; OR participates and has input into some; or most or all decisions regarding the activity; OR someone else decides but feels could decide to a medium or high extent if wanted to | Participates but does not have input into some; or most or all decisions regarding the activity; OR does not make the decision NOR feels he or she could to a medium or high extent (93 "no decision made" coded as missing) | 1/5    |
|                                 |                                              | "How much input did you have in making decisions about food crop farming, cash crop farming, livestock raising, and fishing or fishpond culture?"                         | Q.6203 (a, b, c, f)              | v6202_01-v6202_03, v6202_06      |                                                                                                                                                                                                                            |                                                                                                                                                                                                                              |        |

<sup>205</sup> Zalisk, K., Dupuis, G., Gauthier, M., Kaur, J., Khan, N., Swindale, A. and Johnson, K.B., 2019. *Feed the Future Zone of Influence Surveys: Guide to Feed the Future Statistics*. Washington, DC: Bureau for Food Security, United States Agency for International Development.

| Domain              | Indicator name                     | Survey questions                                                                                                                                                                                                                                                                                                                                                                                                         | ZOI Survey (2018–2019) questions | ZOI Survey (2018–2019) variables   | Adequacy criteria                                                                                                                                                                                            | Inadequacy criteria                                                            | Weight |
|---------------------|------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|--------|
|                     |                                    | “To what extent do you feel you can make your own decisions regarding these aspects of household life if you want(ed) to: food crop farming, cash crop farming, livestock raising, and fishing or fishpond culture if you wanted to?”                                                                                                                                                                                    | Q.6204 (a, b, c, f)              | v6202_01-<br>v6202_03,<br>v6202_06 |                                                                                                                                                                                                              |                                                                                |        |
| Access to resources | Indicator 2.1: Ownership of assets | “Does anyone in your household currently have any [ITEM]?: agricultural land, large livestock, small livestock, chickens/ducks/turkeys/pigeons, fishpond or fishing equipment, hand tools, non-mechanized farm equipment, mechanized farm equipment, non-farm business equipment, house, large consumer durable goods, small consumer durable goods, cell phone, other land or structures, and means of transportation?” | Q.6301a–<br>Q.6301n              | v6301_01-<br>v6301_15              | Owns—alone or jointly—at least one large asset or two types of small assets (small assets are chickens/ducks / turkeys/pigeons, hand tools, non-mechanized farm equipment, and small consumer durable goods) | Does not own any assets; OR owns only one type of small asset alone or jointly | 2/15   |
|                     |                                    | “Do you own any of the item either by yourself or jointly with someone else?”                                                                                                                                                                                                                                                                                                                                            | Q.6303a–<br>Q.6303n              | v6303_01-<br>v6303_15              |                                                                                                                                                                                                              |                                                                                |        |



| Domain              | Indicator name                                     | Survey questions                                                                                                                                                                                                                                                                                                               | ZOI Survey (2018–2019) questions | ZOI Survey (2018–2019) variables | Adequacy criteria                                                                                                                             | Inadequacy criteria                                                                                                                                                                   | Weight |
|---------------------|----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
|                     | Indicator 2.2: Access to and decisions over credit | “Has anyone in your household taken any loans or borrowed cash/in-kind from [SOURCE] in the past 12 months?: NGO, informal lender, formal lender, friends or relatives, group-based microfinance or lending (savings/credit group), informal credit/savings groups such as merry-go-rounds, tontines, funeral societies, etc.” | Q.6308a–Q.6308f                  | v6308_1-v6303_6                  | Can alone or jointly make at least one decision regarding at least one source of credit                                                       | Household has no credit; OR household has credit but respondent did not participate in any decision about it                                                                          | 1/15   |
|                     |                                                    | “Who made the decision to borrow from [SOURCE]?”                                                                                                                                                                                                                                                                               | Q.6309a–Q.6309f                  | v6309_1-v6309_6                  |                                                                                                                                               |                                                                                                                                                                                       |        |
|                     |                                                    | “Who makes the decision about what to do with the money/item borrowed from [SOURCE]?”                                                                                                                                                                                                                                          | Q.6310a–Q.6310f                  | v6310_1-v6310_6                  |                                                                                                                                               |                                                                                                                                                                                       |        |
| Control over income | Indicator 3: Control of use of income              | “How much input did you have in decisions on the use of income generated from food crop farming, cash crop farming, livestock raising, non-farm economic activities, wage and salary employment, and fishing or fishpond culture?”                                                                                             | Q.6205a–Q.6205f                  | v6205_01-v6206_03, v6206_06      | Has input into some; or most or all decisions on use of income for at least one productive/ economic activity; OR feels can make decisions to | Participates in activity but has no input in decisions about income, OR feels she or he has no or very little input into the decision regarding income from non-farm activities, wage | 1/5    |

| Domain                          | Indicator name                                        | Survey questions                                                                                                                                                                                                                                                                                                                                                                | ZOI Survey (2018–2019) questions | ZOI Survey (2018–2019) variables | Adequacy criteria                                                                                                                | Inadequacy criteria                                                                                    | Weight |
|---------------------------------|-------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|--------|
|                                 |                                                       | “To what extent do you feel you can make your own personal decisions regarding these aspects of household life if you want(ed) to?: non-farm activities, own wage and salary employment, major household expenditures”                                                                                                                                                          | Q.6204d, Q.6204e, Q.6204g        | v6204_04, v6204_05, v6204_07     | medium or high extent if respondent wanted for at least one income or expenditure decision—excludes minor household expenditures | and salary employment, or decisions regarding major household expenditures even if she or he wanted to |        |
| Group membership and leadership | Indicator 4.1: Membership in economic or social group | “Are you an active member of an agricultural/livestock/fisheries producers’ group, waters users’ group, forest users’ group, credit/microfinance group, mutual help/insurance group, trade and business association, trade and business association, civic groups, local government, religious group, other women’s/men’s group, or any other formal or informal organization?” | Q.6405a–Q.6405k                  | v6405_01–v6405_11                | Is an active member of at least one group                                                                                        | Is not an active member of at least one group                                                          | 1/5    |

| Domain          | Indicator name          | Survey questions                                                                                                                                                             | ZOI Survey (2018–2019) questions | ZOI Survey (2018–2019) variables                                                                                | Adequacy criteria                                        | Inadequacy criteria                          | Weight |
|-----------------|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|----------------------------------------------|--------|
| Time allocation | Indicator 5.1: Workload | The survey collected information on respondents' time allocation for a 24-hour period. Information was collected for primary activities and reported in 15-minute intervals. | Q.6601                           | v6601p_15_[hour],<br>v6601p_30_[hour],<br>v6601p_45_[hour],<br>v6601p_60_[hour]<br>where [hour] is a value 1–24 | Works less than or equal to 10.5 hours in 24-hour period | Works more than 10.5 hours in 24-hour period | 1/5    |

## APPENDIX 3. DATA QUALITY

This appendix presents information that reflects the quality of data collected in the ZOI in the Feed the Future Nepal ZOI Survey 2019. Data-driven decisions call for high-quality data collection. High-quality data were ensured in the endline ZOI Survey through the data collection program, field monitoring, data post-processing, and data analysis. The Nepal ZOI Survey used CSPro software and a standardized data collection program developed for all ZOI Survey implementers to use. The data collection program ensured a high level of data quality through validation constraints and automatic checks that were included in the program to check for correctness, consistency, and meaningfulness of data entered by interviewers. These checks included, but were not limited to, completion checks, structure checks, and consistency checks. The organization of the data file, including the validation constraints, is described in the ZOI Survey data dictionary.

Similarly, continuous data monitoring in the field is fundamental to the quality of data collection. In addition to using the data collection and monitoring approach described in the Feed the Future ZOI Survey Toolkit field manuals, the Nepal ZOI Survey in-country data manager ran field check tables that provided a management system for checking data quality.<sup>206</sup> These tables cross-checked certain quality control indicators by field teams and individual interviewers to detect potential areas in which correction and remedial action were required. Any issues that were attributed to non-sampling error (i.e., field-based error) were communicated as feedback to the field teams.

In the post-processing stage, secondary editing procedures were implemented according to the Feed the Future ZOI Survey Data Processing Manual to ensure the data were clean and of the highest quality. During the analysis phase, any inconsistencies or issues identified by data analysts were communicated to the data processing manual for troubleshooting and resolution.

The remainder of this appendix focuses on final field check tables, which are a reflection of the quality of fieldwork, for the Feed the Future Nepal ZOI Survey 2019.

The following field check tables report a number of statistics that are helpful to monitor the quality of incoming survey data by flagging statistics that appear to be lower or higher than anticipated. These tables report survey completion rates, eligibility and response rates, and tabulations to assess for the possibility of age heaping amongst several subgroups. These indicators were used to help identify interviewers and teams that are responsible for serious lapses in field procedures, intentional or otherwise. The statistics below are calculated with all data submitted.

**Table FC-I** below illustrates that a total of 2,481 household surveys were completed and submitted during data collection.<sup>207</sup> Completed surveys by enumerator range from 1 to 123. This large variation in range is in part due to an early programming issue. Due to early issues with data transmission, Interviewer A were the only enumerators permitted to open the household, while Interviewer D

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<sup>206</sup> USAID 2018b.

<sup>207</sup> The field check tables below display figures for the entire survey sample, inclusive of data for both the Phase One ZOI (2,081 households total) and the Phase Two ZOI (2,481 households total). Due to the joint nature of the survey, data quality monitoring was conducted on the entire sample throughout fieldwork.

primarily assisted the agricultural interviewer. The problem was resolved, and the number of modules and work responsibilities were distributed equally across interviewers. Nonetheless, Interviewer A continued to open the majority of households, which adds to this perceived imbalance in completion rates across interviewers.

**Table FC-1: Household completion rate**

Percent distribution of sampled households by result of household interview and household response rate by interviewer team, Nepal, 2019

| Interviewer number | Result of household interview |              |                                          |
|--------------------|-------------------------------|--------------|------------------------------------------|
|                    | Completed                     | Total number | Household response rate (%) <sup>1</sup> |
| Interviewer 011    | 98.2                          | 114          | 98.2                                     |
| Interviewer 014    | 100.0                         | 21           | 100.0                                    |
| Interviewer 021    | 96.7                          | 123          | 96.7                                     |
| Interviewer 024    | 100.0                         | 13           | 100.0                                    |
| Interviewer 031    | 100.0                         | 92           | 100.0                                    |
| Interviewer 034    | 100.0                         | 28           | 100.0                                    |
| Interviewer 041    | 100.0                         | 94           | 100.0                                    |
| Interviewer 043    | 100.0                         | 1            | 100.0                                    |
| Interviewer 044    | 100.0                         | 25           | 100.0                                    |
| Interviewer 051    | 100.0                         | 73           | 100.0                                    |
| Interviewer 052    | 100.0                         | 4            | 100.0                                    |
| Interviewer 053    | 100.0                         | 21           | 100.0                                    |
| Interviewer 054    | 100.0                         | 52           | 100.0                                    |
| Interviewer 061    | 100.0                         | 95           | 100.0                                    |
| Interviewer 062    | 100.0                         | 12           | 100.0                                    |
| Interviewer 063    | 100.0                         | 5            | 100.0                                    |
| Interviewer 064    | 100.0                         | 8            | 100.0                                    |
| Interviewer 071    | 100.0                         | 60           | 100.0                                    |
| Interviewer 074    | 95.0                          | 60           | 95.0                                     |
| Interviewer 081    | 100.0                         | 103          | 100.0                                    |
| Interviewer 084    | 100.0                         | 17           | 100.0                                    |
| Interviewer 091    | 100.0                         | 102          | 100.0                                    |
| Interviewer 094    | 100.0                         | 18           | 100.0                                    |
| Interviewer 101    | 96.2                          | 106          | 96.2                                     |
| Interviewer 104    | 100.0                         | 14           | 100.0                                    |
| Interviewer 111    | 95.1                          | 81           | 95.1                                     |
| Interviewer 114    | 100.0                         | 26           | 100.0                                    |
| Interviewer 121    | 99.0                          | 100          | 99.0                                     |
| Interviewer 124    | 100.0                         | 20           | 100.0                                    |
| Interviewer 131    | 100.0                         | 79           | 100.0                                    |
| Interviewer 134    | 100.0                         | 41           | 100.0                                    |
| Interviewer 141    | 100.0                         | 85           | 100.0                                    |
| Interviewer 144    | 100.0                         | 38           | 100.0                                    |
| Interviewer 151    | 100.0                         | 61           | 100.0                                    |
| Interviewer 154    | 100.0                         | 59           | 100.0                                    |
| Interviewer 161    | 100.0                         | 96           | 100.0                                    |
| Interviewer 163    | 100.0                         | 1            | 100.0                                    |
| Interviewer 164    | 100.0                         | 24           | 100.0                                    |
| Interviewer 171    | 100.0                         | 92           | 100.0                                    |
| Interviewer 174    | 100.0                         | 28           | 100.0                                    |
| Interviewer 181    | 100.0                         | 120          | 100.0                                    |
| Interviewer 191    | 100.0                         | 87           | 100.0                                    |
| Interviewer 194    | 100.0                         | 32           | 100.0                                    |
| Interviewer 201    | 99.0                          | 101          | 99.0                                     |

| Interviewer number | Result of household interview |              |                                          |
|--------------------|-------------------------------|--------------|------------------------------------------|
|                    | Completed                     | Total number | Household response rate (%) <sup>1</sup> |
| Interviewer 204    | 98.0                          | 49           | 98.0                                     |
| <b>All teams</b>   | <b>99.2</b>                   | <b>2,481</b> | <b>99.2</b>                              |

<sup>1</sup> Target is 95 percent for household response rate. The total response rate as reported here is not an exact match to module response rates reported above due to minor differences in the calculation of response rate between the CSPro program and SI's analysis in Stata.

**Table FC-2** demonstrates that for 2,461 completed interviews, at least one primary adult decision-maker was reported. The majority of households reported having a primary female adult decision-maker.<sup>208</sup>

### Table FC-2: Primary male and female decision-makers

Number of households with a completed roster and, among those households, the percentage with at least one male member age 18+, the percentage with a male decision-maker, the percentage with at least one female member age 18+, the percentage with a female decision-maker, and the percentage of households with at least one decision-maker, by interviewer team, Nepal, 2019.

| Interviewer number | Households with Module 1 completed (N) | Male                                             |                                                       | Female                                             |                                                         | Households with at least one primary adult decision-maker (%) |
|--------------------|----------------------------------------|--------------------------------------------------|-------------------------------------------------------|----------------------------------------------------|---------------------------------------------------------|---------------------------------------------------------------|
|                    |                                        | Households with at least one male member 18+ (%) | Households with primary adult male decision-maker (%) | Households with at least one female member 18+ (%) | Households with primary adult female decision-maker (%) |                                                               |
| Interviewer 011    | 112                                    | 91.1                                             | 91.1                                                  | 93.8                                               | 93.8                                                    | 100.0                                                         |
| Interviewer 014    | 21                                     | 81.0                                             | 81.0                                                  | 90.5                                               | 90.5                                                    | 100.0                                                         |
| Interviewer 021    | 119                                    | 91.6                                             | 91.6                                                  | 95.0                                               | 95.0                                                    | 100.0                                                         |
| Interviewer 024    | 13                                     | 69.2                                             | 69.2                                                  | 100.0                                              | 100.0                                                   | 100.0                                                         |
| Interviewer 031    | 92                                     | 84.8                                             | 84.8                                                  | 94.6                                               | 94.6                                                    | 100.0                                                         |
| Interviewer 034    | 28                                     | 78.6                                             | 78.6                                                  | 100.0                                              | 100.0                                                   | 100.0                                                         |
| Interviewer 041    | 94                                     | 69.1                                             | 69.1                                                  | 97.9                                               | 97.9                                                    | 100.0                                                         |
| Interviewer 043    | 1                                      | 0.0                                              | 0.0                                                   | 100.0                                              | 100.0                                                   | 100.0                                                         |
| Interviewer 044    | 25                                     | 80.0                                             | 80.0                                                  | 100.0                                              | 100.0                                                   | 100.0                                                         |
| Interviewer 051    | 73                                     | 79.5                                             | 79.5                                                  | 93.2                                               | 93.2                                                    | 100.0                                                         |
| Interviewer 052    | 4                                      | 75.0                                             | 75.0                                                  | 100.0                                              | 100.0                                                   | 100.0                                                         |
| Interviewer 053    | 21                                     | 52.4                                             | 52.4                                                  | 100.0                                              | 100.0                                                   | 100.0                                                         |
| Interviewer 054    | 52                                     | 69.2                                             | 69.2                                                  | 94.2                                               | 94.2                                                    | 100.0                                                         |
| Interviewer 061    | 95                                     | 91.6                                             | 91.6                                                  | 95.8                                               | 95.8                                                    | 100.0                                                         |
| Interviewer 062    | 12                                     | 75.0                                             | 75.0                                                  | 100.0                                              | 100.0                                                   | 100.0                                                         |
| Interviewer 063    | 5                                      | 100.0                                            | 100.0                                                 | 100.0                                              | 100.0                                                   | 100.0                                                         |
| Interviewer 064    | 8                                      | 100.0                                            | 100.0                                                 | 100.0                                              | 100.0                                                   | 100.0                                                         |
| Interviewer 071    | 60                                     | 78.3                                             | 78.3                                                  | 100.0                                              | 100.0                                                   | 100.0                                                         |
| Interviewer 074    | 57                                     | 78.9                                             | 78.9                                                  | 94.7                                               | 94.7                                                    | 100.0                                                         |
| Interviewer 081    | 103                                    | 85.4                                             | 85.4                                                  | 99.0                                               | 99.0                                                    | 100.0                                                         |
| Interviewer 084    | 17                                     | 94.1                                             | 94.1                                                  | 94.1                                               | 94.1                                                    | 100.0                                                         |
| Interviewer 091    | 102                                    | 63.7                                             | 63.7                                                  | 99.0                                               | 99.0                                                    | 100.0                                                         |
| Interviewer 094    | 18                                     | 38.9                                             | 38.9                                                  | 94.4                                               | 94.4                                                    | 100.0                                                         |
| Interviewer 101    | 102                                    | 86.3                                             | 86.3                                                  | 94.1                                               | 94.1                                                    | 100.0                                                         |
| Interviewer 104    | 14                                     | 85.7                                             | 85.7                                                  | 100.0                                              | 100.0                                                   | 100.0                                                         |
| Interviewer 111    | 77                                     | 75.3                                             | 75.3                                                  | 98.7                                               | 98.7                                                    | 100.0                                                         |

<sup>208</sup> There were 2,461 interviews completed and an additional 20 interviews partially completed; thus, some tables in this section reflect a total of 2,461, and some with partially complete data reflect a total of 2,481. Data for the partially completed surveys was used in analysis when data for an entire indicator were available.

| Interviewer number | Households with Module 1 completed (N) | Male                                             |                                                       | Female                                             |                                                         | Households with at least one primary adult decision-maker (%) |
|--------------------|----------------------------------------|--------------------------------------------------|-------------------------------------------------------|----------------------------------------------------|---------------------------------------------------------|---------------------------------------------------------------|
|                    |                                        | Households with at least one male member 18+ (%) | Households with primary adult male decision-maker (%) | Households with at least one female member 18+ (%) | Households with primary adult female decision-maker (%) |                                                               |
| Interviewer 114    | 26                                     | 76.9                                             | 76.9                                                  | 100.0                                              | 100.0                                                   | 100.0                                                         |
| Interviewer 121    | 99                                     | 85.9                                             | 85.9                                                  | 100.0                                              | 100.0                                                   | 100.0                                                         |
| Interviewer 124    | 20                                     | 80.0                                             | 80.0                                                  | 100.0                                              | 100.0                                                   | 100.0                                                         |
| Interviewer 131    | 79                                     | 79.7                                             | 79.7                                                  | 98.7                                               | 98.7                                                    | 100.0                                                         |
| Interviewer 134    | 41                                     | 75.6                                             | 75.6                                                  | 97.6                                               | 97.6                                                    | 100.0                                                         |
| Interviewer 141    | 85                                     | 84.7                                             | 84.7                                                  | 98.8                                               | 98.8                                                    | 100.0                                                         |
| Interviewer 144    | 38                                     | 86.8                                             | 86.8                                                  | 100.0                                              | 100.0                                                   | 100.0                                                         |
| Interviewer 151    | 61                                     | 78.7                                             | 78.7                                                  | 98.4                                               | 98.4                                                    | 100.0                                                         |
| Interviewer 154    | 59                                     | 84.7                                             | 84.7                                                  | 100.0                                              | 100.0                                                   | 100.0                                                         |
| Interviewer 161    | 96                                     | 84.4                                             | 84.4                                                  | 99.0                                               | 99.0                                                    | 100.0                                                         |
| Interviewer 163    | 1                                      | 0.0                                              | 0.0                                                   | 100.0                                              | 100.0                                                   | 100.0                                                         |
| Interviewer 164    | 24                                     | 95.8                                             | 95.8                                                  | 100.0                                              | 100.0                                                   | 100.0                                                         |
| Interviewer 171    | 92                                     | 81.5                                             | 81.5                                                  | 96.7                                               | 96.7                                                    | 100.0                                                         |
| Interviewer 174    | 28                                     | 75.0                                             | 75.0                                                  | 100.0                                              | 100.0                                                   | 100.0                                                         |
| Interviewer 181    | 120                                    | 75.0                                             | 75.0                                                  | 98.3                                               | 98.3                                                    | 100.0                                                         |
| Interviewer 191    | 87                                     | 77.0                                             | 77.0                                                  | 100.0                                              | 100.0                                                   | 100.0                                                         |
| Interviewer 194    | 32                                     | 71.9                                             | 71.9                                                  | 100.0                                              | 100.0                                                   | 100.0                                                         |
| Interviewer 201    | 100                                    | 98.0                                             | 98.0                                                  | 97.0                                               | 97.0                                                    | 100.0                                                         |
| Interviewer 204    | 48                                     | 95.8                                             | 95.8                                                  | 100.0                                              | 100.0                                                   | 100.0                                                         |
| <b>All teams</b>   | <b>2,461</b>                           | <b>81.6</b>                                      | <b>81.6</b>                                           | <b>97.5</b>                                        | <b>97.5</b>                                             | <b>100.0</b>                                                  |

Target is 100 percent - expected prevalence of child-only households.

Age heaping was monitored carefully and smoothed out over time. Nonetheless, the rates of individuals reported as ages 35 and 40 remained slightly elevated, although they still fall below the target threshold of 30 percent.

**Table FC-3: Age heaping in the household roster**

Percentage of household members in five-year age groups with ages recorded as ending in five or zero by interviewer team, Nepal, 2019

| Interviewer number | Ages of household members  |                              |                               |                               |                               |                               |                               |                               |                               |                               |                               | Number of household members |
|--------------------|----------------------------|------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-----------------------------|
|                    | Ages 3-7 recorded as 5 (%) | Ages 8-12 recorded as 10 (%) | Ages 13-17 recorded as 15 (%) | Ages 18-22 recorded as 20 (%) | Ages 23-27 recorded as 25 (%) | Ages 28-32 recorded as 30 (%) | Ages 33-37 recorded as 35 (%) | Ages 38-42 recorded as 40 (%) | Ages 43-47 recorded as 45 (%) | Ages 48-52 recorded as 50 (%) | All ages ending in 5 or 0 (%) |                             |
| Interviewer 011    | 25.9                       | 9.1                          | 20.7                          | 12.8                          | 6.1                           | 36.0                          | 33.3                          | 15.4                          | 30.0                          | 21.7                          | 23.7                          | 396                         |
| Interviewer 014    | 0.0                        | 0.0                          | 0.0                           | 0.0                           | 22.2                          | 20.0                          | 16.7                          | 0.0                           | 50.0                          | 50.0                          | 23.8                          | 63                          |
| Interviewer 021    | 27.5                       | 20.6                         | 22.4                          | 14.3                          | 24.4                          | 26.7                          | 14.3                          | 34.8                          | 14.7                          | 17.1                          | 13.3                          | 910                         |
| Interviewer 024    | 66.7                       | 33.3                         | 75.0                          | 42.9                          | 50.0                          | 0.0                           | 0.0                           | 0.0                           | 0.0                           | 16.7                          | 11.0                          | 136                         |
| Interviewer 031    | 20.9                       | 24.1                         | 12.8                          | 20.7                          | 35.5                          | 31.0                          | 15.8                          | 23.1                          | 15.8                          | 47.6                          | 21.9                          | 425                         |
| Interviewer 034    | 9.1                        | 25.0                         | 14.3                          | 0.0                           | 33.3                          | 40.0                          | 40.0                          | 33.3                          | 0.0                           | 0.0                           | 11.2                          | 205                         |
| Interviewer 041    | 22.6                       | 20.0                         | 31.4                          | 27.0                          | 16.7                          | 5.6                           | 44.4                          | 15.8                          | 16.7                          | 43.8                          | 23.3                          | 361                         |
| Interviewer 043    | -                          | -                            | -                             | -                             | -                             | -                             | -                             | -                             | -                             | -                             | 0.0                           | 1                           |
| Interviewer 044    | 16.7                       | 10.0                         | 25.0                          | 33.3                          | 21.4                          | 55.6                          | 60.0                          | 66.7                          | 20.0                          | 66.7                          | 31.7                          | 120                         |
| Interviewer 051    | 3.7                        | 26.1                         | 16.1                          | 17.6                          | 29.6                          | 40.0                          | 38.9                          | 31.6                          | 35.7                          | 60.0                          | 30.3                          | 277                         |
| Interviewer 052    | 0.0                        | -                            | 100.0                         | 0.0                           | 66.7                          | -                             | -                             | 0.0                           | 100.0                         | 50.0                          | 35.7                          | 14                          |
| Interviewer 053    | 50.0                       | 20.0                         | 14.3                          | 0.0                           | 20.0                          | 0.0                           | 16.7                          | 0.0                           | 25.0                          | 50.0                          | 21.1                          | 76                          |
| Interviewer 054    | 0.0                        | 13.3                         | 12.5                          | 26.7                          | 36.8                          | 12.5                          | 30.8                          | 45.5                          | 60.0                          | 0.0                           | 19.6                          | 219                         |
| Interviewer 061    | 14.3                       | 18.1                         | 21.3                          | 26.7                          | 22.6                          | 41.2                          | 32.3                          | 36.7                          | 20.7                          | 33.3                          | 27.8                          | 597                         |
| Interviewer 062    | 27.3                       | 10.0                         | 50.0                          | 16.7                          | 30.0                          | -                             | 0.0                           | 33.3                          | 60.0                          | 20.0                          | 31.0                          | 71                          |
| Interviewer 063    | 40.0                       | 20.0                         | 20.0                          | 0.0                           | 33.3                          | 0.0                           | 0.0                           | 50.0                          | 0.0                           | 0.0                           | 26.5                          | 34                          |



| Interviewer number | Ages of household members  |                              |                               |                               |                               |                               |                               |                               |                               |                               |                               | Number of household members |
|--------------------|----------------------------|------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-----------------------------|
|                    | Ages 3-7 recorded as 5 (%) | Ages 8-12 recorded as 10 (%) | Ages 13-17 recorded as 15 (%) | Ages 18-22 recorded as 20 (%) | Ages 23-27 recorded as 25 (%) | Ages 28-32 recorded as 30 (%) | Ages 33-37 recorded as 35 (%) | Ages 38-42 recorded as 40 (%) | Ages 43-47 recorded as 45 (%) | Ages 48-52 recorded as 50 (%) | All ages ending in 5 or 0 (%) |                             |
| Interviewer 064    | 0.0                        | 12.5                         | 0.0                           | 0.0                           | 50.0                          | 28.6                          | -                             | 33.3                          | 50.0                          | -                             | 25.0                          | 44                          |
| Interviewer 071    | 25.0                       | 21.9                         | 28.6                          | 16.1                          | 34.8                          | 25.0                          | 21.1                          | 22.7                          | 25.0                          | 50.0                          | 17.2                          | 437                         |
| Interviewer 074    | 23.5                       | 25.9                         | 21.1                          | 13.9                          | 18.2                          | 26.1                          | 36.4                          | 35.3                          | 20.0                          | 15.4                          | 25.9                          | 320                         |
| Interviewer 081    | 13.3                       | 28.3                         | 18.4                          | 17.9                          | 30.0                          | 15.2                          | 7.9                           | 5.9                           | 4.0                           | 17.2                          | 9.1                           | 798                         |
| Interviewer 084    | 14.3                       | 13.3                         | 25.0                          | 25.0                          | 22.2                          | 0.0                           | 23.1                          | 50.0                          | -                             | 0.0                           | 16.3                          | 92                          |
| Interviewer 091    | 14.3                       | 22.2                         | 20.4                          | 23.7                          | 25.6                          | 20.8                          | 39.1                          | 25.0                          | 38.9                          | 12.5                          | 26.5                          | 431                         |
| Interviewer 094    | 20.0                       | 14.3                         | 33.3                          | 0.0                           | 50.0                          | 40.0                          | 0.0                           | 33.3                          | 0.0                           | 0.0                           | 24.1                          | 58                          |
| Interviewer 101    | 11.1                       | 10.7                         | 29.2                          | 20.5                          | 16.0                          | 27.8                          | 33.3                          | 25.0                          | 26.9                          | 29.6                          | 15.4                          | 680                         |
| Interviewer 104    | 22.2                       | 27.3                         | 11.1                          | 0.0                           | 25.0                          | 33.3                          | 9.1                           | 66.7                          | 0.0                           | 0.0                           | 21.9                          | 64                          |
| Interviewer 111    | 21.2                       | 16.7                         | 18.8                          | 18.8                          | 17.4                          | 15.4                          | 26.3                          | 20.0                          | 30.8                          | 23.8                          | 21.9                          | 361                         |
| Interviewer 114    | 12.5                       | 15.4                         | 9.1                           | 44.4                          | 37.5                          | 22.2                          | 0.0                           | 0.0                           | 0.0                           | 66.7                          | 22.7                          | 119                         |
| Interviewer 121    | 16.4                       | 16.9                         | 15.8                          | 29.1                          | 22.6                          | 6.9                           | 40.5                          | 7.7                           | 16.7                          | 31.3                          | 22.1                          | 494                         |
| Interviewer 124    | 33.3                       | 11.8                         | 23.1                          | 18.2                          | 12.5                          | 33.3                          | 75.0                          | 100.0                         | 50.0                          | 80.0                          | 32.0                          | 100                         |
| Interviewer 131    | 13.0                       | 29.3                         | 22.2                          | 17.5                          | 13.0                          | 20.0                          | 21.7                          | 27.3                          | 9.1                           | 29.4                          | 23.1                          | 407                         |
| Interviewer 134    | 9.4                        | 20.0                         | 9.5                           | 15.4                          | 7.1                           | 22.2                          | 23.1                          | 27.3                          | 28.6                          | 28.6                          | 20.5                          | 190                         |
| Interviewer 141    | 13.8                       | 14.0                         | 8.0                           | 17.9                          | 18.8                          | 37.5                          | 11.5                          | 22.7                          | 21.9                          | 10.0                          | 18.0                          | 438                         |
| Interviewer 144    | 26.1                       | 16.1                         | 31.8                          | 26.1                          | 17.6                          | 20.0                          | 22.2                          | 23.1                          | 27.3                          | 25.0                          | 15.4                          | 311                         |
| Interviewer 151    | 14.7                       | 19.0                         | 3.0                           | 41.2                          | 9.1                           | 25.9                          | 31.3                          | 25.0                          | 26.7                          | 20.0                          | 23.8                          | 281                         |

| Interviewer number | Ages of household members  |                              |                               |                               |                               |                               |                               |                               |                               |                               |                               | Number of household members |
|--------------------|----------------------------|------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-----------------------------|
|                    | Ages 3-7 recorded as 5 (%) | Ages 8-12 recorded as 10 (%) | Ages 13-17 recorded as 15 (%) | Ages 18-22 recorded as 20 (%) | Ages 23-27 recorded as 25 (%) | Ages 28-32 recorded as 30 (%) | Ages 33-37 recorded as 35 (%) | Ages 38-42 recorded as 40 (%) | Ages 43-47 recorded as 45 (%) | Ages 48-52 recorded as 50 (%) | All ages ending in 5 or 0 (%) |                             |
| Interviewer 154    | 23.3                       | 21.6                         | 7.1                           | 23.8                          | 33.3                          | 53.8                          | 42.1                          | 28.6                          | 15.4                          | 9.1                           | 22.3                          | 314                         |
| Interviewer 161    | 25.9                       | 24.4                         | 23.8                          | 22.2                          | 20.8                          | 20.6                          | 12.0                          | 31.0                          | 17.6                          | 25.0                          | 22.3                          | 471                         |
| Interviewer 163    | 0.0                        | 0.0                          | 0.0                           | -                             | -                             | 0.0                           | -                             | -                             | -                             | -                             | 0.0                           | 8                           |
| Interviewer 164    | 0.0                        | 33.3                         | 25.0                          | 23.5                          | 37.5                          | 20.0                          | 40.0                          | 9.1                           | 37.5                          | 33.3                          | 26.4                          | 121                         |
| Interviewer 171    | 20.7                       | 11.3                         | 32.1                          | 14.8                          | 27.0                          | 25.0                          | 22.6                          | 33.3                          | 28.6                          | 25.0                          | 24.3                          | 420                         |
| Interviewer 174    | 26.7                       | 18.8                         | 29.4                          | 27.3                          | 0.0                           | 25.0                          | 14.3                          | 0.0                           | 25.0                          | 0.0                           | 21.1                          | 128                         |
| Interviewer 181    | 35.0                       | 19.3                         | 24.4                          | 25.9                          | 19.7                          | 13.9                          | 41.3                          | 35.0                          | 20.6                          | 17.2                          | 26.8                          | 583                         |
| Interviewer 191    | 19.5                       | 29.4                         | 14.0                          | 19.0                          | 21.1                          | 12.5                          | 29.6                          | 20.0                          | 32.1                          | 5.3                           | 11.9                          | 806                         |
| Interviewer 194    | 21.1                       | 10.0                         | 28.6                          | 11.1                          | 23.5                          | 12.5                          | 11.8                          | 0.0                           | 14.3                          | 25.0                          | 13.9                          | 201                         |
| Interviewer 201    | 25.0                       | 15.1                         | 22.0                          | 29.7                          | 12.7                          | 18.8                          | 24.2                          | 30.0                          | 45.0                          | 33.3                          | 25.0                          | 496                         |
| Interviewer 204    | 16.0                       | 19.4                         | 34.6                          | 26.1                          | 30.8                          | 12.9                          | 22.2                          | 23.8                          | 12.5                          | 9.1                           | 19.7                          | 310                         |
| <b>All teams</b>   | <b>19.1</b>                | <b>19.3</b>                  | <b>21.1</b>                   | <b>21.3</b>                   | <b>22.7</b>                   | <b>23.0</b>                   | <b>27.1</b>                   | <b>26.7</b>                   | <b>23.3</b>                   | <b>24.5</b>                   | <b>20.2</b>                   | <b>13,388</b>               |

Note: The target for all age ranges is 30 percent.

**Table FC-4** below illustrates that 2,461 surveyed households reported an average of 1.3 eligible women per household. This report did not change across weeks and is slightly lower than the anticipated figure of 1.78 eligible women per household.

**Table FC-4: Eligible women per household**

Mean number of eligible women ages 15-49 years per household, Nepal, 2019

| Interviewer number | Completed households (N) | Eligible women in completed households (N) | Mean number of eligible women per household |
|--------------------|--------------------------|--------------------------------------------|---------------------------------------------|
| Interviewer 011    | 112                      | 110                                        | 1.0                                         |
| Interviewer 014    | 21                       | 15                                         | 0.7                                         |
| Interviewer 021    | 119                      | 138                                        | 1.2                                         |
| Interviewer 024    | 13                       | 18                                         | 1.4                                         |
| Interviewer 031    | 92                       | 101                                        | 1.1                                         |
| Interviewer 034    | 28                       | 28                                         | 1.0                                         |
| Interviewer 041    | 94                       | 99                                         | 1.1                                         |
| Interviewer 043    | 1                        | 0                                          | 0.0                                         |
| Interviewer 044    | 25                       | 33                                         | 1.3                                         |
| Interviewer 051    | 73                       | 78                                         | 1.1                                         |
| Interviewer 052    | 4                        | 5                                          | 1.3                                         |
| Interviewer 053    | 21                       | 25                                         | 1.2                                         |
| Interviewer 054    | 52                       | 56                                         | 1.1                                         |
| Interviewer 061    | 95                       | 156                                        | 1.6                                         |
| Interviewer 062    | 12                       | 21                                         | 1.8                                         |
| Interviewer 063    | 5                        | 10                                         | 2.0                                         |
| Interviewer 064    | 8                        | 12                                         | 1.5                                         |
| Interviewer 071    | 60                       | 83                                         | 1.4                                         |
| Interviewer 074    | 57                       | 78                                         | 1.4                                         |
| Interviewer 081    | 103                      | 120                                        | 1.2                                         |
| Interviewer 084    | 17                       | 21                                         | 1.2                                         |
| Interviewer 091    | 102                      | 122                                        | 1.2                                         |
| Interviewer 094    | 18                       | 21                                         | 1.2                                         |
| Interviewer 101    | 102                      | 121                                        | 1.2                                         |
| Interviewer 104    | 14                       | 15                                         | 1.1                                         |
| Interviewer 111    | 77                       | 100                                        | 1.3                                         |
| Interviewer 114    | 26                       | 29                                         | 1.1                                         |
| Interviewer 121    | 99                       | 125                                        | 1.3                                         |
| Interviewer 124    | 20                       | 23                                         | 1.1                                         |
| Interviewer 131    | 79                       | 103                                        | 1.3                                         |
| Interviewer 134    | 41                       | 48                                         | 1.2                                         |
| Interviewer 141    | 85                       | 121                                        | 1.4                                         |
| Interviewer 144    | 38                       | 59                                         | 1.6                                         |
| Interviewer 151    | 61                       | 64                                         | 1.0                                         |
| Interviewer 154    | 59                       | 73                                         | 1.2                                         |
| Interviewer 161    | 96                       | 135                                        | 1.4                                         |
| Interviewer 163    | 1                        | 1                                          | 1.0                                         |
| Interviewer 164    | 24                       | 35                                         | 1.5                                         |
| Interviewer 171    | 92                       | 136                                        | 1.5                                         |
| Interviewer 174    | 28                       | 36                                         | 1.3                                         |
| Interviewer 181    | 120                      | 186                                        | 1.6                                         |
| Interviewer 191    | 87                       | 141                                        | 1.6                                         |
| Interviewer 194    | 32                       | 44                                         | 1.4                                         |
| Interviewer 201    | 100                      | 134                                        | 1.3                                         |
| Interviewer 204    | 48                       | 76                                         | 1.6                                         |
| <b>All teams</b>   | <b>2,461</b>             | <b>3,155</b>                               | <b>1.3</b>                                  |

Note: The target is 1.78 eligible women per household.

**Tables FC-5A to FC-5D** at times generated slight concern regarding age heaping. This smoothed over time. However, the number of women aged 47 and 50 remained high for the duration of data collection. All table apart from **Table FC-5B** exceed the target age ratio of 0.80. However, both the age ratio and extended age ratio in **Table FC-5B** fall slightly below this threshold.

**Table FC-5A: Female age displacement**

Number of all women ages 12-17 years listed in the household roster by single years of age and age ratios, by interviewer team, Nepal, 2019

| Interviewer number | Age of women in years (N) |            |            |            |            |            | Age ratio<br>(15/14) | Extended age<br>ratio<br>(15+16)/(13+14) |
|--------------------|---------------------------|------------|------------|------------|------------|------------|----------------------|------------------------------------------|
|                    | 12                        | 13         | 14         | 15         | 16         | 17         |                      |                                          |
| Interviewer 011    | 3                         | 2          | 3          | 3          | 2          | 5          | 1.0                  | 1.0                                      |
| Interviewer 014    | 0                         | 0          | 0          | 0          | 1          | 0          | -                    | -                                        |
| Interviewer 021    | 4                         | 5          | 3          | 6          | 2          | 10         | 2.0                  | 1.0                                      |
| Interviewer 024    | 0                         | 0          | 1          | 1          | 0          | 0          | 1.0                  | 1.0                                      |
| Interviewer 031    | 4                         | 5          | 2          | 4          | 5          | 4          | 2.0                  | 1.3                                      |
| Interviewer 034    | 1                         | 0          | 2          | 1          | 1          | 0          | 0.5                  | 1.0                                      |
| Interviewer 041    | 3                         | 4          | 2          | 5          | 5          | 4          | 2.5                  | 1.7                                      |
| Interviewer 044    | 2                         | 2          | 2          | 3          | 1          | 0          | 1.5                  | 1.0                                      |
| Interviewer 051    | 2                         | 4          | 3          | 4          | 3          | 4          | 1.3                  | 1.0                                      |
| Interviewer 053    | 1                         | 0          | 0          | 1          | 0          | 1          | -                    | -                                        |
| Interviewer 054    | 2                         | 1          | 2          | 1          | 1          | 4          | 0.5                  | 0.7                                      |
| Interviewer 061    | 14                        | 5          | 4          | 7          | 11         | 4          | 1.8                  | 2.0                                      |
| Interviewer 062    | 1                         | 1          | 1          | 3          | 0          | 0          | 3.0                  | 1.5                                      |
| Interviewer 063    | 0                         | 0          | 0          | 1          | 0          | 2          | -                    | -                                        |
| Interviewer 064    | 1                         | 1          | 1          | 0          | 1          | 1          | 0.0                  | 0.5                                      |
| Interviewer 071    | 2                         | 3          | 3          | 1          | 2          | 4          | 0.3                  | 0.5                                      |
| Interviewer 074    | 5                         | 4          | 1          | 2          | 5          | 3          | 2.0                  | 1.4                                      |
| Interviewer 081    | 0                         | 8          | 8          | 5          | 5          | 2          | 0.6                  | 0.6                                      |
| Interviewer 084    | 1                         | 4          | 0          | 2          | 2          | 1          | -                    | 1.0                                      |
| Interviewer 091    | 2                         | 8          | 4          | 5          | 4          | 8          | 1.3                  | 0.8                                      |
| Interviewer 094    | 1                         | 0          | 0          | 1          | 1          | 1          | -                    | -                                        |
| Interviewer 101    | 10                        | 9          | 4          | 10         | 10         | 4          | 2.5                  | 1.5                                      |
| Interviewer 104    | 2                         | 0          | 2          | 0          | 0          | 1          | 0.0                  | 0.0                                      |
| Interviewer 111    | 3                         | 5          | 3          | 4          | 9          | 4          | 1.3                  | 1.6                                      |
| Interviewer 114    | 1                         | 1          | 0          | 1          | 0          | 1          | -                    | 1.0                                      |
| Interviewer 121    | 6                         | 5          | 13         | 6          | 3          | 8          | 0.5                  | 0.5                                      |
| Interviewer 124    | 2                         | 1          | 0          | 0          | 1          | 0          | -                    | 1.0                                      |
| Interviewer 131    | 8                         | 11         | 7          | 5          | 7          | 7          | 0.7                  | 0.7                                      |
| Interviewer 134    | 4                         | 0          | 3          | 0          | 3          | 3          | 0.0                  | 1.0                                      |
| Interviewer 141    | 4                         | 4          | 5          | 2          | 8          | 7          | 0.4                  | 1.1                                      |
| Interviewer 144    | 1                         | 1          | 2          | 4          | 0          | 5          | 2.0                  | 1.3                                      |
| Interviewer 151    | 9                         | 9          | 7          | 0          | 4          | 2          | 0.0                  | 0.3                                      |
| Interviewer 154    | 5                         | 3          | 5          | 1          | 4          | 2          | 0.2                  | 0.6                                      |
| Interviewer 161    | 4                         | 5          | 5          | 6          | 6          | 12         | 1.2                  | 1.2                                      |
| Interviewer 163    | 1                         | 0          | 1          | 0          | 0          | 0          | 0.0                  | 0.0                                      |
| Interviewer 164    | 3                         | 3          | 1          | 2          | 2          | 3          | 2.0                  | 1.0                                      |
| Interviewer 171    | 8                         | 6          | 7          | 7          | 5          | 5          | 1.0                  | 0.9                                      |
| Interviewer 174    | 1                         | 0          | 3          | 2          | 1          | 2          | 0.7                  | 1.0                                      |
| Interviewer 181    | 10                        | 9          | 9          | 11         | 7          | 3          | 1.2                  | 1.0                                      |
| Interviewer 191    | 3                         | 9          | 3          | 3          | 2          | 4          | 1.0                  | 0.4                                      |
| Interviewer 194    | 4                         | 1          | 1          | 1          | 0          | 3          | 1.0                  | 0.5                                      |
| Interviewer 201    | 4                         | 4          | 2          | 5          | 4          | 7          | 2.5                  | 1.5                                      |
| Interviewer 204    | 2                         | 5          | 1          | 7          | 2          | 3          | 7.0                  | 1.5                                      |
| <b>All teams</b>   | <b>144</b>                | <b>148</b> | <b>126</b> | <b>133</b> | <b>130</b> | <b>144</b> | <b>1.1</b>           | <b>1.0</b>                               |

Note: Targets are ratios greater than 0.80.

**Table FC-5B: Female age displacement**

Number of all women ages 47-52 years listed in the household roster by single years of age and age ratios, by interviewer team, Nepal, 2019

| Interviewer number | Age of women in years (N) |           |           |           |           |           | Age ratio<br>(49/50) | Extended age<br>ratio<br>(48+49)/(50+51) |
|--------------------|---------------------------|-----------|-----------|-----------|-----------|-----------|----------------------|------------------------------------------|
|                    | 47                        | 48        | 49        | 50        | 51        | 52        |                      |                                          |
| Interviewer 011    | 1                         | 5         | 0         | 3         | 4         | 1         | 0.0                  | 0.7                                      |
| Interviewer 014    | 0                         | 0         | 0         | 2         | 1         | 0         | 0.0                  | 0.0                                      |
| Interviewer 021    | 6                         | 6         | 3         | 4         | 3         | 3         | 0.8                  | 1.3                                      |
| Interviewer 024    | 2                         | 2         | 0         | 0         | 1         | 0         | -                    | 2.0                                      |
| Interviewer 031    | 3                         | 0         | 2         | 6         | 1         | 2         | 0.3                  | 0.3                                      |
| Interviewer 034    | 0                         | 0         | 1         | 0         | 2         | 1         | -                    | 0.5                                      |
| Interviewer 041    | 8                         | 2         | 1         | 3         | 1         | 2         | 0.3                  | 0.8                                      |
| Interviewer 044    | 1                         | 0         | 0         | 2         | 1         | 1         | 0.0                  | 0.0                                      |
| Interviewer 051    | 2                         | 0         | 1         | 4         | 0         | 3         | 0.3                  | 0.3                                      |
| Interviewer 052    | 0                         | 0         | 0         | 1         | 0         | 0         | 0.0                  | 0.0                                      |
| Interviewer 053    | 0                         | 0         | 0         | 1         | 0         | 1         | 0.0                  | 0.0                                      |
| Interviewer 054    | 1                         | 1         | 1         | 0         | 2         | 4         | -                    | 1.0                                      |
| Interviewer 061    | 3                         | 2         | 2         | 6         | 1         | 3         | 0.3                  | 0.6                                      |
| Interviewer 062    | 0                         | 1         | 0         | 1         | 0         | 0         | 0.0                  | 1.0                                      |
| Interviewer 071    | 2                         | 2         | 0         | 2         | 1         | 0         | 0.0                  | 0.7                                      |
| Interviewer 074    | 2                         | 3         | 0         | 1         | 1         | 1         | 0.0                  | 1.5                                      |
| Interviewer 081    | 5                         | 3         | 4         | 3         | 1         | 3         | 1.3                  | 1.8                                      |
| Interviewer 084    | 0                         | 0         | 0         | 0         | 1         | 1         | -                    | 0.0                                      |
| Interviewer 091    | 1                         | 1         | 5         | 2         | 1         | 1         | 2.5                  | 2.0                                      |
| Interviewer 094    | 0                         | 0         | 0         | 0         | 0         | 1         | -                    | -                                        |
| Interviewer 101    | 2                         | 2         | 1         | 4         | 2         | 2         | 0.3                  | 0.5                                      |
| Interviewer 104    | 1                         | 0         | 0         | 0         | 0         | 0         | -                    | -                                        |
| Interviewer 111    | 0                         | 1         | 1         | 1         | 5         | 5         | 1.0                  | 0.3                                      |
| Interviewer 114    | 1                         | 0         | 0         | 1         | 0         | 1         | 0.0                  | 0.0                                      |
| Interviewer 121    | 0                         | 3         | 2         | 5         | 2         | 1         | 0.4                  | 0.7                                      |
| Interviewer 124    | 0                         | 0         | 0         | 3         | 0         | 1         | 0.0                  | 0.0                                      |
| Interviewer 131    | 3                         | 1         | 1         | 3         | 4         | 0         | 0.3                  | 0.3                                      |
| Interviewer 134    | 2                         | 0         | 0         | 1         | 1         | 1         | 0.0                  | 0.0                                      |
| Interviewer 141    | 4                         | 4         | 2         | 0         | 3         | 0         | -                    | 2.0                                      |
| Interviewer 144    | 0                         | 1         | 2         | 2         | 1         | 3         | 1.0                  | 1.0                                      |
| Interviewer 151    | 1                         | 1         | 2         | 2         | 0         | 2         | 1.0                  | 1.5                                      |
| Interviewer 154    | 0                         | 1         | 1         | 1         | 4         | 1         | 1.0                  | 0.4                                      |
| Interviewer 161    | 1                         | 0         | 0         | 2         | 0         | 3         | 0.0                  | 0.0                                      |
| Interviewer 164    | 3                         | 0         | 0         | 0         | 1         | 1         | -                    | 0.0                                      |
| Interviewer 171    | 2                         | 2         | 2         | 1         | 1         | 2         | 2.0                  | 2.0                                      |
| Interviewer 174    | 2                         | 3         | 0         | 0         | 0         | 0         | -                    | -                                        |
| Interviewer 181    | 5                         | 4         | 4         | 1         | 3         | 4         | 4.0                  | 2.0                                      |
| Interviewer 191    | 3                         | 4         | 2         | 1         | 9         | 2         | 2.0                  | 0.6                                      |
| Interviewer 194    | 1                         | 0         | 1         | 1         | 2         | 2         | 1.0                  | 0.3                                      |
| Interviewer 201    | 1                         | 0         | 1         | 3         | 1         | 4         | 0.3                  | 0.3                                      |
| Interviewer 204    | 0                         | 2         | 1         | 1         | 1         | 1         | 1.0                  | 1.5                                      |
| <b>All teams</b>   | <b>69</b>                 | <b>57</b> | <b>43</b> | <b>74</b> | <b>62</b> | <b>64</b> | <b>0.6</b>           | <b>0.7</b>                               |

Note: Targets are ratios greater than 0.80.

**Table FC-5C: Female age displacement**

Number of all women ages 15-20 years listed in the household roster by single years of age and age ratios, by interviewer team, Nepal, 2019

| Interviewer number | Age of women in years (N) |            |            |            |            |            | Age ratio<br>(18/17) | Extended age<br>ratio<br>(18+19)/(16+17) |
|--------------------|---------------------------|------------|------------|------------|------------|------------|----------------------|------------------------------------------|
|                    | 15                        | 16         | 17         | 18         | 19         | 20         |                      |                                          |
| Interviewer 011    | 3                         | 2          | 5          | 2          | 7          | 1          | 0.4                  | 1.3                                      |
| Interviewer 014    | 0                         | 1          | 0          | 0          | 1          | 0          | -                    | 1.0                                      |
| Interviewer 021    | 6                         | 2          | 10         | 10         | 6          | 4          | 1.0                  | 1.3                                      |
| Interviewer 024    | 1                         | 0          | 0          | 1          | 0          | 2          | -                    | -                                        |
| Interviewer 031    | 4                         | 5          | 4          | 5          | 4          | 2          | 1.3                  | 1.0                                      |
| Interviewer 034    | 1                         | 1          | 0          | 2          | 3          | 0          | -                    | 5.0                                      |
| Interviewer 041    | 5                         | 5          | 4          | 5          | 2          | 6          | 1.3                  | 0.8                                      |
| Interviewer 044    | 3                         | 1          | 0          | 2          | 1          | 3          | -                    | 3.0                                      |
| Interviewer 051    | 4                         | 3          | 4          | 2          | 2          | 2          | 0.5                  | 0.6                                      |
| Interviewer 052    | 0                         | 0          | 0          | 2          | 0          | 0          | -                    | -                                        |
| Interviewer 053    | 1                         | 0          | 1          | 0          | 2          | 0          | 0.0                  | 2.0                                      |
| Interviewer 054    | 1                         | 1          | 4          | 2          | 0          | 3          | 0.5                  | 0.4                                      |
| Interviewer 061    | 7                         | 11         | 4          | 8          | 5          | 15         | 2.0                  | 0.9                                      |
| Interviewer 062    | 3                         | 0          | 0          | 1          | 0          | 1          | -                    | -                                        |
| Interviewer 063    | 1                         | 0          | 2          | 0          | 1          | 0          | 0.0                  | 0.5                                      |
| Interviewer 064    | 0                         | 1          | 1          | 1          | 0          | 0          | 1.0                  | 0.5                                      |
| Interviewer 071    | 1                         | 2          | 4          | 3          | 4          | 2          | 0.8                  | 1.2                                      |
| Interviewer 074    | 2                         | 5          | 3          | 2          | 6          | 5          | 0.7                  | 1.0                                      |
| Interviewer 081    | 5                         | 5          | 2          | 3          | 2          | 4          | 1.5                  | 0.7                                      |
| Interviewer 084    | 2                         | 2          | 1          | 0          | 1          | 0          | 0.0                  | 0.3                                      |
| Interviewer 091    | 5                         | 4          | 8          | 6          | 7          | 7          | 0.8                  | 1.1                                      |
| Interviewer 094    | 1                         | 1          | 1          | 4          | 1          | 0          | 4.0                  | 2.5                                      |
| Interviewer 101    | 10                        | 10         | 4          | 7          | 3          | 2          | 1.8                  | 0.7                                      |
| Interviewer 104    | 0                         | 0          | 1          | 0          | 0          | 0          | 0.0                  | 0.0                                      |
| Interviewer 111    | 4                         | 9          | 4          | 4          | 3          | 4          | 1.0                  | 0.5                                      |
| Interviewer 114    | 1                         | 0          | 1          | 1          | 1          | 3          | 1.0                  | 2.0                                      |
| Interviewer 121    | 6                         | 3          | 8          | 5          | 5          | 9          | 0.6                  | 0.9                                      |
| Interviewer 124    | 0                         | 1          | 0          | 0          | 3          | 1          | -                    | 3.0                                      |
| Interviewer 131    | 5                         | 7          | 7          | 5          | 5          | 4          | 0.7                  | 0.7                                      |
| Interviewer 134    | 0                         | 3          | 3          | 3          | 2          | 2          | 1.0                  | 0.8                                      |
| Interviewer 141    | 2                         | 8          | 7          | 9          | 3          | 6          | 1.3                  | 0.8                                      |
| Interviewer 144    | 4                         | 0          | 5          | 2          | 2          | 3          | 0.4                  | 0.8                                      |
| Interviewer 151    | 0                         | 4          | 2          | 3          | 1          | 5          | 1.5                  | 0.7                                      |
| Interviewer 154    | 1                         | 4          | 2          | 4          | 1          | 2          | 2.0                  | 0.8                                      |
| Interviewer 161    | 6                         | 6          | 12         | 6          | 4          | 7          | 0.5                  | 0.6                                      |
| Interviewer 164    | 2                         | 2          | 3          | 1          | 1          | 2          | 0.3                  | 0.4                                      |
| Interviewer 171    | 7                         | 5          | 5          | 5          | 8          | 4          | 1.0                  | 1.3                                      |
| Interviewer 174    | 2                         | 1          | 2          | 0          | 1          | 2          | 0.0                  | 0.3                                      |
| Interviewer 181    | 11                        | 7          | 3          | 8          | 7          | 10         | 2.7                  | 1.5                                      |
| Interviewer 191    | 3                         | 2          | 4          | 8          | 8          | 6          | 2.0                  | 2.7                                      |
| Interviewer 194    | 1                         | 0          | 3          | 2          | 2          | 2          | 0.7                  | 1.3                                      |
| Interviewer 201    | 5                         | 4          | 7          | 6          | 5          | 10         | 0.9                  | 1.0                                      |
| Interviewer 204    | 7                         | 2          | 3          | 1          | 5          | 3          | 0.3                  | 1.2                                      |
| <b>All teams</b>   | <b>133</b>                | <b>130</b> | <b>144</b> | <b>141</b> | <b>125</b> | <b>144</b> | <b>1.0</b>           | <b>1.0</b>                               |

Note: Targets are ratios greater than 0.80.

**Table FC-5D: Male age displacement**

Number of all men aged 15-20 years listed in the household roster by single years of age and age ratios, by interviewer team, Nepal, 2019

| Interviewer number | Age of men in years (N) |            |           |            |           |           | Age ratio<br>(18/17) | Extended age<br>ratio<br>(18+19)/(16+17) |
|--------------------|-------------------------|------------|-----------|------------|-----------|-----------|----------------------|------------------------------------------|
|                    | 15                      | 16         | 17        | 18         | 19        | 20        |                      |                                          |
| Interviewer 011    | 3                       | 4          | 3         | 7          | 6         | 4         | 2.3                  | 1.9                                      |
| Interviewer 014    | 0                       | 1          | 3         | 0          | 0         | 0         | 0.0                  | 0.0                                      |
| Interviewer 021    | 5                       | 5          | 4         | 7          | 4         | 4         | 1.8                  | 1.2                                      |
| Interviewer 024    | 2                       | 0          | 0         | 0          | 0         | 1         | -                    | -                                        |
| Interviewer 031    | 1                       | 6          | 2         | 4          | 1         | 4         | 2.0                  | 0.6                                      |
| Interviewer 034    | 1                       | 3          | 4         | 1          | 0         | 0         | 0.3                  | 0.1                                      |
| Interviewer 041    | 6                       | 1          | 1         | 3          | 5         | 4         | 3.0                  | 4.0                                      |
| Interviewer 044    | 0                       | 1          | 1         | 1          | 2         | 1         | 1.0                  | 1.5                                      |
| Interviewer 051    | 1                       | 4          | 1         | 2          | 2         | 1         | 2.0                  | 0.8                                      |
| Interviewer 052    | 1                       | 0          | 0         | 0          | 0         | 0         | -                    | -                                        |
| Interviewer 053    | 0                       | 1          | 2         | 2          | 0         | 0         | 1.0                  | 0.7                                      |
| Interviewer 054    | 1                       | 2          | 1         | 2          | 0         | 1         | 2.0                  | 0.7                                      |
| Interviewer 061    | 6                       | 6          | 5         | 9          | 9         | 5         | 1.8                  | 1.6                                      |
| Interviewer 062    | 1                       | 2          | 0         | 0          | 2         | 0         | -                    | 1.0                                      |
| Interviewer 063    | 0                       | 0          | 1         | 0          | 0         | 0         | 0.0                  | 0.0                                      |
| Interviewer 064    | 0                       | 0          | 0         | 1          | 2         | 0         | -                    | -                                        |
| Interviewer 071    | 9                       | 2          | 7         | 5          | 5         | 3         | 0.7                  | 1.1                                      |
| Interviewer 074    | 6                       | 4          | 3         | 5          | 4         | 0         | 1.7                  | 1.3                                      |
| Interviewer 081    | 4                       | 7          | 2         | 2          | 2         | 1         | 1.0                  | 0.4                                      |
| Interviewer 084    | 1                       | 1          | 0         | 0          | 2         | 1         | -                    | 2.0                                      |
| Interviewer 091    | 5                       | 2          | 2         | 4          | 3         | 2         | 2.0                  | 1.8                                      |
| Interviewer 094    | 1                       | 0          | 1         | 0          | 0         | 0         | 0.0                  | 0.0                                      |
| Interviewer 101    | 11                      | 3          | 5         | 5          | 5         | 6         | 1.0                  | 1.3                                      |
| Interviewer 104    | 1                       | 0          | 0         | 1          | 0         | 0         | -                    | -                                        |
| Interviewer 111    | 2                       | 2          | 1         | 2          | 3         | 2         | 2.0                  | 1.7                                      |
| Interviewer 114    | 0                       | 2          | 1         | 0          | 1         | 1         | 0.0                  | 0.3                                      |
| Interviewer 121    | 3                       | 7          | 4         | 6          | 5         | 7         | 1.5                  | 1.0                                      |
| Interviewer 124    | 3                       | 2          | 2         | 2          | 0         | 1         | 1.0                  | 0.5                                      |
| Interviewer 131    | 7                       | 2          | 3         | 1          | 4         | 3         | 0.3                  | 1.0                                      |
| Interviewer 134    | 2                       | 2          | 2         | 0          | 0         | 0         | 0.0                  | 0.0                                      |
| Interviewer 141    | 2                       | 7          | 3         | 2          | 6         | 1         | 0.7                  | 0.8                                      |
| Interviewer 144    | 3                       | 0          | 0         | 1          | 1         | 3         | -                    | -                                        |
| Interviewer 151    | 1                       | 4          | 3         | 1          | 1         | 2         | 0.3                  | 0.3                                      |
| Interviewer 154    | 1                       | 2          | 1         | 0          | 2         | 3         | 0.0                  | 0.7                                      |
| Interviewer 161    | 9                       | 8          | 3         | 6          | 1         | 1         | 2.0                  | 0.6                                      |
| Interviewer 164    | 3                       | 1          | 1         | 2          | 0         | 2         | 2.0                  | 1.0                                      |
| Interviewer 171    | 11                      | 3          | 3         | 5          | 3         | 4         | 1.7                  | 1.3                                      |
| Interviewer 174    | 3                       | 1          | 0         | 1          | 0         | 1         | -                    | 1.0                                      |
| Interviewer 181    | 8                       | 6          | 4         | 3          | 4         | 4         | 0.8                  | 0.7                                      |
| Interviewer 191    | 3                       | 9          | 4         | 3          | 2         | 5         | 0.8                  | 0.4                                      |
| Interviewer 194    | 3                       | 3          | 0         | 3          | 4         | 0         | -                    | 2.3                                      |
| Interviewer 201    | 6                       | 6          | 7         | 9          | 1         | 9         | 1.3                  | 0.8                                      |
| Interviewer 204    | 2                       | 2          | 1         | 0          | 3         | 3         | 0.0                  | 1.0                                      |
| <b>All teams</b>   | <b>138</b>              | <b>124</b> | <b>91</b> | <b>108</b> | <b>95</b> | <b>90</b> | <b>1.2</b>           | <b>0.9</b>                               |

Note: Targets are ratios greater than 0.80.

More children than anticipated were reported eligible for the survey. However, the mean number of eligible children per household decreased over time. In any case, these figures did not draw concern at any point in time.

**Table FC-6: Eligible children per household**

Mean number of eligible children younger than six years per household, Nepal, 2019

| Interviewer number | Completed households (N) | Eligible children in household (N) | Mean number of eligible children per household |
|--------------------|--------------------------|------------------------------------|------------------------------------------------|
| Interviewer 011    | 112                      | 38                                 | 0.3                                            |
| Interviewer 014    | 21                       | 3                                  | 0.1                                            |
| Interviewer 021    | 119                      | 459                                | 3.9                                            |
| Interviewer 024    | 13                       | 96                                 | 7.4                                            |
| Interviewer 031    | 92                       | 93                                 | 1.0                                            |
| Interviewer 034    | 28                       | 101                                | 3.6                                            |
| Interviewer 041    | 94                       | 44                                 | 0.5                                            |
| Interviewer 043    | 1                        | 0                                  | 0.0                                            |
| Interviewer 044    | 25                       | 13                                 | 0.5                                            |
| Interviewer 051    | 73                       | 26                                 | 0.4                                            |
| Interviewer 052    | 4                        | 2                                  | 0.5                                            |
| Interviewer 053    | 21                       | 10                                 | 0.5                                            |
| Interviewer 054    | 52                       | 58                                 | 1.1                                            |
| Interviewer 061    | 95                       | 76                                 | 0.8                                            |
| Interviewer 062    | 12                       | 11                                 | 0.9                                            |
| Interviewer 063    | 5                        | 4                                  | 0.8                                            |
| Interviewer 064    | 8                        | 4                                  | 0.5                                            |
| Interviewer 071    | 60                       | 182                                | 3.0                                            |
| Interviewer 074    | 57                       | 41                                 | 0.7                                            |
| Interviewer 081    | 103                      | 411                                | 4.0                                            |
| Interviewer 084    | 17                       | 8                                  | 0.5                                            |
| Interviewer 091    | 102                      | 52                                 | 0.5                                            |
| Interviewer 094    | 18                       | 9                                  | 0.5                                            |
| Interviewer 101    | 102                      | 276                                | 2.7                                            |
| Interviewer 104    | 14                       | 7                                  | 0.5                                            |
| Interviewer 111    | 77                       | 53                                 | 0.7                                            |
| Interviewer 114    | 26                       | 21                                 | 0.8                                            |
| Interviewer 121    | 99                       | 69                                 | 0.7                                            |
| Interviewer 124    | 20                       | 14                                 | 0.7                                            |
| Interviewer 131    | 79                       | 55                                 | 0.7                                            |
| Interviewer 134    | 41                       | 30                                 | 0.7                                            |
| Interviewer 141    | 85                       | 57                                 | 0.7                                            |
| Interviewer 144    | 38                       | 120                                | 3.2                                            |
| Interviewer 151    | 61                       | 35                                 | 0.6                                            |
| Interviewer 154    | 59                       | 79                                 | 1.3                                            |
| Interviewer 161    | 96                       | 55                                 | 0.6                                            |
| Interviewer 163    | 1                        | 2                                  | 2.0                                            |
| Interviewer 164    | 24                       | 7                                  | 0.3                                            |
| Interviewer 171    | 92                       | 38                                 | 0.4                                            |
| Interviewer 174    | 28                       | 17                                 | 0.6                                            |
| Interviewer 181    | 120                      | 56                                 | 0.5                                            |
| Interviewer 191    | 87                       | 397                                | 4.6                                            |
| Interviewer 194    | 32                       | 60                                 | 1.9                                            |
| Interviewer 201    | 100                      | 55                                 | 0.6                                            |
| Interviewer 204    | 48                       | 81                                 | 1.7                                            |
| <b>All teams</b>   | <b>2,461</b>             | <b>3,325</b>                       | <b>1.4</b>                                     |

Note: The target is 0.7 eligible children per household.



Age heaping, especially around age six, was a cause for concern at certain points during data collection. However, **Table FC-7** illustrates that this age heaping smoothed over time. Both the age ratio and extended age ratio exceed the target ratio of 0.80.

**Table FC-7: Child age displacement**

Number of all children ages 2-8 listed in the household roster by single years of age and age ratios, by interviewer team, Nepal, 2019

| Interviewer number | Age of children in years (N) |            |            |            |            |            |              | Age ratio (5/6) | Extended age ratio (4+5)/(6+7) |
|--------------------|------------------------------|------------|------------|------------|------------|------------|--------------|-----------------|--------------------------------|
|                    | 2                            | 3          | 4          | 5          | 6          | 7          | 8            |                 |                                |
| Interviewer 011    | 12                           | 4          | 9          | 7          | 4          | 3          | 5.0          | 1.8             | 2.3                            |
| Interviewer 014    | 1                            | 1          | 1          | 0          | 2          | 0          | 0.0          | 0.0             | 0.5                            |
| Interviewer 021    | 8                            | 8          | 7          | 11         | 11         | 3          | 5.0          | 1.0             | 1.3                            |
| Interviewer 024    | 2                            | 0          | 1          | 2          | 0          | 0          | 1.0          | -               | -                              |
| Interviewer 031    | 14                           | 6          | 9          | 9          | 7          | 12         | 5.0          | 1.3             | 0.9                            |
| Interviewer 034    | 2                            | 2          | 4          | 1          | 1          | 3          | 0.0          | 1.0             | 1.3                            |
| Interviewer 041    | 5                            | 8          | 7          | 7          | 4          | 5          | 1.0          | 1.8             | 1.6                            |
| Interviewer 044    | 1                            | 4          | 3          | 2          | 0          | 3          | 4.0          | -               | 1.7                            |
| Interviewer 051    | 5                            | 2          | 12         | 1          | 3          | 9          | 3.0          | 0.3             | 1.1                            |
| Interviewer 052    | 1                            | 0          | 1          | 0          | 0          | 0          | 0.0          | -               | -                              |
| Interviewer 053    | 1                            | 0          | 2          | 3          | 1          | 0          | 2.0          | 3.0             | 5.0                            |
| Interviewer 054    | 5                            | 3          | 1          | 0          | 3          | 3          | 2.0          | 0.0             | 0.2                            |
| Interviewer 061    | 15                           | 16         | 8          | 8          | 11         | 13         | 20.0         | 0.7             | 0.7                            |
| Interviewer 062    | 2                            | 3          | 1          | 3          | 3          | 1          | 3.0          | 1.0             | 1.0                            |
| Interviewer 063    | 0                            | 1          | 0          | 2          | 1          | 1          | 1.0          | 2.0             | 1.0                            |
| Interviewer 064    | 0                            | 0          | 2          | 0          | 0          | 2          | 3.0          | -               | 1.0                            |
| Interviewer 071    | 9                            | 5          | 5          | 7          | 9          | 2          | 8.0          | 0.8             | 1.1                            |
| Interviewer 074    | 5                            | 8          | 2          | 8          | 9          | 7          | 12.0         | 0.9             | 0.6                            |
| Interviewer 081    | 7                            | 12         | 9          | 6          | 9          | 9          | 10.0         | 0.7             | 0.8                            |
| Interviewer 084    | 1                            | 0          | 3          | 1          | 1          | 2          | 4.0          | 1.0             | 1.3                            |
| Interviewer 091    | 12                           | 8          | 7          | 6          | 13         | 8          | 10.0         | 0.5             | 0.6                            |
| Interviewer 094    | 1                            | 2          | 1          | 2          | 5          | 0          | 1.0          | 0.4             | 0.6                            |
| Interviewer 101    | 8                            | 7          | 8          | 4          | 8          | 9          | 12.0         | 0.5             | 0.7                            |
| Interviewer 104    | 1                            | 3          | 0          | 2          | 1          | 3          | 1.0          | 2.0             | 0.5                            |
| Interviewer 111    | 5                            | 12         | 11         | 11         | 6          | 12         | 6.0          | 1.8             | 1.2                            |
| Interviewer 114    | 3                            | 2          | 6          | 2          | 1          | 5          | 5.0          | 2.0             | 1.3                            |
| Interviewer 121    | 16                           | 12         | 17         | 10         | 14         | 8          | 11.0         | 0.7             | 1.2                            |
| Interviewer 124    | 2                            | 1          | 3          | 3          | 0          | 2          | 6.0          | -               | 3.0                            |
| Interviewer 131    | 9                            | 12         | 13         | 7          | 8          | 14         | 2.0          | 0.9             | 0.9                            |
| Interviewer 134    | 5                            | 6          | 8          | 3          | 6          | 9          | 6.0          | 0.5             | 0.7                            |
| Interviewer 141    | 7                            | 15         | 10         | 8          | 15         | 10         | 13.0         | 0.5             | 0.7                            |
| Interviewer 144    | 6                            | 3          | 5          | 6          | 3          | 6          | 3.0          | 2.0             | 1.2                            |
| Interviewer 151    | 3                            | 10         | 4          | 5          | 11         | 4          | 10.0         | 0.5             | 0.6                            |
| Interviewer 154    | 5                            | 2          | 5          | 7          | 8          | 8          | 5.0          | 0.9             | 0.8                            |
| Interviewer 161    | 7                            | 11         | 7          | 15         | 11         | 14         | 7.0          | 1.4             | 0.9                            |
| Interviewer 163    | 0                            | 1          | 1          | 0          | 1          | 0          | 0.0          | 0.0             | 1.0                            |
| Interviewer 164    | 0                            | 0          | 2          | 0          | 3          | 4          | 3.0          | 0.0             | 0.3                            |
| Interviewer 171    | 4                            | 6          | 7          | 6          | 1          | 9          | 8.0          | 6.0             | 1.3                            |
| Interviewer 174    | 4                            | 2          | 4          | 4          | 2          | 3          | 3.0          | 2.0             | 1.6                            |
| Interviewer 181    | 4                            | 9          | 11         | 14         | 3          | 3          | 10.0         | 4.7             | 4.2                            |
| Interviewer 191    | 9                            | 9          | 10         | 8          | 10         | 4          | 4.0          | 0.8             | 1.3                            |
| Interviewer 194    | 4                            | 4          | 2          | 4          | 3          | 6          | 4.0          | 1.3             | 0.7                            |
| Interviewer 201    | 13                           | 5          | 12         | 11         | 8          | 8          | 8.0          | 1.4             | 1.4                            |
| Interviewer 204    | 8                            | 4          | 6          | 4          | 5          | 6          | 4.0          | 0.8             | 0.9                            |
| <b>All teams</b>   | <b>232</b>                   | <b>229</b> | <b>247</b> | <b>220</b> | <b>225</b> | <b>233</b> | <b>231.0</b> | <b>1.0</b>      | <b>1.0</b>                     |

Note: Targets are ratios greater than 0.80.

Module 6 response rates for both women and men varied across interviewer team and did not meet the target of 95 percent overall. The response rate for women was 69.9 percent, and 74.6 percent for men. The lower response rates relative to the target are likely due to the long duration of the survey module.

**Table FC-8A: Module 6 (Women) Women's Empowerment in Agriculture Module, eligibility and response rate**

Percent distribution of eligible women (primary adult female decision-maker) by result of individual outcome, by interviewer team, Nepal, 2019

| Interviewer number | Result of module completed (N) | Number of women (N) | Response rate (%) |
|--------------------|--------------------------------|---------------------|-------------------|
| Interviewer 011    | 93                             | 107                 | 86.9              |
| Interviewer 014    | 4                              | 19                  | 21.1              |
| Interviewer 021    | 105                            | 117                 | 89.7              |
| Interviewer 024    | 8                              | 13                  | 61.5              |
| Interviewer 031    | 64                             | 87                  | 73.6              |
| Interviewer 034    | 10                             | 28                  | 35.7              |
| Interviewer 041    | 79                             | 91                  | 86.8              |
| Interviewer 043    | 1                              | 1                   | 100.0             |
| Interviewer 044    | 16                             | 25                  | 64.0              |
| Interviewer 051    | 37                             | 68                  | 54.4              |
| Interviewer 052    | 1                              | 4                   | 25.0              |
| Interviewer 053    | 18                             | 21                  | 85.7              |
| Interviewer 054    | 28                             | 49                  | 57.1              |
| Interviewer 061    | 82                             | 91                  | 90.1              |
| Interviewer 062    | 8                              | 12                  | 66.7              |
| Interviewer 063    | 0                              | 5                   | 0.0               |
| Interviewer 064    | 7                              | 8                   | 87.5              |
| Interviewer 071    | 1                              | 60                  | 1.7               |
| Interviewer 074    | 39                             | 57                  | 68.4              |
| Interviewer 081    | 40                             | 100                 | 40.0              |
| Interviewer 084    | 2                              | 16                  | 12.5              |
| Interviewer 091    | 68                             | 101                 | 67.3              |
| Interviewer 094    | 15                             | 17                  | 88.2              |
| Interviewer 101    | 88                             | 100                 | 88.0              |
| Interviewer 104    | 13                             | 14                  | 92.9              |
| Interviewer 111    | 69                             | 76                  | 90.8              |
| Interviewer 114    | 26                             | 26                  | 100.0             |
| Interviewer 121    | 59                             | 100                 | 59.0              |
| Interviewer 124    | 12                             | 20                  | 60.0              |
| Interviewer 131    | 59                             | 78                  | 75.6              |
| Interviewer 134    | 28                             | 40                  | 70.0              |
| Interviewer 141    | 84                             | 84                  | 100.0             |
| Interviewer 144    | 38                             | 38                  | 100.0             |
| Interviewer 151    | 20                             | 59                  | 33.9              |
| Interviewer 154    | 23                             | 59                  | 39.0              |
| Interviewer 161    | 48                             | 93                  | 51.6              |
| Interviewer 163    | 0                              | 1                   | 0.0               |
| Interviewer 164    | 13                             | 24                  | 54.2              |
| Interviewer 171    | 28                             | 85                  | 32.9              |
| Interviewer 174    | 3                              | 28                  | 10.7              |
| Interviewer 181    | 108                            | 118                 | 91.5              |
| Interviewer 191    | 78                             | 87                  | 89.7              |
| Interviewer 194    | 21                             | 32                  | 65.6              |
| Interviewer 201    | 94                             | 98                  | 95.9              |
| Interviewer 204    | 43                             | 49                  | 87.8              |
| <b>All teams</b>   | <b>1,681</b>                   | <b>2,406</b>        | <b>69.9</b>       |

The target response rate is 95 percent.

**Table FC-8B: Module 6 (Men) Women's Empowerment in Agriculture Module, eligibility and response rate**

Percent distribution of eligible men (primary adult male decision-maker) by result of individual outcome, by interviewer team, Nepal, 2019

| Interviewer number | Result of module completed (N) | Number of eligible men (N) | Response rate (%) |
|--------------------|--------------------------------|----------------------------|-------------------|
| Interviewer 011    | 85                             | 94                         | 90.4              |
| Interviewer 014    | 2                              | 15                         | 13.3              |
| Interviewer 021    | 105                            | 110                        | 95.5              |
| Interviewer 024    | 5                              | 9                          | 55.6              |
| Interviewer 031    | 66                             | 76                         | 86.8              |
| Interviewer 034    | 12                             | 22                         | 54.5              |
| Interviewer 041    | 50                             | 60                         | 83.3              |
| Interviewer 043    | -                              | 0                          | -                 |
| Interviewer 044    | 11                             | 19                         | 57.9              |
| Interviewer 051    | 33                             | 53                         | 62.3              |
| Interviewer 052    | 1                              | 3                          | 33.3              |
| Interviewer 053    | 6                              | 10                         | 60.0              |
| Interviewer 054    | 21                             | 34                         | 61.8              |
| Interviewer 061    | 79                             | 86                         | 91.9              |
| Interviewer 062    | 6                              | 8                          | 75.0              |
| Interviewer 063    | 0                              | 5                          | 0.0               |
| Interviewer 064    | 7                              | 8                          | 87.5              |
| Interviewer 071    | 0                              | 46                         | 0.0               |
| Interviewer 074    | 35                             | 48                         | 72.9              |
| Interviewer 081    | 34                             | 84                         | 40.5              |
| Interviewer 084    | 2                              | 16                         | 12.5              |
| Interviewer 091    | 46                             | 64                         | 71.9              |
| Interviewer 094    | 6                              | 7                          | 85.7              |
| Interviewer 101    | 73                             | 75                         | 97.3              |
| Interviewer 104    | 12                             | 12                         | 100.0             |
| Interviewer 111    | 50                             | 51                         | 98.0              |
| Interviewer 114    | 14                             | 14                         | 100.0             |
| Interviewer 121    | 64                             | 83                         | 77.1              |
| Interviewer 124    | 12                             | 16                         | 75.0              |
| Interviewer 131    | 47                             | 62                         | 75.8              |
| Interviewer 134    | 25                             | 31                         | 80.6              |
| Interviewer 141    | 71                             | 71                         | 100.0             |
| Interviewer 144    | 33                             | 33                         | 100.0             |
| Interviewer 151    | 19                             | 46                         | 41.3              |
| Interviewer 154    | 22                             | 50                         | 44.0              |
| Interviewer 161    | 40                             | 71                         | 56.3              |
| Interviewer 163    | 0                              | 0                          | -                 |
| Interviewer 164    | 11                             | 19                         | 57.9              |
| Interviewer 171    | 23                             | 70                         | 32.9              |
| Interviewer 174    | 2                              | 20                         | 10.0              |
| Interviewer 181    | 85                             | 88                         | 96.6              |
| Interviewer 191    | 63                             | 63                         | 100.0             |
| Interviewer 194    | 18                             | 23                         | 78.3              |
| Interviewer 201    | 91                             | 94                         | 96.8              |
| Interviewer 204    | 43                             | 47                         | 91.5              |
| <b>All teams</b>   | <b>1,430</b>                   | <b>1,916</b>               | <b>74.6</b>       |

The target response rate is 95 percent.

**Table FC-9** demonstrates varying response rates by interviewer team. Though the target response rate for this module is 95 percent, the response rate across all teams was not far from the target at 86.7 percent.

**Table FC-9: Module 4 Results (Women's anthropometry and dietary diversity)**

Percent distribution of all eligible women by result of individual outcomes, by interviewer team, Nepal, 2019

| Interviewer number | Result of household interview completed | Number of women | Response rate <sup>1</sup> |
|--------------------|-----------------------------------------|-----------------|----------------------------|
| Interviewer 011    | 100.0                                   | 75              | 100.0                      |
| Interviewer 014    | 100.0                                   | 10              | 100.0                      |
| Interviewer 021    | 85.6                                    | 104             | 85.6                       |
| Interviewer 024    | 100.0                                   | 12              | 100.0                      |
| Interviewer 031    | 48.6                                    | 146             | 48.6                       |
| Interviewer 034    | 100.0                                   | 21              | 100.0                      |
| Interviewer 041    | 98.6                                    | 73              | 98.6                       |
| Interviewer 044    | 54.5                                    | 33              | 54.5                       |
| Interviewer 051    | 100.0                                   | 57              | 100.0                      |
| Interviewer 052    | 100.0                                   | 4               | 100.0                      |
| Interviewer 053    | 100.0                                   | 16              | 100.0                      |
| Interviewer 054    | 74.6                                    | 59              | 74.6                       |
| Interviewer 061    | 100.0                                   | 85              | 100.0                      |
| Interviewer 062    | 100.0                                   | 12              | 100.0                      |
| Interviewer 063    | 100.0                                   | 5               | 100.0                      |
| Interviewer 064    | 100.0                                   | 8               | 100.0                      |
| Interviewer 071    | 47.4                                    | 114             | 47.4                       |
| Interviewer 074    | 76.6                                    | 64              | 76.6                       |
| Interviewer 081    | 59.7                                    | 149             | 59.7                       |
| Interviewer 084    | 92.3                                    | 13              | 92.3                       |
| Interviewer 091    | 100.0                                   | 86              | 100.0                      |
| Interviewer 094    | 100.0                                   | 16              | 100.0                      |
| Interviewer 101    | 100.0                                   | 83              | 100.0                      |
| Interviewer 104    | 100.0                                   | 14              | 100.0                      |
| Interviewer 111    | 68.1                                    | 94              | 68.1                       |
| Interviewer 114    | 100.0                                   | 25              | 100.0                      |
| Interviewer 121    | 82.8                                    | 99              | 82.8                       |
| Interviewer 124    | 100.0                                   | 18              | 100.0                      |
| Interviewer 131    | 98.6                                    | 71              | 98.6                       |
| Interviewer 134    | 100.0                                   | 37              | 100.0                      |
| Interviewer 141    | 100.0                                   | 78              | 100.0                      |
| Interviewer 144    | 100.0                                   | 35              | 100.0                      |
| Interviewer 151    | 100.0                                   | 52              | 100.0                      |
| Interviewer 154    | 100.0                                   | 51              | 100.0                      |
| Interviewer 161    | 100.0                                   | 85              | 100.0                      |
| Interviewer 163    | 100.0                                   | 1               | 100.0                      |
| Interviewer 164    | 100.0                                   | 22              | 100.0                      |
| Interviewer 171    | 100.0                                   | 83              | 100.0                      |
| Interviewer 174    | 100.0                                   | 25              | 100.0                      |
| Interviewer 181    | 100.0                                   | 109             | 100.0                      |
| Interviewer 191    | 100.0                                   | 77              | 100.0                      |
| Interviewer 194    | 64.3                                    | 42              | 64.3                       |
| Interviewer 201    | 100.0                                   | 90              | 100.0                      |
| Interviewer 204    | 100.0                                   | 45              | 100.0                      |
| <b>All teams</b>   | <b>86.7</b>                             | <b>2,398</b>    | <b>86.7</b>                |

<sup>1</sup> The figures reported in this table were generated directly by the Feed the Future field check table program in CSPro. The total response rate as reported here is not an exact match to module response rates reported above due to minor differences in the calculation of response rate between the CSPro program and SI's analysis in Stata.

The target response rate is 95 percent.

**Table FC-10A** illustrates that 93.3 percent of eligible children completed Module 5. This response rate is slightly lower than the target response rate of 95 percent. However, a number of challenges were present during data collection that prevented New ERA from reaching this target, including children who were absent from their homes for an extended period of time.

**Table FC-10A: Module 5 Results (Children's nutrition)**

Percent distribution of all eligible children younger than six years by result of Module 5, by interviewer team, Nepal, 2019

| Interviewer Number | Number of eligible children | Number of children that completed Module 5 | Response Rate <sup>1</sup> |
|--------------------|-----------------------------|--------------------------------------------|----------------------------|
| 11                 | 38                          | 36                                         | 94.7                       |
| 14                 | 3                           | 3                                          | 100.0                      |
| 21                 | 46                          | 36                                         | 78.3                       |
| 24                 | 6                           | 4                                          | 66.7                       |
| 31                 | 48                          | 47                                         | 97.9                       |
| 34                 | 13                          | 13                                         | 100.00                     |
| 41                 | 42                          | 38                                         | 90.5                       |
| 44                 | 12                          | 13                                         | 108.3                      |
| 51                 | 26                          | 23                                         | 88.5                       |
| 52                 | 2                           | 2                                          | 100.0                      |
| 53                 | 10                          | 10                                         | 100.0                      |
| 54                 | 11                          | 10                                         | 90.9                       |
| 61                 | 76                          | 74                                         | 97.4                       |
| 62                 | 11                          | 11                                         | 100.0                      |
| 63                 | 4                           | 4                                          | 100.0                      |
| 64                 | 4                           | 3                                          | 75.0                       |
| 71                 | 39                          | 37                                         | 94.9                       |
| 74                 | 45                          | 40                                         | 88.9                       |
| 81                 | 44                          | 43                                         | 97.7                       |
| 84                 | 7                           | 7                                          | 100.0                      |
| 91                 | 51                          | 51                                         | 100.0                      |
| 94                 | 9                           | 9                                          | 100.0                      |
| 101                | 45                          | 39                                         | 86.7                       |
| 104                | 7                           | 6                                          | 85.7                       |
| 111                | 54                          | 51                                         | 94.4                       |
| 114                | 21                          | 21                                         | 100.0                      |
| 121                | 69                          | 59                                         | 85.5                       |
| 124                | 14                          | 14                                         | 100.0                      |
| 131                | 55                          | 52                                         | 94.6                       |
| 134                | 30                          | 30                                         | 100.0                      |
| 141                | 56                          | 54                                         | 96.4                       |
| 144                | 29                          | 29                                         | 100.0                      |
| 151                | 35                          | 34                                         | 97.1                       |
| 154                | 37                          | 37                                         | 100.0                      |
| 161                | 55                          | 54                                         | 98.2                       |
| 163                | 2                           | 2                                          | 100.0                      |
| 164                | 7                           | 6                                          | 85.7                       |
| 171                | 38                          | 38                                         | 100.0                      |
| 174                | 17                          | 17                                         | 100.0                      |
| 181                | 56                          | 54                                         | 96.4                       |
| 191                | 51                          | 42                                         | 82.4                       |
| 194                | 16                          | 14                                         | 87.5                       |
| 201                | 56                          | 45                                         | 80.4                       |
| 204                | 36                          | 32                                         | 88.9                       |
| <b>Total</b>       | <b>1333</b>                 | <b>1244</b>                                | <b>93.3</b>                |

<sup>1</sup> Figures reported in this table were generated directly by the Feed the Future field check table program in CSPro. The total response rate as reported here is not an exact match to module response rates reported above due to minor differences in the calculation of response rate between the CSPro program and SI's analysis in Stata.

**Table FC-10B** demonstrates that only 93.9 percent of eligible children have been both weighed and measured. This falls just short of the target of 95 percent of eligible children.

**Table FC-10B: Module 5 Results (Children anthropometry)**

Percent distribution of all eligible children younger than six years by result of Module 5, by interviewer team, Nepal, 2019

| Interviewer Number | Height Measured | Weight Measured | Number of eligible children | Measured for both height and weight <sup>1</sup> |
|--------------------|-----------------|-----------------|-----------------------------|--------------------------------------------------|
| 11                 | 36              | 36              | 38                          | 94.7                                             |
| 14                 | 3               | 3               | 3                           | 100.0                                            |
| 21                 | 36              | 36              | 46                          | 78.3                                             |
| 24                 | 4               | 4               | 6                           | 66.7                                             |
| 31                 | 47              | 47              | 48                          | 97.9                                             |
| 34                 | 13              | 13              | 13                          | 100.0                                            |
| 41                 | 38              | 38              | 42                          | 90.5                                             |
| 44                 | 13              | 13              | 12                          | 108.3                                            |
| 51                 | 23              | 23              | 26                          | 88.5                                             |
| 52                 | 2               | 2               | 2                           | 100.0                                            |
| 53                 | 10              | 10              | 10                          | 100.0                                            |
| 54                 | 10              | 10              | 11                          | 90.9                                             |
| 61                 | 74              | 74              | 76                          | 97.4                                             |
| 62                 | 11              | 11              | 11                          | 100.0                                            |
| 63                 | 4               | 4               | 4                           | 100.0                                            |
| 64                 | 3               | 3               | 4                           | 75.0                                             |
| 71                 | 37              | 37              | 39                          | 94.8                                             |
| 74                 | 40              | 40              | 45                          | 88.9                                             |
| 81                 | 43              | 43              | 44                          | 97.7                                             |
| 84                 | 7               | 7               | 7                           | 100.0                                            |
| 91                 | 51              | 51              | 51                          | 100.0                                            |
| 94                 | 9               | 9               | 9                           | 100.0                                            |
| 101                | 44              | 44              | 45                          | 97.8                                             |
| 104                | 7               | 7               | 7                           | 100.0                                            |
| 111                | 51              | 51              | 54                          | 94.4                                             |
| 114                | 21              | 21              | 21                          | 100.0                                            |
| 121                | 59              | 59              | 69                          | 85.5                                             |
| 124                | 14              | 14              | 14                          | 100.0                                            |
| 131                | 52              | 52              | 55                          | 94.6                                             |
| 134                | 30              | 30              | 30                          | 100.0                                            |
| 141                | 54              | 54              | 56                          | 96.4                                             |
| 144                | 29              | 29              | 29                          | 100.0                                            |
| 151                | 34              | 34              | 35                          | 97.1                                             |
| 154                | 37              | 37              | 37                          | 100.0                                            |
| 161                | 54              | 54              | 55                          | 98.2                                             |
| 163                | 2               | 2               | 2                           | 100.0                                            |
| 164                | 6               | 6               | 7                           | 85.7                                             |
| 171                | 38              | 38              | 38                          | 100.0                                            |
| 174                | 17              | 17              | 17                          | 100.0                                            |
| 181                | 54              | 54              | 56                          | 96.4                                             |
| 191                | 43              | 43              | 51                          | 84.3                                             |
| 194                | 14              | 14              | 16                          | 87.5                                             |
| 201                | 46              | 45              | 56                          | 80.4                                             |
| 204                | 32              | 32              | 36                          | 88.9                                             |
| <b>Total</b>       | <b>1252</b>     | <b>1251</b>     | <b>1333</b>                 | <b>93.9</b>                                      |

<sup>1</sup> The figures reported in this table were generated directly by the Feed the Future field check table program in CSPro. The total response rate as reported here is not an exact match to module response rates reported above due to minor differences in the calculation of response rate between the CSPro program and SI's analysis in Stata.

**Table FC-II** demonstrated slight age heaping during data collection and was monitored closely. Nonetheless, age heaping remained high around children aged 24 months at the conclusion of data collection and children aged 24 months still fall below the 30 percent threshold.

**Table FC-II: Age heaping in months of age**

Percentage of children in Module 5 in each age group with age reported as six, 12, 18, or 24 months by interviewer team, Nepal, 2019

| Interviewer number | Children's age in months                    |                                              |                                              |                                              |                                              |                                              | Average percentage of children recorded at six-month intervals <sup>1</sup> |
|--------------------|---------------------------------------------|----------------------------------------------|----------------------------------------------|----------------------------------------------|----------------------------------------------|----------------------------------------------|-----------------------------------------------------------------------------|
|                    | Ages 4-8 months, recorded as six months (%) | Ages 10-14 months, recorded as 12 months (%) | Ages 16-20 months, recorded as 18 months (%) | Ages 22-26 months, recorded as 24 months (%) | Ages 28-32 months, recorded as 30 months (%) | Ages 34-38 months, recorded as 36 months (%) |                                                                             |
| Interviewer 011    | 100.0                                       | -                                            | 0.0                                          | 0.0                                          | 0.0                                          | 0.0                                          | -                                                                           |
| Interviewer 021    | 33.3                                        | 0.0                                          | 0.0                                          | 20.0                                         | 0.0                                          | 0.0                                          | 8.9                                                                         |
| Interviewer 031    | 0.0                                         | 0.0                                          | 16.7                                         | 33.3                                         | 33.3                                         | 0.0                                          | 13.9                                                                        |
| Interviewer 034    | 0.0                                         | 100.0                                        | 50.0                                         | -                                            | 100.0                                        | 0.0                                          | -                                                                           |
| Interviewer 041    | 0.0                                         | -                                            | 40.0                                         | 50.0                                         | -                                            | 20.0                                         | -                                                                           |
| Interviewer 051    | -                                           | 0.0                                          | -                                            | 0.0                                          | 0.0                                          | 20.0                                         | -                                                                           |
| Interviewer 053    | -                                           | -                                            | 50.0                                         | 100.0                                        | 100.0                                        | -                                            | -                                                                           |
| Interviewer 054    | 0.0                                         | -                                            | 0.0                                          | 50.0                                         | 100.0                                        | 0.0                                          | -                                                                           |
| Interviewer 061    | 33.3                                        | 100.0                                        | 20.0                                         | 50.0                                         | 33.3                                         | 55.6                                         | 48.7                                                                        |
| Interviewer 074    | 0.0                                         | 33.3                                         | 25.0                                         | 0.0                                          | -                                            | 66.7                                         | -                                                                           |
| Interviewer 081    | 66.7                                        | 0.0                                          | 50.0                                         | 0.0                                          | 33.3                                         | 14.3                                         | 27.4                                                                        |
| Interviewer 084    | -                                           | -                                            | 0.0                                          | 0.0                                          | -                                            | 100.0                                        | -                                                                           |
| Interviewer 091    | 0.0                                         | 50.0                                         | 33.3                                         | 0.0                                          | 0.0                                          | 0.0                                          | 13.9                                                                        |
| Interviewer 094    | -                                           | 100.0                                        | 0.0                                          | 0.0                                          | 0.0                                          | -                                            | -                                                                           |
| Interviewer 101    | 0.0                                         | 0.0                                          | 50.0                                         | 33.3                                         | 0.0                                          | 0.0                                          | 13.9                                                                        |
| Interviewer 111    | 0.0                                         | 0.0                                          | 0.0                                          | 50.0                                         | 33.3                                         | 0.0                                          | 13.9                                                                        |
| Interviewer 114    | 0.0                                         | 0.0                                          | 0.0                                          | 50.0                                         | 0.0                                          | -                                            | -                                                                           |
| Interviewer 121    | 100.0                                       | 33.3                                         | 100.0                                        | 33.3                                         | 0.0                                          | 25.0                                         | 48.6                                                                        |
| Interviewer 124    | 0.0                                         | 66.7                                         | -                                            | 0.0                                          | -                                            | -                                            | -                                                                           |
| Interviewer 131    | 0.0                                         | 0.0                                          | 0.0                                          | 50.0                                         | 0.0                                          | 14.3                                         | 10.7                                                                        |
| Interviewer 134    | -                                           | 0.0                                          | 0.0                                          | 0.0                                          | 50.0                                         | 0.0                                          | -                                                                           |
| Interviewer 141    | 0.0                                         | 50.0                                         | 0.0                                          | 16.7                                         | 0.0                                          | 33.3                                         | 16.7                                                                        |
| Interviewer 151    | 28.6                                        | 33.3                                         | 33.3                                         | 0.0                                          | 100.0                                        | 0.0                                          | 32.5                                                                        |
| Interviewer 154    | 16.7                                        | -                                            | 40.0                                         | 40.0                                         | -                                            | 0.0                                          | -                                                                           |
| Interviewer 161    | 0.0                                         | 0.0                                          | 40.0                                         | 50.0                                         | 0.0                                          | 0.0                                          | 15.0                                                                        |
| Interviewer 171    | 25.0                                        | -                                            | -                                            | 20.0                                         | 0.0                                          | 0.0                                          | -                                                                           |
| Interviewer 174    | -                                           | 100.0                                        | -                                            | -                                            | 0.0                                          | -                                            | -                                                                           |
| Interviewer 181    | 50.0                                        | 0.0                                          | 25.0                                         | 33.3                                         | 0.0                                          | 40.0                                         | 24.7                                                                        |
| Interviewer 191    | 25.0                                        | 0.0                                          | 25.0                                         | -                                            | 25.0                                         | 0.0                                          | -                                                                           |
| Interviewer 194    | -                                           | 0.0                                          | -                                            | 50.0                                         | 0.0                                          | 0.0                                          | -                                                                           |
| Interviewer 201    | -                                           | 0.0                                          | 0.0                                          | 33.3                                         | 20.0                                         | 0.0                                          | -                                                                           |
| Interviewer 204    | 20.0                                        | 0.0                                          | 0.0                                          | 0.0                                          | 20.0                                         | 66.7                                         | 17.8                                                                        |
| <b>All teams</b>   | <b>19.0</b>                                 | <b>18.9</b>                                  | <b>23.3</b>                                  | <b>27.9</b>                                  | <b>15.7</b>                                  | <b>19.6</b>                                  | <b>20.7</b>                                                                 |

**Table FC-12** demonstrates that all interviewers submitted perfectly complete birth date and age information.

**Table FC-12: Birth date and age reporting**

Percent distribution of the completeness of birth date and age information, by interviewer team, Nepal, 2019

| Interviewer number | Completeness for children whose caretakers have been interviewed |                    | Total (%)    |
|--------------------|------------------------------------------------------------------|--------------------|--------------|
|                    | Age only for year and month of birth                             | Age only in months |              |
| Interviewer 011    | 0.0                                                              | 0.0                | 100.0        |
| Interviewer 014    | 0.0                                                              | 0.0                | 100.0        |
| Interviewer 021    | 0.0                                                              | 0.0                | 100.0        |
| Interviewer 024    | 0.0                                                              | 0.0                | 100.0        |
| Interviewer 031    | 0.0                                                              | 0.0                | 100.0        |
| Interviewer 034    | 0.0                                                              | 0.0                | 100.0        |
| Interviewer 041    | 0.0                                                              | 0.0                | 100.0        |
| Interviewer 044    | 0.0                                                              | 0.0                | 100.0        |
| Interviewer 051    | 29.2                                                             | 0.0                | 100.0        |
| Interviewer 052    | 0.0                                                              | 0.0                | 100.0        |
| Interviewer 053    | 10.0                                                             | 0.0                | 100.0        |
| Interviewer 054    | 45.5                                                             | 9.1                | 100.0        |
| Interviewer 061    | 100.0                                                            | 0.0                | 100.0        |
| Interviewer 062    | 100.0                                                            | 0.0                | 100.0        |
| Interviewer 063    | 100.0                                                            | 0.0                | 100.0        |
| Interviewer 064    | 100.0                                                            | 0.0                | 100.0        |
| Interviewer 071    | 100.0                                                            | 0.0                | 100.0        |
| Interviewer 074    | 100.0                                                            | 0.0                | 100.0        |
| Interviewer 081    | 100.0                                                            | 0.0                | 100.0        |
| Interviewer 084    | 100.0                                                            | 0.0                | 100.0        |
| Interviewer 091    | 100.0                                                            | 0.0                | 100.0        |
| Interviewer 094    | 100.0                                                            | 0.0                | 100.0        |
| Interviewer 101    | 100.0                                                            | 0.0                | 100.0        |
| Interviewer 104    | 100.0                                                            | 0.0                | 100.0        |
| Interviewer 111    | 100.0                                                            | 0.0                | 100.0        |
| Interviewer 114    | 100.0                                                            | 0.0                | 100.0        |
| Interviewer 121    | 100.0                                                            | 0.0                | 100.0        |
| Interviewer 124    | 100.0                                                            | 0.0                | 100.0        |
| Interviewer 131    | 100.0                                                            | 0.0                | 100.0        |
| Interviewer 134    | 100.0                                                            | 0.0                | 100.0        |
| Interviewer 141    | 100.0                                                            | 0.0                | 100.0        |
| Interviewer 144    | 100.0                                                            | 0.0                | 100.0        |
| Interviewer 151    | 100.0                                                            | 0.0                | 100.0        |
| Interviewer 154    | 100.0                                                            | 0.0                | 100.0        |
| Interviewer 161    | 100.0                                                            | 0.0                | 100.0        |
| Interviewer 163    | 100.0                                                            | 0.0                | 100.0        |
| Interviewer 164    | 100.0                                                            | 0.0                | 100.0        |
| Interviewer 171    | 100.0                                                            | 0.0                | 100.0        |
| Interviewer 174    | 100.0                                                            | 0.0                | 100.0        |
| Interviewer 181    | 100.0                                                            | 0.0                | 100.0        |
| Interviewer 191    | 100.0                                                            | 0.0                | 100.0        |
| Interviewer 194    | 100.0                                                            | 0.0                | 100.0        |
| Interviewer 201    | 100.0                                                            | 0.0                | 100.0        |
| Interviewer 204    | 100.0                                                            | 0.0                | 100.0        |
| <b>All teams</b>   | <b>81.6</b>                                                      | <b>0.1</b>         | <b>100.0</b> |

Note: Birth date may be reported in questions 502 or 506.

Targets are 95 percent or higher complete and 5 percent or lower with no data.

**Table FC-13** below illustrates the percent distribution of household members who cultivated VCC crops, responded to agricultural technology modules, and allowed their crops to be measured and soil



to be assessed. As illustrated below, maize and paddy rice are still the most commonly reported VCCs, with only a handful of farmers indicating that they cultivate cauliflower or tomatoes. As agreed with USAID, a maximum of two plots per VCC per household were to be measured. One plot per VCC was to be randomly selected for a soil assessment. Overall, 95 percent of the targeted soil assessments were completed, meeting the survey targets. Some interviewers surpassed their target number of soil assessments, while others fell short.

**Table FC-13: Module 7 – Agricultural practices and land measurement**

| Supervisor Number | Module 7.1 Maize          |               | Module 7.2 Cauliflower    |               | Module 7.3 Tomato         |               | Module 7.4 Paddy Rice     |               | Plot measurement and soil assessment |                           |                   |
|-------------------|---------------------------|---------------|---------------------------|---------------|---------------------------|---------------|---------------------------|---------------|--------------------------------------|---------------------------|-------------------|
|                   | Total eligible member (N) | Completed (%) | Total eligible member (N) | Completed (%) | Total eligible member (N) | Completed (%) | Total eligible member (N) | Completed (%) | Total plots (N)                      | Measured <sup>a</sup> (%) | Soil assessed (%) |
| 10                | 78                        | 100%          | 2                         | -             | 0                         | -             | 63                        | 100%          | 268                                  | -                         | 92%               |
| 20                | 83                        | 100%          | 3                         | -             | 3                         | 100%          | 58                        | 100%          | 255                                  | -                         | 88%               |
| 30                | 66                        | 100%          | 0                         | -             | 3                         | 100%          | 45                        | 100%          | 129                                  | -                         | 63%               |
| 40                | 105                       | 100%          | 0                         | -             | 2                         | 100%          | 76                        | 100%          | 330                                  | -                         | 86%               |
| 50                | 90                        | 100%          | 8                         | 100%          | 2                         | 100%          | 53                        | 100%          | 238                                  | -                         | 81%               |
| 60                | 0                         | -             | 3                         | 100%          | 2                         | 100%          | 99                        | 100%          | 396                                  | -                         | 195%              |
| 70                | 12                        | 100%          | 0                         | -             | 0                         | -             | 85                        | 100%          | 364                                  | -                         | 189%              |
| 80                | 83                        | 100%          | 9                         | 100%          | 4                         | 100%          | 69                        | 100%          | 281                                  | -                         | 95%               |
| 90                | 104                       | 100%          | 1                         | 100%          | 5                         | 100%          | 25                        | 100%          | 165                                  | -                         | 65%               |
| 100               | 116                       | 100%          | 17                        | 100%          | 8                         | 100%          | 67                        | 100%          | 423                                  | -                         | 109%              |
| 110               | 99                        | 100%          | 0                         | -             | 1                         | -             | 16                        | 100%          | 291                                  | -                         | 131%              |
| 120               | 97                        | 100%          | 4                         | 100%          | 3                         | 100%          | 66                        | 100%          | 278                                  | -                         | 83%               |
| 130               | 88                        | 100%          | 1                         | -             | 1                         | 100%          | 64                        | 100%          | 269                                  | -                         | 92%               |
| 140               | 44                        | 100%          | 1                         | 100%          | 2                         | 100%          | 85                        | 100%          | 223                                  | -                         | 84%               |
| 150               | 94                        | 100%          | 1                         | -             | 2                         | 100%          | 87                        | 100%          | 230                                  | -                         | 63%               |
| 160               | 52                        | 100%          | 1                         | -             | 0                         | -             | 96                        | 100%          | 185                                  | -                         | 62%               |
| 170               | 12                        | 100%          | 7                         | 100%          | 5                         | 100%          | 77                        | 100%          | 159                                  | -                         | 82%               |
| 180               | 25                        | 100%          | 3                         | -             | 1                         | -             | 74                        | 100%          | 239                                  | -                         | 129%              |
| 190               | 20                        | 100%          | 5                         | 100%          | 2                         | 100%          | 96                        | 100%          | 233                                  | -                         | 93%               |
| 200               | 8                         | 100%          | 1                         | -             | 0                         | -             | 46                        | 100%          | 91                                   | -                         | 96%               |
| <b>All teams</b>  | <b>1276</b>               | <b>100%</b>   | <b>67</b>                 | <b>100%</b>   | <b>46</b>                 | <b>100%</b>   | <b>1347</b>               | <b>100%</b>   | <b>5047</b>                          | <b>3863</b>               | <b>95%</b>        |

<sup>a</sup> Data for plots measured by supervisor are unavailable due to issues merging measurement data between CSPro and the area measurement software.

Target is 95 percent of interviews be completed.



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