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MONITORING AND EVALUATION SUPPORT FOR COLLABORATIVE LEARNING AND ADAPTING (MESCLA) ACTIVITY

IMPACT EVALUATION BASELINE REPORT OF THE GOVERNANCE IN ECOSYSTEMS, LIVELIHOODS, AND WATER ACTIVITY IN HONDURAS

SUBMISSION DATE: DECEMBER, 2018

Contract Number: AID-OAA-I-15-00019 – Task Order Number: AID-522-TO-16-00002

This publication was produced for review by the United States Agency for International Development. It was prepared by International Advisory Products and Systems, for the MESCLA Activity implemented by Dexis Consulting Group.

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VERSION:

- Final – January 10, 2019

SUBMITTED TO:

USAID/Honduras

Prepared by:

International Advisory Products and Systems for Dexis Consulting Group

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ACRONYM LIST

AI	Areas of Influence
CDCS	Country Development Cooperation Strategy
CIAT	International Center for Tropical Agriculture
CODEL	Local Emergency Committee
DAI	Development Alternatives Incorporated
DO	Development Objective
EQ	Evaluation Question
ESA	European Space Agency
GEMA	Gobernanza en Ecosistemas, Medios de Vida y Agua
GIS	Geographical Information System
GPS	Global Positioning System
GOH	Government of Honduras
Ha	Hectare
HH	Household
i-APS	International Advisory, Products and Systems
ICF	Instituto Nacional de Conservacion y Desarrollo Forestal (National Institute for Conservation and Forest Development)
IE	Impact Evaluation
IR	Intermediate Result
JAA	Water Administrative Council (Junta Administradora de Agua)
MASL	Meters Above Sea Level
MCC	Micro-cuenca (Micro-watershed)
MESCLA	Monitoring & Evaluation Support for Collaborative Learning and Adapting
MSME	Medium Small or Micro Enterprise
NGO	Non-Governmental Organization
NRM	Natural Resource Management
PA	Protected Area
PE	Performance Evaluation
QDA	Quebrada (Creek/Stream)
QSWAT	Quantum Geographic Information System Interface of the Soil and Water Assessment Tool
SINAPH	Sistema Nacional de Áreas Protegidas de Honduras
SINIT	Sistema Nacional de Información Territorial
SWAT	Soil and Water Assessment Tool
TA	Technical Assistance
TAPS	Technical Assistance Packages
USAID	United States Agency for International Development
WA	Work Areas

EXECUTIVE SUMMARY

This document reports on the 2018 phase of an Impact Evaluation (IE). This was designed and financed by USAID to evaluate those land and forest cover change rates over a three-year timeframe that might be attributed to the impacts of technical assistance packages (TAPs) that are currently under implementation by the *Gobernanza en Ecosistemas, Medios de Vida y Agua (GEMA)* Activity.

This baseline assessment was managed by the USAID/Honduras Monitoring & Evaluation Support for Collaborative Learning and Adapting Activity (MESCLA), which contracted International Advisory Products and Systems (i-APS), that in turn fielded a capable team of US and Latin American experts.

Building on the results of the prior USAID ProParque Activity, GEMA is a 4-year project targeting Western Honduras to improve natural resource management (NRM) approaches, and is focused upon priority watersheds which are linked to the Honduran Protected Areas System (SINAPH). GEMA builds beneficiary and institutional capabilities, promotes cleaner production practices, and develops opportunities for inclusive, environmentally-sustainable economic growth, within a climate-informed and resilient civil society.

The IE measurements aim to provide statistically-significant evidence of the impact of the GEMA activity on land use and vegetation cover in selected Level 1 micro-watersheds (MCC), by comparing two sets of 12 treatment watersheds, with 12 matched control areas. The final IE, in 2020, will repeat the information gathering and analysis procedures used to prepare this report, to update the status of land use and vegetation cover in the same set of treatments and controls.

This report presents baseline information on those 24 micro-watersheds that are to be compared with the end-line IE assessment, to establish if any future changes identified in land and forest cover, can then be robustly attributed to GEMA's activities.

The key underlying assumption is that, at a watershed level, those areas experiencing conservation benefits from the implementation of GEMA Technical Assistance Packages may show significant and measurable differences in land cover/land use in analytical comparisons of satellite images, between the periods of 2016/17 and 2020 within GEMA's Areas of Influence.

In 2020, these IE report findings will be analyzed, together with the results of the end-line PE. A comparative analysis will be conducted between the IE and PE 2018 baseline and end-line reports, to determine which of GEMA's expected results were achieved and how, to identify GEMA's end-of-life impacts, to attribute any identified land and forest cover changes to the impacts of GEMA's TAPs, and provide recommendations for the design and implementation of future USAID/Honduras activities.

The audience for the IE is the USAID/Honduras Mission, USAID/Washington bureaus and offices, including the Bureau for Latin America and the Caribbean, the Office of Forestry and Biodiversity, the Bureau for Economic Growth, Education, and Environment; and stakeholders in Honduras, including Development Alternatives Incorporated (DAI), GEMA partners, and national and regional government ministries and offices.

I INTRODUCTION

I.1 BACKGROUND

I.1.1 CONTEXT

Across the mountainous terrain of Western Honduras, a complex set of forest ecosystems support a diverse array of plant and animal species; however, these forests and their soils are threatened by increasing human pressures. The remaining high-altitude cloud, dry-zone, and pine forests occur both within and outside the buffer and nuclear zones of national protected areas which form part of the Government of Honduras (GoH) Protected Areas System, SINAPH. These landscapes supply vital services, upon which human populations depend for their health and economic welfare.

Drivers of biodiversity loss in Western Honduras include high levels of poverty, food insecurity, and weak governance, which all threaten fragile efforts to more effectively manage critical natural resources and promote sustainable livelihoods. Deforestation threatens the integrity of ecosystems, and the continued supply of products and services that these areas deliver. The majority of biodiversity loss is related to the conversion of forests to other land-use systems, such as traditional, extensive basic grain (maize and beans) cropping; low-yielding coffee plantations; cattle grazing; sugar cane and avocado cultivation; and potato and other vegetable production. Forest fires linked to escaped agricultural burns and lightning strikes also cause major forest loss. Additionally, a *Dendroctonus frontalis* (Southern Pine Beetle) infestation has decimated large areas of *Pinus oocarpa* coniferous woodlands over the last decade.

Growing environmental pressures in recent years has been caused by greater variability in climate patterns and increasing severity of extreme events, which amongst many other impacts, has led to shifting altitudinal limits of several agricultural cropping systems, as well as altering forest limits, ecological dynamics and life-zones. The combination of climate shifts, coffee rust disease, and declining yields at lower elevations, have together placed pressures on vulnerable coffee farmers to push their plots upwards into often-forested higher-altitude areas. Analyses show further causes of forest loss include: the opening or maintenance of road networks; urban growth and expansion of tourism; and hydroelectric schemes. Additionally, legal and illegal harvesting of timber products may also contribute to forest loss. Some studies conclude firewood demand may often be largely met by regeneration from on-farm plots¹, and these local effects may not lead to forest loss on a watershed scale.

The quality of water in the region is threatened by a wide range of point and diffuse contaminant sources: coffee milling, inadequate pulp and wastewater management; poor landfill and solid waste management; urban and rural black and gray wastewater; heavy metals due to mining; soil erosion from agricultural land; runoff contamination from improper agrochemical use; and poor animal husbandry practices. Each of these direct physical threats and pressures on forests and water are driven by local social and economic forces and processes, as well as important institutional and policy failures at the national level.

To counter these and other concerns, USAID/Honduras has established a Country Development Cooperation Strategy (CDCS) with the goal to enhance “*a more prosperous and safer Honduras that advance inclusive social and economic development among vulnerable populations.*” The CDCS Development Objective 2 (DO2) is to reduce the poverty of vulnerable populations in six departments in Western Honduras. The DO2’s development hypothesis is: “*if natural resources and biodiversity are protected and enhanced, resilience of livelihoods to climatic and economic shocks is strengthened (IR 2.1), families can increase their incomes (IR 2.2), and human capital is improved by focusing on improving education and health for these communities (IR 2.3), then poverty in Western Honduras will be sustainably reduced.*” The development hypotheses for IR 2.1’s Sub-IR’s are: “*If Honduras’ management of ecosystems in Western Honduras is sustainably improved (Sub-IR 2.1.1) and*

¹ Yale University Wisdom study (2015) <https://www.cleancookingalliance.org/binary-data/RESOURCE/file/000/000/425-1.pdf>

climate change adaptation actions are implemented (Sub-IR 2.1.2), then the poorest households who depend on the natural resources provided by ecosystems in Western Honduras will have more resilient livelihoods.”

To contribute to the achievement of DO2, USAID/Honduras has financed the *Governance in Ecosystems, Livelihoods, and Water Activity* (or *Gobernanza en Ecosistemas, Medios de Vida y Agua (GEMA) Activity*).

1.1.2 GEMA ACTIVITY BACKGROUND

GEMA is a four-year project targeting Western Honduras to improve natural conservation policies and practices; develop opportunities for inclusive, environmentally-sustainable economic growth; and promote a more climate-informed and resilient civil society. Building on the accomplishments of the previous USAID-funded ProParque activity, GEMA has a projected investment of \$23.8 million, and is implemented by Development Alternatives Incorporated (DAI), with partners including the Irish NGO GOAL, and the University of Zamorano (UZamorano). The Activity began in 09/2016 and ends 12/2020.

GEMA combines a focus on key protected areas identified in partnership with GoH, critical watersheds and a mosaic of other land-use categories; sustainable economic growth actions; climate change information and adaptation strategies; and conservation initiatives, with the aim of reducing poverty, while contributing to NRM. GEMA’s integrated strategy focuses on gender equality, organizational strengthening, and a project management approach that is both adaptive and proactive, adjusting in response to changes in context, aiming to ensure continuous learning by staff and stakeholders. Institutional capacity development is fostered through competitive processes, whereby grants and contracts are distributed to local service providers to increase their effectiveness and to promote local management. The project targets the economically-disadvantaged through livelihoods development and access to water.

GEMA’s three results statements are:

Result 1. Reduce threats in areas of biological significance and/or natural resources reduced, in order to conserve biodiversity and protect water delivery;

Result 2. Conservation-related, income-generating actions increased; and

Result 3. The vulnerable population’s capacity to adapt to climate change increased

1.1.3 EVALUATION PURPOSE, TEAM, TIMELINE, AND AUDIENCE

The purpose of the Impact Evaluation (IE) is to first to create a baseline in 2018 and then, in 2020, to measure land cover and forest cover status and rate of change between 2018 and 2020. The baseline and end-line impact evaluation assessments will establish what impacts can be attributed to GEMA’s activities in relation to any potentially-identified changes in forest and land cover.

The IE measurements aim to provide statistically significant evidence of the impact of the GEMA activity on land use and vegetation cover in the GEMA priority watersheds, by comparing two sets of 12 treatment watersheds and 12 matched control areas. The assumption is that, at a watershed level, those areas experiencing conservation benefits from the implementation of GEMA Technical Assistance Packages (TAPs) may show significant and measurable differences in land cover/land-use in analytical comparisons of images taken between the periods 2016/17 and 2020.

While the IE team and USAID, do recognize that in the short 3-year time frame it is likely that relatively little change may be detected, even so the study will seek to inform future USAID interventions in addition to the current GEMA activity.

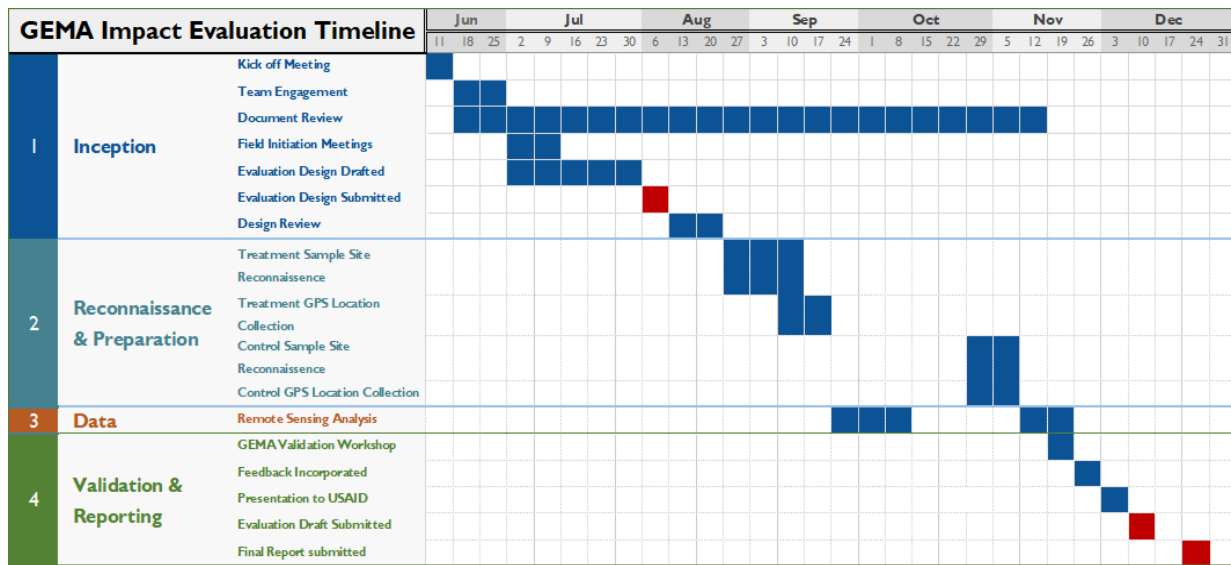
Figure 1: Impact Evaluation Team

IE Team Members	Position
Bruce Kernan	Team Leader
Dr. Peter Schlesinger	Remote Sensing
Jose Ney Rios	Watershed Management

To conduct the Impact Evaluation, i-APS assembled a team of experienced US and Latin American forestry and environment experts. The team was led by Bruce Kernan, an international forestry expert. Technical delivery of the IE was led by Dr. Peter Schlesinger.

The overall scheduling of the IE followed the following sequence: (1) Inception Phase; (2) Field Reconnaissance and Preparation; (3) Data Collection and Analysis Phase; and (4) Output Validation and Reporting, as outlined below.

Figure 2: GEMA Impact Evaluation Timeline



The final IE will compare the status of land use and vegetation cover, in the same treatment and control Level I micro-watersheds, between 2016/17 and 2020. These IE findings will be analyzed together with the results of the end-line PE. This comparative analysis will be conducted between the IE and PE 2018 baseline reports, and the IE and PE 2020 end-line reports.

This will lead to combined determination of which of GEMA’s expected results were achieved and how, identify the end-of-life impacts, and attribute any identified land and forest cover changes to the impacts of GEMA’s TAPS, as well as providing recommendations for the design and implementation of future USAID/Honduras activities.

The audience for the IE is the USAID/Honduras Mission, USAID/Washington bureaus and offices, including the Bureau for Latin America and the Caribbean, the Office of Forestry and Biodiversity, the Bureau for Economic Growth, Education, and Environment; and stakeholders in Honduras, including DAI, GEMA partners, and national and regional government ministries and offices.

1.1.4 EVALUATION QUESTIONS

The following are the IE’s evaluation questions (EQs):

Figure 3: IE Evaluation Questions:

1. **Change in Forest Cover:** What is the impact of GEMA’s TAPs on the rate of change in forest cover in its micro-watersheds?
2. **Change in Land Cover:**
 - 2A: What is the impact of GEMA’s TAPs on the rate of change in land cover types in GEMA’s micro-watersheds?
 - 2B: What is the impact of GEMA’s TAPs on the rate of change in land cover types in GEMA’s micro-watersheds within 50 meters of water bodies’ borders?
 - 2C: What is the rate of change in land cover types within 250 meters around Juntas de Agua water sources within GEMA micro-watersheds?

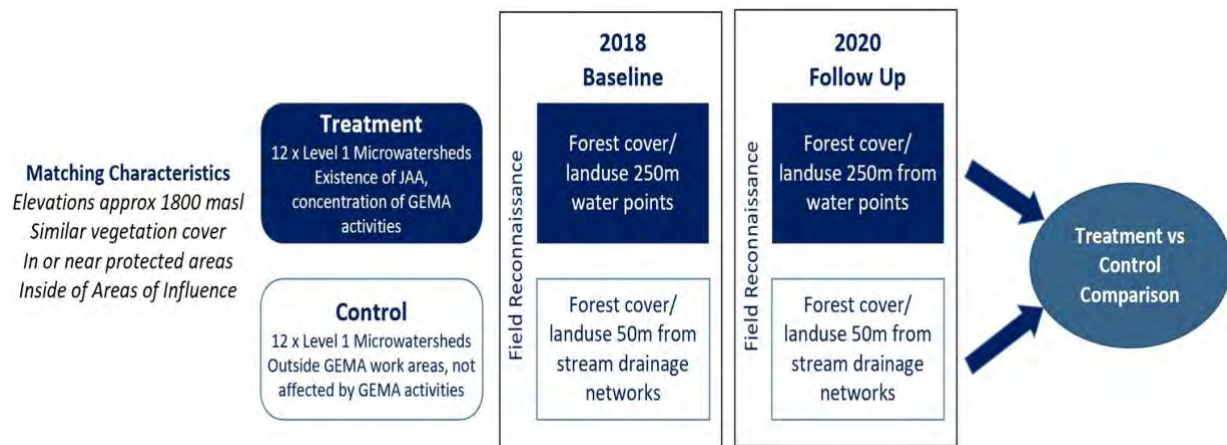
2 METHODOLOGY

The methodology was carried out in three stages:

1. Selection of Treatment and Control Watersheds
2. Data collection through reconnaissance of watersheds, gathering of focus group and informant data, and collection of Global Positioning System (GPS) coordinates for water intake structures
3. Remote sensing image analysis and reporting

An overall view of the approach to the Impact Evaluation is shown in the following figure:

Figure 4: Overall Impact Evaluation Methodology



2.1 SELECTION OF TREATMENT AND CONTROL WATERSHEDS

The aim of study site selection was to identify areas which would serve to compare GEMA's impacts on land cover and land-use, by using a treatment set² of micro-watersheds, composed of 12 watersheds impacted by GEMA's TAPs, that were matched with a control dataset of 12 watersheds that were not participating in GEMA activities, and therefore, were not impacted by its TAPs. For this purpose, a total of 24 treatment and control Level I micro-watersheds were identified for the study site selection.

The IE team's Watershed Management and Remote-Sensing specialists collected the best available geospatial data for the Western Honduras region, primarily prepared by CIAT and GEMA. Digital elevation data developed by GEMA GIS staff were used to diminish the chance of creating different drainage network models. These data were analyzed through the use of QSWAT, a public domain tool that implements the SWAT code for QGIS to analyze potential treatment and control Level I micro-watersheds. Note that Level I micro-watersheds are defined as those which have no tributaries, function at the highest level of spatial detail available, and do not change in size when greater spatial resolution is applied.

The IE baseline team applied robust methods for watershed selection in accordance with international best-practice for analysis of geospatial information, to delimit areas that are comparable between treatments and controls. The IE team's approach to selection of these polygons was complemented by GEMA's focus on field experience and project needs. In this way the selection process applied a joint selection protocol, that is summarized in Figure 5 below. More detail on this is given in [Appendix N](#).

Figure 5: Selection Criteria Applied to Treatment and Control Watersheds

TREATMENT LEVEL I MICRO-WATERSHEDS SELECTION CRITERIA
<ul style="list-style-type: none">• Inside of GEMA Work Areas, with a concentration of GEMA activities• Maximum elevations around 1800 meters above sea level (masl)• Locations in buffer zones, or near the nucleus zone, of a national protected area• Representative distribution of treatment micro-watersheds across GEMA's Work Areas• Existence of a significant number of Water Boards (Junta Administrador de Agua) in the watershed• Potentially some of the treatment sites may have protected zones with Declaration of Micro-watershed status and associated management plans
CONTROL LEVEL I MICRO-WATERSHEDS SELECTION CRITERIA
<ul style="list-style-type: none">• Located outside the Work Areas, but inside Areas of Influence, with no or few GEMA activities• Minimum elevation of micro-watersheds as high as the topography of the Areas of Influence allows• Adjacent as feasible to a protected area if matched treatment was also adjacent to a protected area• Comparable in size to a matching treatment Level I micro-watershed• If possible, with similar vegetation types as treatments, using CIAT digital land cover and use maps

This selection has served as the foundation for both the IE analyses of forest and land cover types, and also for the work carried out by the PE team to implement a Household (HH) Survey, and to conduct qualitative data collection within these watersheds.

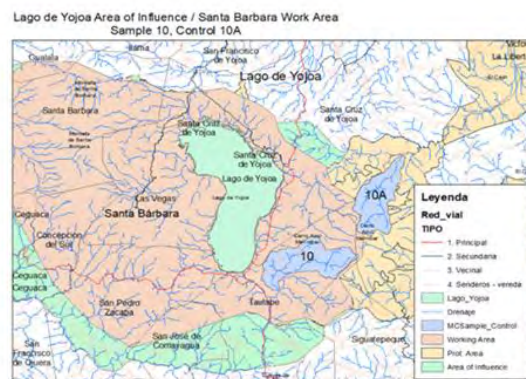
Individual Treatment Watersheds were first identified, as shown in Figure 6a and Figure 6b. The next step was to assess each of the 12 selected treatment sites to match these with equivalent polygons that complied with the set criteria, to produce twelve sets of treatment and control pairs, as shown in Figure 6b, for the example watersheds 10 and 10A.

² The term "treatment", as applied here, is synonymous with the term "sample".

Figure 6a: Example of the polygon for treatment Watershed 10, selected using the agreed criteria



Figure 6b: Example of arrangement of treatment and control polygons for watersheds 10 and 10A



Note that control watersheds could not be selected outside of GEMA’s Areas of Influence, because no land cover or land use data were available outside of the Areas of Influence.

Applying these criteria led to 12 treatment Level 1 micro-watersheds (MCC) were selected from GEMA’s 55 priority micro-watersheds to provide representative sample zones that are within the 12 Work Areas, which include elevations above 1,800 masl, and comprise numerous TAPs of different types. These were given indicative names in relation to their core principal river, or creek (Quebrada or QDA); or according to the associated Protected Area. Figure 7 provides the names and area of the treatment micro-watersheds, and the work area within which they are fully or partially-located:

Figure 7: Key Attributes of Treatment Watersheds

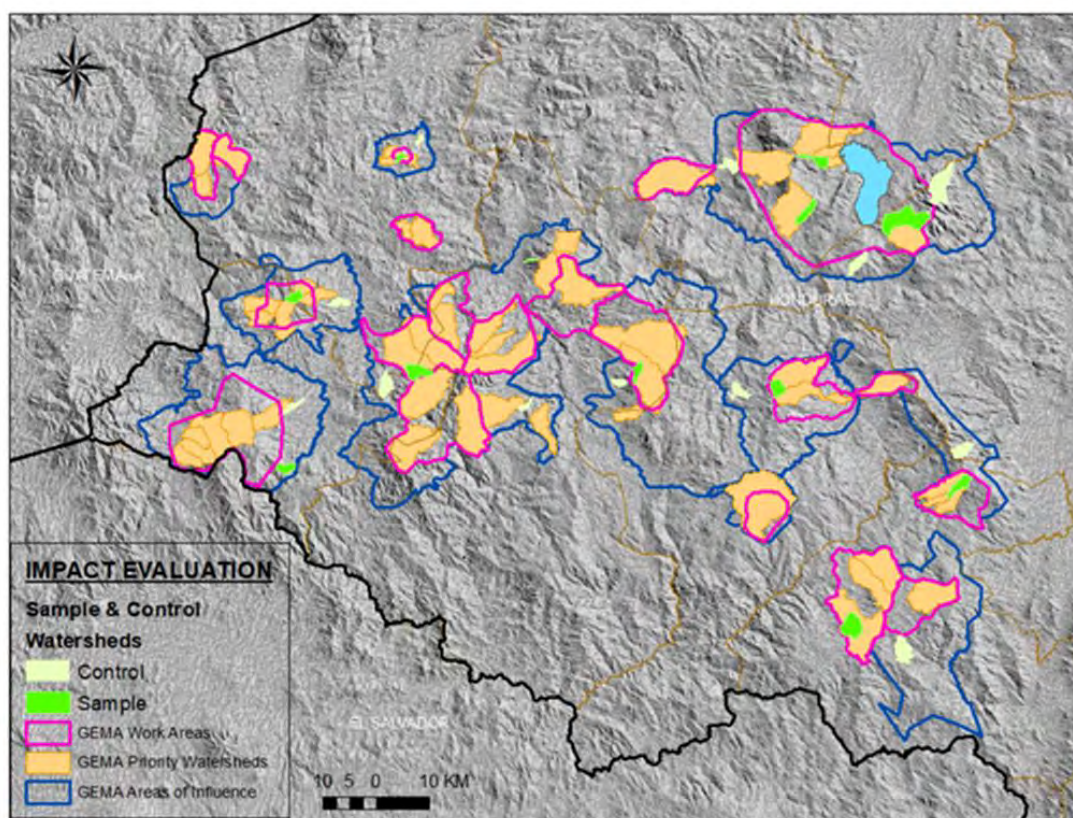
NUMBER	1	2	3	4	5	6	7	8	9	10	11	12
PRIORITY MCC	RIO SALADO	RIO HONDO	QDA PALANIA	RIO QUEBRADITAS	RIO EL COYAL	RIO CONCHAGUAL	LA FLORIDA	URNGO	SAN ISIDRO	RIO VARSOVIA	LAS FLORES BIJAO	EL TUNCO
MAIN LAND USE/COVER CLASS	P/C/V	P/C	B/C	B/C	B/C	B/C	C/P	B/P	B/P	B/V/P	C/P/V	P/C/V
ELEVATION (MIN – MASL)	340	1264	963	1491	1325	1288	1324	1235	1434	665	1483	415
AREA (HA)	73.24	470.81	168.09	480.92	975.82	370.17	1383.19	722.44	672.94	2664.23	620.47	630
GEMA WORK AREA	Celaque-Puca	Ocotepaque	Cocoyagua	Erapuca	Celaque-Puca	Opalaca	La Paz	Santiago Puringla	Mixcure	Santa Barbara	Santa Barbara	Santa Barbara
MUNICIPALITY	Lapaera	San Francisco del Valle	Veracruz	La Union, Encarnacion	Belen Gualcho	Belen	Marcala	Santiago de Puringla	Intibuca, San Isidro	Taulabe	Las Vegas	Concepción del Sur /
AREA OF INFLUENCE	Celaque-Puca	Guisayote	Cocoyagua	Erapuca	Celaque-Puca	Montaña Verde	El Jilguero	Montecillos	Mixcure	Lago de Yojoa	Lago de Yojoa	Lago de Yojoa

B = Bosque conífero/latifoliado (Forest: Broadleaf/Evergreen); P = Pastos y agricultura (Pasture and Agriculture); C = Café (Coffee) V = Vegetación secundaria secondary vegetation) in order of areal coverage/importance

[Appendix B](#) provides a map of the locations of treatment and control watersheds, while [Appendices C and D](#) set out the attributes of these matched pairs, in more detail. Note that the average area of the treatment watersheds is 782 ha. and the average area of the control watersheds is 815 ha. Their total areas are respectively 9232 ha and 9782 ha.

Figure 8 shows the distribution of selected watersheds, in relation to GEMA's Work and Influence Areas.

Figure 8: Distribution of polygons of paired watersheds in work areas & areas of influence



This geographical information from remote sensing sources was analyzed to generate an appropriate distribution of treatment and control watersheds, as one of the first inputs into this IE report.

2.2 WATERSHED RECONNAISSANCE AND GEO-LOCATION OF WATER INTAKES

As described above, a total of 24 treatment and control watersheds were identified to provide the sampling framework for the combined IE and PE. After the treatment set was identified, reconnaissance information was gathered for both the selected treatment and control micro-watersheds. Collection of this data was critical in order to develop an understanding of land uses, threats to biodiversity, and potential TAP beneficiaries, such as users of fuel-efficient stoves, livestock and agricultural producers, and the non-agricultural businesses and organizations that were supported through GEMA's activities.

Following the identification of the treatment and control watersheds, field site visits to each watershed were carried out, to build the profile of the location and gather key information on the informants for the qualitative data collection for the baseline PE. The field site visits consisted of identifying members of the CODELs, Junta de Agua, and owners of conservation enterprises supported by GEMA.

To generate the baseline for EQ 2C, water sources within the 24 treatment and control watersheds were visited by members of the IE team to obtain GPS locations as inputs for the remote sensing imagery analysis, described in greater detail below. Location data is shown in [Appendices E and F](#). These locations are taken as the focal sites around which to measure the change in vegetation at 250m distance intervals from each water source.

A typical set of water intake structures constructed by communities to collect inflowing water from streams and springs are shown in Figure 9.

Figure 9: Images of water intakes taken during field reconnaissance

Water Intake for Control Watershed 7A:
Community El Zacatón and Pacaya



Water Intake for Control Watershed 12A:
Community of El Chaparral



Water Intake for Treatment Watershed 6:
Community of Puerta del Ocote



Water intake for Treatment Watershed 6:
Community of Agua Helada



Information was gathered and analyzed from key informants, through focus groups interviews, and from direct site observations, in order to ensure data were available regarding the influence of the populations in both the treatment and control areas that interact with the forested areas, and with water supplied by these micro-watersheds. As far as feasible, equivalent data were collected from populations across both sets of sites.

With this data, the IE and PE teams will be able to explain the degree to which the differences in the observed changes between 2016 and 2020 in forest cover and land use in the sample and control watersheds can be plausibly and accurately attributed to GEMA's actions.

Profiles of each of the target 24 target watersheds were created to inform the data collection activities and provide a basis for comparisons at the end-line. These watershed profiles will support future assertions of the attribution of any changes observed at end-line.

2.3 ANALYSIS OF CIAT DIGITAL MAPS OF LAND COVER AND LAND USE

2.3.1 GENERAL ANALYSIS OF CIAT REMOTE SENSING IMAGERY

Remote sensing data used for the IE were collected based on data sets acquired from sources such as the joint CIAT/GEMA Terra-i program (<http://www.terra-i.org/terra-i/about.html>) and from image data from the ESA and NASA. Sentinel 2 optical digital land cover and land use classification (10x10m European Space Agency; carried out by CIAT) was compiled and created using Google Earth Engine, based upon 679 satellite scenes from January 1, 2016 to December 31, 2017.

Based on an acquired copy of the CIAT pixel classification methodology code, the digital classification was trained and validated using approximately 20,000 training sites for each of 18 cover classes collected by GEMA, and a suitable accuracy rate was reached via a confusion matrix. This digital map layer was downloaded for use by the i-APS project team, shared with project partners, and is the critical layer upon which all IE findings are based. A similar digital classification map using optical Sentinel 2 data is planned for 2020 by the CIAT group.

The IE Technical Design document (as summarized in the SOW) establishes that the question of GEMA's potential effects between 2016/17 and 2020 on rates of change in forest cover and land use should be tackled by looking at the following four parameters:

1. Rates of change in overall total forest cover and for each forest-type class, for treatment and control watersheds.
2. Determine baseline and changes in the areal extent and types of forest and land cover within the entire area of treatment and control watersheds.
3. Determine baseline and changes in areal extent and types of land cover in zones that are focused upon water intake structures, within circular areas of 250 meters radius.
4. Determine baseline and changes in vegetation along modeled stream networks as a sentinel indicator providing "advance warning" of change because of vegetation cover's strong impact on water quality.

All IE questions relate to differences in the rates of change between start year 2016/2017 and end-year of 2020. Rates of change are to be calculated in the end year using Puyravaud's (2003) rules to standardize annual rates of change.

The two IE key analytical steps for evaluating all the above parameters are as follows:

- Derive the baseline set of areas and types of forest and land cover types relevant to each IE question. For this, the Remote-Sensing Specialist prepared a set of Excel spreadsheets summarized in [Appendices G to M](#), that provides the baseline data of this assessment of land cover, land use, and forest cover for the 12 treatment and control watersheds.
- In 2020, based on classified optical Sentinel 2 data as deployed by CIAT, the IE team will compare 2018 to 2020 forest cover and land-use changes for entire watersheds (for forest type cover; and for land cover), as well as land cover at 50m distances from the stream drainage networks, and in addition for in circular plots of 250m radius around water intake sources.

2.3.2 ANALYSES FOR EACH IMPACT EVALUATION QUESTION

Evaluation Question 1: What is the impact of GEMA's TAPs on the rate of change in forest cover in its micro-watersheds?

The overall method to address EQ1 used by the IE team was to calculate the rate of change in forest cover in the Level 1 micro-watersheds between 2018 and 2020, using the same or similar digital classified map data on the same or similar spatial and thematic resolution. To generate the baseline data set, each of the Level 1 micro-watershed boundary polygons of the 12 Level 1 micro-watershed treatment and control sites was used to extract baseline cell counts of forest cover, for each of the forest cover classes measured and classified by CIAT. The forest cover is created using the five forested classes that make up the Sentinel 2 classification, as listed in Figure 10.

Figure 10: CIAT Sentinel 2 Forest Cover Classification

- Humid broadleaf forest
- Sparse evergreen forest
- Dense evergreen forest
- Dry broadleaf forest and
- Mixed forest.

The i-APS IE team will, in 2020, correlate any detected change in forest and land cover with assessments made at that time, of the impacts of GEMA's TAPs that could affect the rate of forest and land cover change. The detected change will depend on the assumption that the main key factor separating the treatment and control will be GEMA's TAPs and on the linked assumption that there are no other significant interventions in the control watersheds.

If changes are detected, and few other factors are influencing these, there is a high likelihood that it will be possible to assert that GEMA's TAPS are impacting those changes to forest and land cover.

The IE has established context indicators for the treatment and control Level 1 micro-watersheds, summarizing characteristics of each watershed, including the presence of other activities and drivers of land-use change. The context indicators will be tracked in 2020 through the CIAT Terra-i early warning alert system, with the aim of explaining differences within the two sets of treatment and control watersheds, and this approach will, try to explain if and why there are significant differences, or lack of these, between treatment and control sites.

Evaluation Question 2: Change in Land Cover:

- 2A: What is the impact of GEMA's TAPs on the rate of change in land cover types in GEMA's micro-watersheds?
- 2B: What is the impact of GEMA's TAPs on the rate of change in land cover types in GEMA's micro-watersheds within 50 meters of water bodies' borders?
- 2C: What is the rate of change in land cover types within 250 meters around Juntas de Agua water sources within GEMA micro-watersheds?

As with EQ 1 above, the IE team calculated the baseline status in land cover types. Overall, each of the micro-watershed boundary polygons of the 12 Level 1 treatments and controls (for EQ2A) and distance polygons (of EQ 2B and EQ 2C) were used to extract cell counts of land cover, for each of the land cover classes measured by CIAT, see Figure 11.

A database file (.DBF) was saved for each of the resulting .TIF files and each of these .DBF files were imported into Microsoft Excel. Land cover cell counts were calculated and then converted to land cover in hectares with the following formula: *Area of class in Hectares = Count X Area of cell in hectares (e.g. 9.88*9.88/10000)*.

Figure 11: CIAT Sentinel 2 Land Cover Classification

- Dispersed Trees
- Inland Wetlands
- Commercial Agriculture
- Dense Evergreen Forest
- Sparse Evergreen Forest
- Humid Broadleaf Forest
- Dry Secondary Vegetation
- Mixed Forest
- Coffee
- Water Bodies
- Pasture and Agriculture
- Degraded Soils
- Sediments
- Humid Secondary Vegetation
- Dry Secondary Vegetation
- Urban Areas

As described for EQ 2A, each of the micro-watershed boundary polygons of the 12 Level 1 treatments were used to extract cell counts of land cover for each of the land cover classes in the Sentinel 2 classification. See [Appendices J and K for tables of the baseline Data](#).

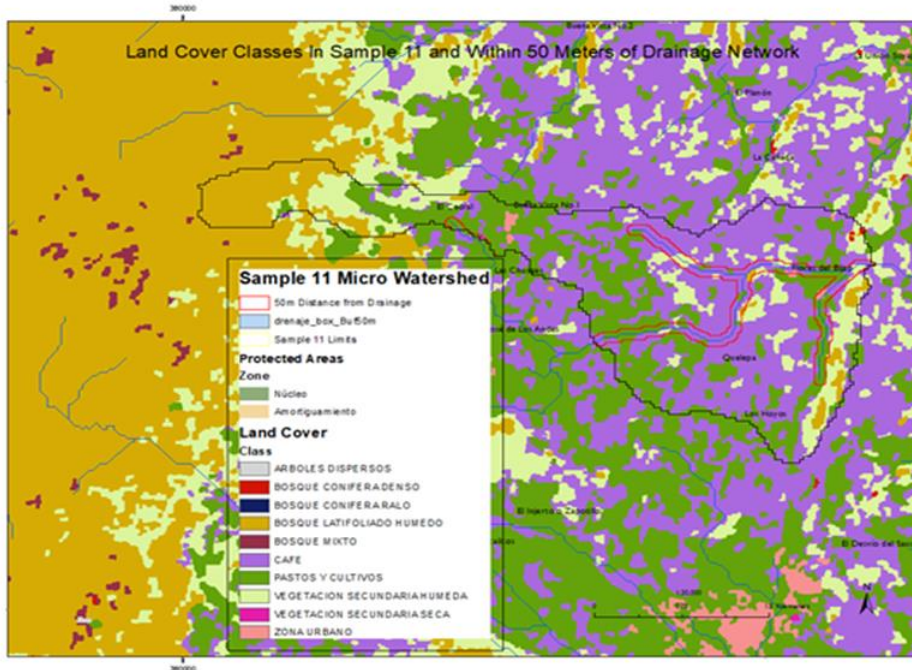
Answering EQ 2B involves a “whole-of-micro-watershed analysis” of the entire river/creek network in that treatment /control watershed, for CIAT's land cover classification.

The IE team defined “water body” in these Level 1 watersheds as all land encompassing the modeled drainage network, usually - but not only - streams or rivers. In the national data set available via the Honduran *Sistema Nacional de Información Territorial* (SINIT), the best resolution dataset on stream networks isn't sufficient for this level of detail (file layer called *m2301vL001970_HN*).

Confining the area to each treatment or control polygon, the modeled drainage network data layer was combined with classified satellite Sentinel 2018 pixel data, to describe the land cover types for a strip approximately 100 meters wide (50 meters from each drainage network line), along the full river/creek system, such as all rivers that are included within that particular watershed.

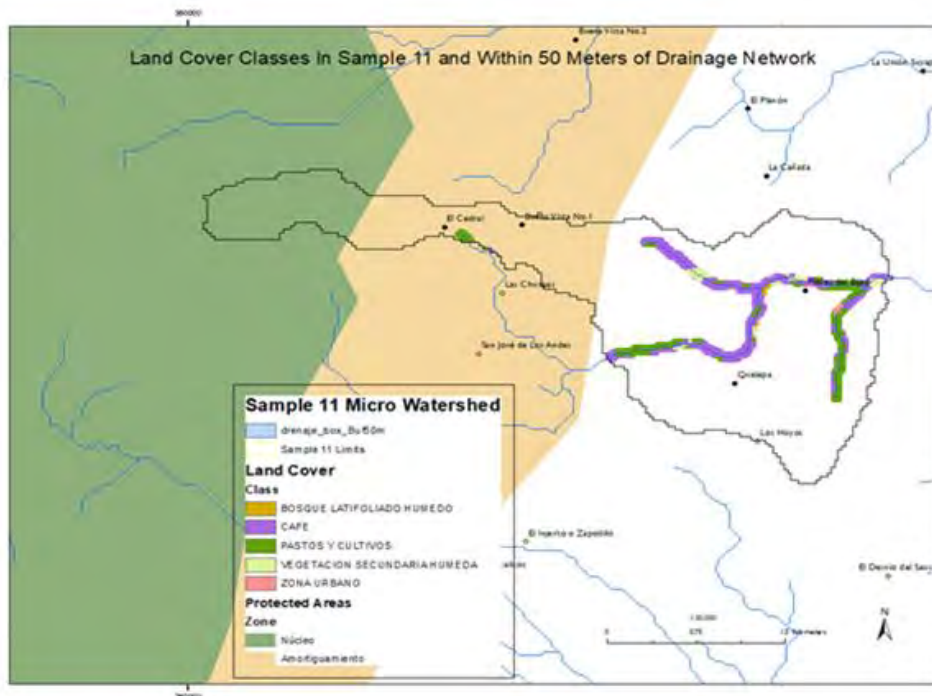
This exercise is shown in Figures 12 and 13.

Figure 12: For EQ 2A, Land Cover Classes for Treatment Watershed 11; and for EQ 2B, within 50m of the drainage network



Fifty-meter Euclidean distances were applied to the modeled Level I micro watershed drainage network produced by GEMA, using BUFFER, an ArcGIS v. 10.6 geoprocessing tool that creates buffer polygons around input features to a specified distance, as shown in Figure 13 below.

Figure 13: Land Cover Classes in Treatment 11 within 50 Meters on Both Sides of the Modeled Drainage Network



Then, each of the buffered distance polygons was extracted to create polygons that conform to the bounds of each 12 Level I treatment and control polygon. To illustrate the methodology, in the case of Treatment Watershed 11, the resulting cell count for the most significant land-cover classes, is outlined in Figure 14.

Figure 14: Example Cell Counts per Land Use Class

<u>Count</u>	<u>Class</u>
61	HUMID BROADLEAF FOREST
3063	COFFEE
2020	PASTURE AND AGRICULTURE
475	SECONDARY HUMID VEGETATION
85	URBAN AREAS

For all 24 treatment and sample watersheds, the remote sensing imagery for the 50-meter-wide border on both sides of these lines was analyzed to generate the baseline land use class information.

A total of 923 hectares of land cover was evaluated in 50-meters from micro-watershed drainage networks (IE2B).

The methods used to identify and analyze these strips of land are key, so that when this work is carried out in 2020 to compare with 2018, the same steps are applied in the end-line assessment. See [Appendices L and M for Baseline Data](#) for EQ 2A results.

To answer EQ 2C, the IE team selected the locations of intake points where Juntas de Agua obtain drinking water and assessed the vegetation for those areas, which are in effect circles of 500 m diameter, centered on the GPS location of those intakes. Each of these areas measures approximately 19 hectares. The areas may also be hot-dog shaped, if the land cover polygon surrounds several water intake zones along a watercourse, as protected by the identified Juntas de Agua.

For this analysis, the IE team identified the water intake GPS locations for the treatment and control watersheds and fixed these plots to assess the imagery for land cover types in 2018, and for detection of a change in 2020.

250-meter radius distances were then applied around the geolocated water intake inventory produced by i-APS, using BUFFER to create buffer polygons around the Water Intake features to the specified distance of 250 meters. Then each of the buffered distance polygons was extracted to create polygons and the pixels classified as for IE EQ2B.

The i-APS team will compare 2018 baseline data for those circular plots, with imagery obtained in 2020. See [Appendices E and F for GPS locations of water intakes](#) and [Appendices L and M](#) for baseline Excel Data.

3 LIMITATIONS

Key assumptions and limitations that underlie the IE are:

1. The overall IE analysis depends on the assumption that the main key factors separating the treatment and control will be GEMA's TAPs, and on the linked assumption that there are no other significant interventions in the control watersheds. In that case, there is a high likelihood that it will be GEMA's TAPS impacting the change.
2. An important issue is the comparability of the treatment and control watershed sites in terms of their respective land and forest covers. While the IE assessment attempts to ensure broad comparability between treatment and control sites of the drivers of environmental degradation, it is important to note that the notion of an IE was not conceived until after the GEMA project had begun. Due to this, GEMA's selection of Working Areas for the CIAT land cover map, and the selection of its Areas of Influence could not account for the IE assessment's needs for comparable lands.

For the IE, the comparability of the two sets of watersheds is influenced by the selection criterion that the treatment watersheds are required to be within GEMA's Working Areas, while control areas are outside Work Areas, but are within GEMA's Areas of Influence. Due to GEMA's focus on Protected Areas (which are often directed at cloud/pine forests in mountainous areas), a larger proportion of GEMA's Working Areas are higher in altitude, compared with the land covered by the Areas of Influence. This leads to treatment watersheds having greater proportions (relative to the controls) of protected land, more humid broadleaf and high-altitude coniferous forest, and lower proportions of areas under coffee, pasture, and agriculture production. The proportions of land under different farming systems (and the associated drivers of land use change), are likewise different between the two sets of watershed areas.

This indicates that the IE in 2020 has to account for likely higher expected rates of change at baseline in the controls, relative to the treatment watersheds. The size of this potential effect is not known at present. The issue of any baseline differential change rate between the two sets of watersheds will be addressed in 2020 by carrying out assessments of those drivers and their likely magnitude, through gathering comparable qualitative information from the treatment watersheds, and control areas.

3. A further issue to be considered is that, for EQs 2B and 2C, expected rates of land/forest cover change may differ between the two types of selected areas, either for the drainage network (for EQ 2B) and those around water intakes (EQ 2C).

For EQ 2C, the micro-zones directly around water intakes are, by and large, amongst the most protected land found in Honduras. Communities are often sensitive to threats to their primary water sources, such as agents converting forest to coffee or pasture, misusing agrochemicals, or to the setting of unmanaged agricultural fires. These threats are often countered by community and municipal responses, even if the micro-watersheds are not officially declared as protected sites.

For EQ 2C, the existence of community protection indicates that the areas within the circular plots that the IE team has defined, may be expected in both treatment and control areas to be relatively unaffected by forest cover change, over the short time period of this study.

For EQ 2B, the broad network of vegetation 50 meters on both sides of the river drainage system is more vulnerable, as, while there may be some local community practices against converting these forests to agriculture, threats to these locations are less actively monitored by communities and

municipalities, and it is easier for rural agents to convert these sites for other land-uses, compared with vegetation around water intake infrastructure.

4. Regarding the degree of land use change within the evaluation time frame, our assumption is that areas experiencing effects of GEMA TAPs will show land cover and land use changes at a watershed level during the evaluation period from 2016-2020; however, it is conceivable that some cover and use types, while impacted to degree some by GEMA's TAPs, may not demonstrate measurable changes, because of underlying uncertainties due to factors of resolution, imagery available, methods used, scale and the short time of the evaluation period, compared with both the rates of change, and the velocity of any reductions in the rates of change that might be due to GEMA's TAPs.
5. Further measurement changes may affect the detection of land use and forest cover rates of change. The methods used by the i-APS IE team are likely to be largely replicable, but by 2020 the tools available may allow for higher resolution. Other technical changes may have occurred, such as alterations in the CIAT classification protocols. Improved tools may limit the IE because this assessment in 2018 was carried out with current software and at a given resolution, and different approaches may result in more precise outputs.

4 EVALUATION QUESTION FINDINGS

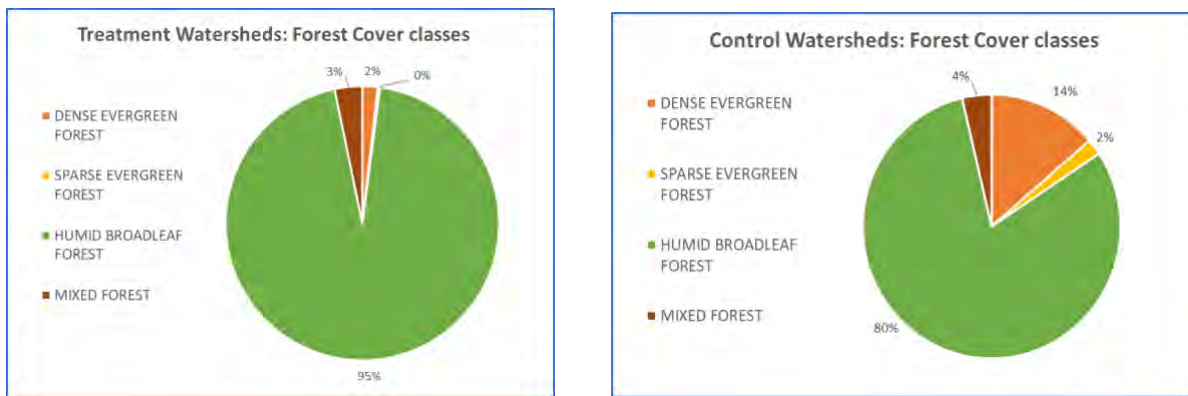
As described above, the imagery information set, composed of 679 satellite scenes (2016-2017), was found to be suitable for the IE baseline. The CIAT pixel classification was successfully used to determine treatment and control forest and land cover types, and their areal extents. Rates of Land Cover change require end year (2020) forest area statistics of comparable quality and detail to this baseline.

4.1 IE EVALUATION QUESTION I: FOREST COVER

EQ 1: Change in Forest Cover: *What is the impact of GEMA's TAPs on the rate of change in forest cover in its micro-watersheds?*

Figure 15 compares the baseline values for total averages of each the main forest types found in the 12 treatment and 12 control watersheds, corresponding to EQ question 1.

Figure 15: Distribution of baseline values for total average areas of key forest types



Each of the micro-watershed boundary polygons of the 12 Level 1 micro-watershed treatment and control sites was used to extract cell counts of forest cover for each of the forest cover classes measured by CIAT. The forest data collected and analyzed in terms of forest cover area (in hectares) are suitable for the IE baseline.

For treatment watersheds, due to the high elevations of much of the treatment areas assessed, the make-up of this Forest Cover across micro-watersheds are mainly Humid Broadleaf Forest (95%), Mixed Forest (3%), and Coniferous Forest (2%).

For control watersheds, dense evergreen forest, which is found at lower elevations, makes up 14% of the areas of those watersheds. In addition, while efforts to select locations of protected area cover has been emphasized, most of the protected lands are in the GEMA Work Areas, where the control sites have not been selected by design, and this leads to a higher proportion of montane broadleaf forest in the 12 treatment watersheds.

The IE team notes that calculating rates of Forest Cover change will require end year (2020) forest area statistics of comparable quality and detail to this baseline.

4.2 IE EVALUATION QUESTIONS 2A, 2B AND 2C: LAND COVER FINDINGS

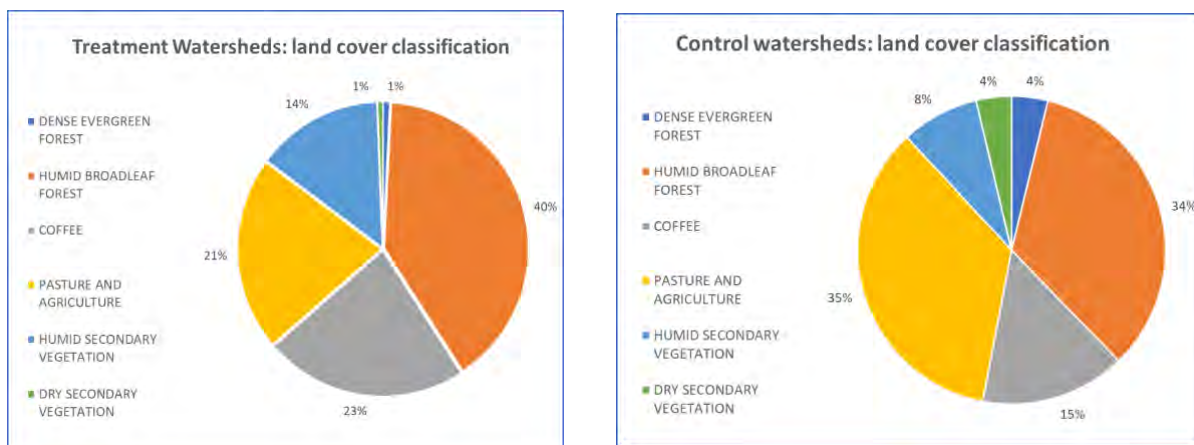
The results of the 2018 analytical effort respond to IE questions 2A, 2B, and 2C (see Appendices G to M).

4.2.1 EVALUATION QUESTION 2A

EQ 2A Change in Land Cover: *What is the impact of GEMA's TAPs on the rate of change in land cover types in GEMA's micro-watersheds?*

Figure 16 compares the percentages of classified land cover areas for the entire areas of each set of 12 watersheds.

Figure 16: Distribution of baseline values of land cover areas in 24 treatment and control watersheds



The three dominant cover classes in the treatment and control sites are Humid Broadleaf Forest; Coffee; and Pastures and Agriculture.

Combining treatments and control sites, Forest Cover makes up 39% of all land cover types.

Coffee production is higher in the treatments (23%) than in the controls (15%), as treatments are situated at higher elevations, that are largely more optimal for coffee.

Similarly, pasture/agricultural activities on cultivated lands are more prominent at lower elevations in zones of multiple use in the control sites (35%) more than treatments (21%), again the differences between these two sets of watershed sites, are likely to be due to differences in elevation and in relative protected area status.

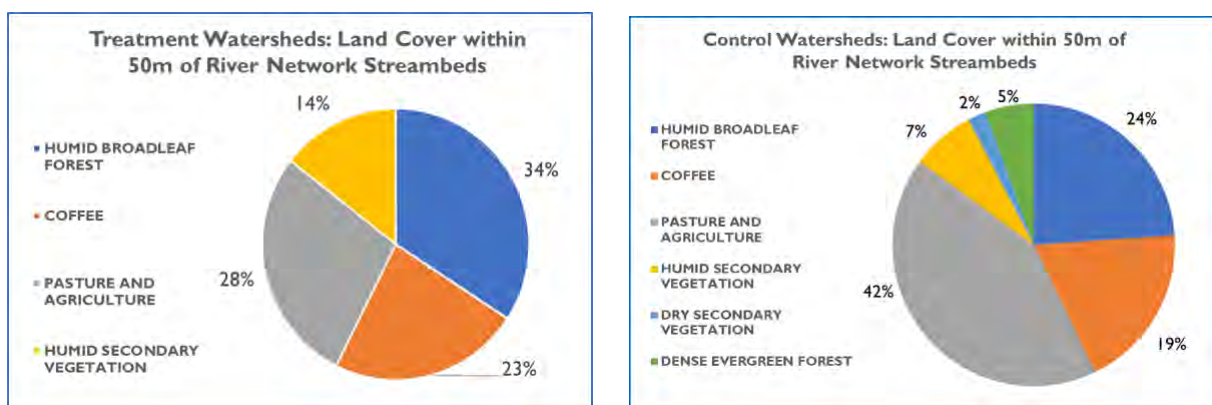
4.2.2 EVALUATION QUESTION 2B

EQ 2B Change in Land Cover: What is the impact of GEMA's TAPs on the rate of change in land cover types in GEMA's micro-watersheds within 50 meters of water bodies' borders?

Figure 17 compares the percentages of land cover areas classified around the drainage networks of the 24 treatment and control watersheds.

A total of 923 hectares of land cover imagery was evaluated, within 50-meters on both sides of the modeled drainage networks, within the treatment and control micro-watershed drainage networks.

Figure 17: Distribution of baseline values of land cover areas within 50 m of drainage networks in 24 treatment and control watersheds



While the proportions of coffee are similar, pasture and agriculture lands comprise a lower proportion of vegetation around the modeled drainage networks in the treatment watersheds (28%) compared with a higher value in the control watersheds (42%), which is likely to be due to the lower elevations of controls and to their lesser level of protection.

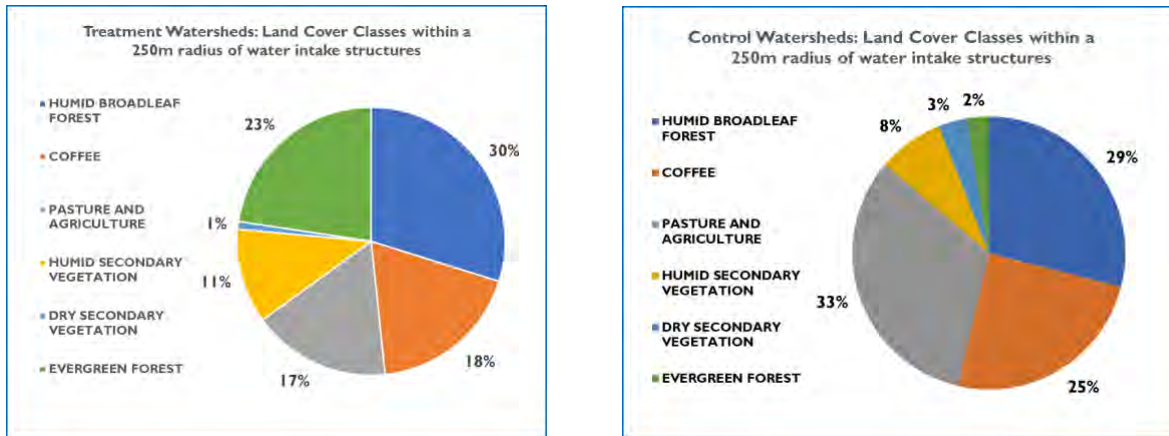
Supporting the argument that treatment watersheds are located at an average altitude higher than the control watersheds, Humid Broadleaf Forest compose 34% of the drainage network land cover in the treatments, while only composing 24% in the controls. Likewise, the cover class of Evergreen Forest is only represented in the control sites, probably again due to their relatively lower elevations, where *Pinus oocarpa* dominates.

An additional cover class, Humid Secondary Vegetation at 14% and 7% respectively in treatment and controls, is important when considering distances from the drainage network, and this can be seen as an indicator of where land changed - probably from forest cover - in the past.

4.2.3 EVALUATION QUESTION 2C

IE EQ 2C Change in Land Cover: What is the rate of change in land cover types within 250 meters around Juntas de Agua water sources within GEMA micro-watersheds?

Figure 18: Distribution of baseline values of areas of land cover within 250 m of water intakes in 24 treatment and control watersheds



Despite the IE team’s intention to establish control sites that are as similar as possible to treatments, there are differences in the composition of the vegetation that is found around the two sets of water intake structures, with Evergreen Forest at 23% taking up a much more significant proportion of land area in the treatment sites, as compared with the Controls where Evergreen Forest only reaches 2%.

The IE team posits that this is because GEMA’s Work Areas are largely located at higher elevations, closely linked to Protected Areas, whereas the control micro-watersheds were located within polygons that were placed in areas outside of GEMA Work Areas, at lower elevations, and are mostly found in non-protected areas. This difference in forest cover types may be due to greater areas of high-altitude conifers that are within a greater area under protection within the treatment watersheds. As well, the proportions of areas under coffee (18 versus 25%), and under pasture and agriculture (17 versus 33%) are larger in the control sites, due to greater levels of human intervention, in the control sites. This also contributes to the differing distribution of land cover classes.

The results from EQ 2C show coffee and pasture and agriculture are land cover types that are significant within the 250m footprint of water intake locations, and it is likely that these important areas and others like them in the study sites and elsewhere should be mapped in greater detail and frequency. Secondary vegetation is currently not viewed as an important feature in the intake footprints, nor in association with current land use.

5 FORWARD PLAN

This section describes how the 2018 IE report will be used as a baseline assessment.

1. As noted above, calculations and conclusions regarding rates of change in forest cover, and other land covers (especially those directly related to land use) require **baseline area at the classification level**, and this report presents the required data collection methodology, selection criteria, and baseline data analyses to produce the start year baseline values.
2. For 2020, in order to calculate rates of forest and land cover change, i-APS will need to acquire **end year (2020) forest area statistics of comparable quality and detail**. Therefore, the availability of CIAT 10x10m land cover map or an alternative of similar quality and detail is critical for the end-line work. The IE team observes that ICF is preparing a 5x5m map based on RapidEye for 2020, and it would be ideal to assure that the map classification of ICF and CIAT are interchangeable. If outputs from CIAT are not available at that time, i-APS has acquired a copy of the CIAT methodology code, and the data used to carry out that assessment should be publicly available from ESA.
3. In 2020, **the IE team will conduct the same analyses of land classes through pixel counts**, aligned as required for each IE Evaluation Question. Following the replication of the 2018 analysis of remote sensing imagery, the i-APS IE team will correlate any detected change in forest and land cover, with the impacts of GEMA's TAPs that impacts upon any identified rates of change, and how those changes may be related to threats and GEMA's TAPs.
4. **Comparative data will be required concerning the influences on forests, land cover and water resources of the populations that are related to both the treatment and control micro-watersheds**. As far as is feasible, similar observational information has been collected in 2018 within the two sets of watershed sites selected for the IE. The combined data will be used to determine the level of implementation of GEMA's TAPs, and to establish if the actions that have the potential to reduce pressure on forests, have in fact been implemented at the scale needed. In 2020, the **repeat data-gathering exercise and analysis** will seek to explain to what extent any differences observed between 2016/17 and 2020, in forest cover and land use between the treatment and the controls, can be accurately attributed to GEMA's actions across the 2018 to 2020 evaluation period.
5. **Context indicators for the treatment and control micro-watersheds**, summarizing characteristics of each watershed, including the presence of other activities and drivers of land-use change, will be tracked in 2020 through the CIAT Terra-i early warning alert system, with the aim of explaining differences within the two sets of treatment and control watersheds, and this approach will, more importantly, try to explain if and why there are significant differences, or lack thereof, between treatment and control sites.
6. **Opportunities for USAID to contribute to a more robust information base**. The IE team observes that GEMA's project and geographic data could be shared among international, national, and local land managers, academics, and NGOs; the *Sistema De Información Territorial Trinacional* (SINTET³) could be an ideal distribution point. The IE team also notes that it will be important for this study that USAID supports the use of mapping resources to produce information at regular frequencies on agroforestry and pasture land uses in the study region (Brenes et al, 2018; Schlesinger et al, 2017).

³ <https://www.sintet.net>

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APPENDICES

APPENDIX A: EVALUATION STATEMENT OF WORK

Background: Dexis Consulting Group (Dexis) has been contracted by the United States Agency for International Development (USAID) to provide management and technical services for the implementation of USAID/Honduras' Monitoring & Evaluation Support for Collaborative Learning and Adapting (MESCLA) activity aimed at supporting and strengthening monitoring and evaluation of USAID financed development assistance in Honduras. MESCLA also supports the Mission measure the effectiveness of its efforts to promote gender equality, support vulnerable populations, reduce migration flows, and prevent violence through its place-based strategy for violence prevention. In 2011, USAID/Honduras contracted DAI to implement its ProParque activity, which worked with government stakeholders to strengthen the nation's protected area management system and promote rural enterprise growth, climate change adaptation, disaster risk reduction, and clean energy development. To build upon these accomplishments, USAID/Honduras has designed the *Gobernanza en Ecosistemas, Medios de Vida, y Agua*, or Governance in Ecosystems, Livelihoods, and Water (GEMA) project as a follow-on activity to scale up and replicate the successes of ProParque. GEMA is working in Western Honduras to further improve natural conservation policies; develop opportunities for inclusive, environmentally sustainable economic growth; and promote a more climate-informed and resilient civil society in Honduras.

SOW Objective: The objective of this SOW is to complete data collection and analysis for a Performance Evaluation and an Impact Evaluation (baseline and mid-line measurements) of the GEMA Activity. The purpose of these evaluations is to provide rigorous evidence on whether and how the expected results of the GEMA Activity have been achieved and provide insights on how to improve its effectiveness. The evaluations will answer the Evaluation Questions put forth by USAID.

Scope of Work of the Impact Evaluation: The Impact Evaluation will provide statistically significant evidence of the impact of the GEMA Activity, comparing treatment and non-treatment areas, in particular as related to the impact of GEMA's Technical Activity Packages. To answer the Evaluation Questions, the subcontractor will be required to design the evaluation, complete briefings on the proposed evaluation plan, and provide MESCLA with reports as described in the Deliverables section. As part of designing the evaluation, the Subcontractor will submit the evaluation methodology and work plan for approval by MESCLA. The Subcontractor will implement the baseline impact evaluation by obtaining and analyzing existing remote sensing data for land cover classification and conduct select ground-truthing of that data. For the end-line impact evaluation the Subcontractor will (1) acquire and process a combination of free and accessible 2020 European Space Agency (ESA) Sentinel 1 radar data, optical ESA Sentinel 2 data, optical NASA Landsat data, and Moderate Resolution Imaging Spectroradiometer (MODIS) Land Cover Type data (necessary because of cloud cover constraints); and (2) make a best-case comparison of land use and vegetation in the treatment watershed in 2010, 2014, and 2020.

Impact Evaluation Questions

- 1) What is the impact of GEMA's Technical Activity Packages (TAPs) on the rate of change in forest cover in its micro-watersheds?
- 2) What is the impact of GEMA's TAPs on the rate of change in land cover types in GEMA's micro-watersheds: (1) within 50 meters of water bodies' borders, (2) within 250 meters around Juntas de Agua water sources, and (3) within and outside of protected areas?

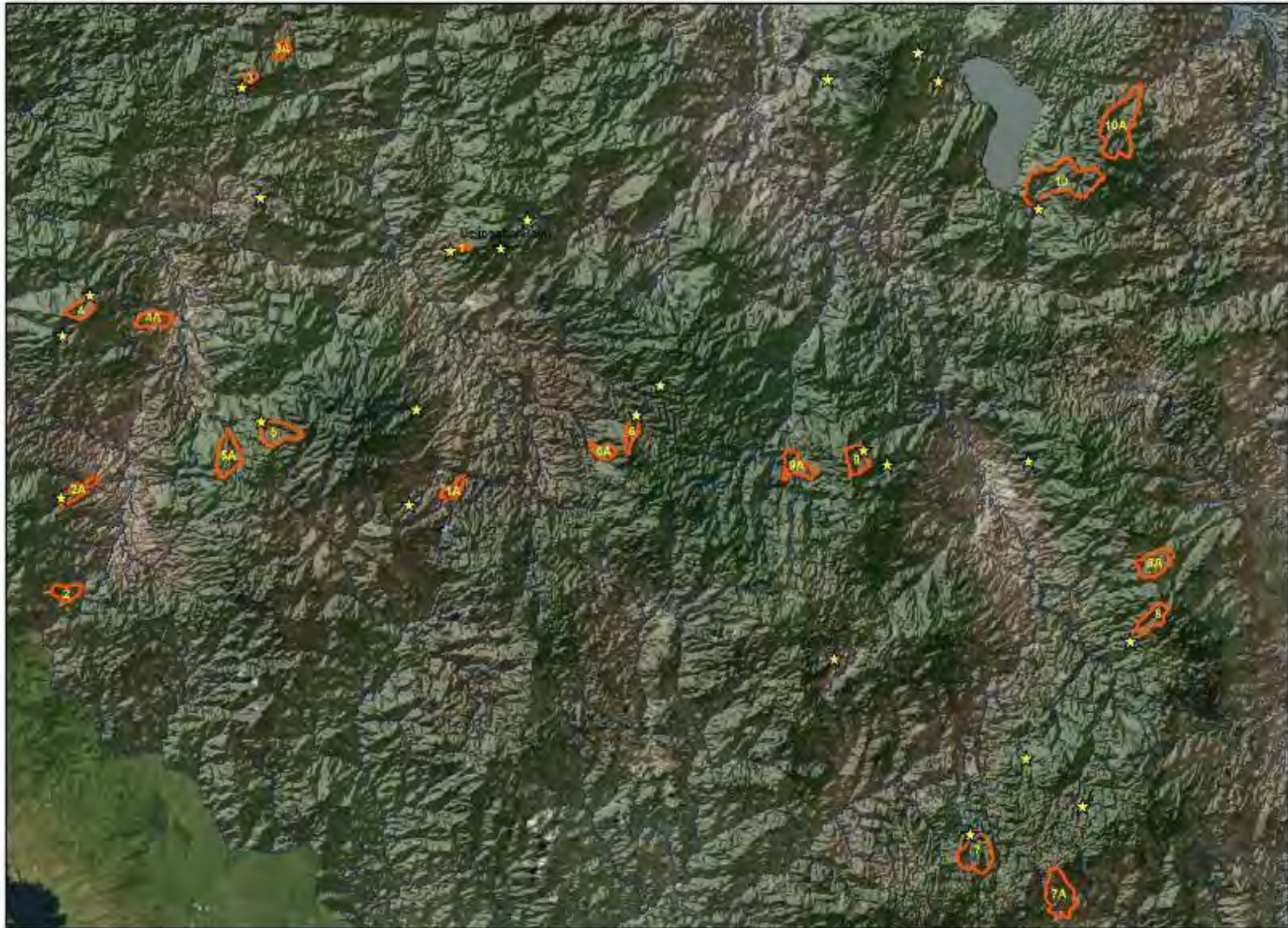
Tasks & Responsibilities: For the PE and IE of the GEMA Activity, the Subcontractor will:

- Work with USAID/Honduras and MESCLA to finalize the GEMA IE and PE evaluation designs and timelines, including data collection and analysis methods
- Develop and review data collection instruments and data analysis tools for all data collection efforts
- Travel to Honduras to oversee data collection phases, at a minimum; additional travel as appropriate
- Conduct data analysis
- Hold briefings on each evaluation in accordance with the approved evaluation methodology/work plan
- For both the PE and IE, develop the draft baseline evaluation reports and submit for comments
- Complete a final end-term evaluation report for both the PE and IE

Deliverables: Name/Description	Deadline
1. Draft version of the Performance Evaluation Design documents and the Impact Evaluation Design Document containing the work plan, implementation approach and calendar, and data collection instruments, with a summary PowerPoint presentation.	20 working days after contract signing
2. Final version of the Performance Evaluation Design document and the Impact Evaluation Design document containing the work plan, implementation approach and calendar, and field-tested versions of the data collection instruments. The Subcontractor will be required to complete the remaining deliverables in accordance with the final Evaluation Design.	35 working days after contract signing
3. Bi-monthly status reports. A brief, combined report covering both the Performance Evaluation and Impact Evaluation tasks, presenting a concise description of achieved versus planned tasks in the current period, and planned tasks for the upcoming period; as well as challenges encountered during implementation of the evaluation tasks and actions taken to resolve them.	7 working days after the end of each bimonthly period.
4. Evaluation Briefings: The specific briefings for the evaluations will be described in the Evaluation Design of both evaluations, but it is anticipated that the briefings will take place in Tegucigalpa at either the Mission or Government of Honduras offices.	TBD
5. Draft Baseline Report of the Performance Evaluation and Draft Baseline Report of the Impact Evaluation not to exceed 30 pages each (exclusive of annexes) and a PowerPoint presentation summarizing the reports. The draft evaluation reports will include all sections of the Final Evaluation Reports, with an outline of Annex contents. The draft evaluation report will follow the criteria found in USAID'S Evaluation Policy.	Approximately 7 months after contract signing
6. Final Baseline Reports. The Final Baseline Evaluation Reports (separate reports for the Performance Evaluation and the Impact Evaluation) will be submitted as an electronic copy with all annexes, and all raw data in a format approved by USAID/Honduras, in both English and Spanish. The main body of the Final Baseline Evaluation Report shall not exceed 30 pages (exclusive of annexes) and must include a title page, an executive summary, introduction, background of the project being evaluated, the main evaluation questions, the methodology or methodologies, the limitations to the evaluation, findings, conclusions, and (if included in the evaluation design) recommendations and lessons learned.	Approximately 8 months after contract signing
7. Draft End Term Evaluation Report of the Performance Evaluation and Draft Baseline Report of the Impact Evaluation. Not to exceed 30 pages each (exclusive of annexes) and a PowerPoint presentation summarizing the reports. The draft evaluation reports will include all sections of the Final Evaluation Reports (separate reports required for the Performance Evaluation and the Impact Evaluation), with an outline of Annex contents. The draft evaluation report will follow the criteria found in USAID'S Evaluation Policy.	TBD (Tentatively September 2020)
8. Final End Term Evaluation Reports. The Final Evaluation Reports for the Performance Evaluation and the Impact Evaluation (separate reports required for each evaluation) will be submitted as an electronic copy with all annexes, and all raw data in a format approved by USAID/Honduras, in both English and Spanish. The main body of the Final Evaluation Reports shall not exceed 30 pages each (exclusive of annexes) and must include a title page, an executive summary, introduction, background of the project being evaluated, the main evaluation questions, the methodology or methodologies, the limitations to the evaluation, findings, conclusions, and (if included in the design) recommendations and lessons learned.	TBD (Tentatively October 2020)

Reporting: During the course of implementation, the Subcontractor will report to Chief of Party Patricia McLaughlin, and MESCLA's technical team as per the CoP's designation for all technical matters. For contractual matters, the Subcontractor will work directly with Wajjiyya Siddiqi and the Dexis Program Management Unit.

APPENDIX B: LOCATIONS OF TREATMENT & CONTROL LEVEL I WATERSHEDS



APPENDIX C: TABLE OF ATTRIBUTES OF TREATMENT-LEVEL I MICRO-WATERSHEDS

	1	2	3	4	5	6	7	8	9	10	11	12
Priority MCC	Rio Salado; Qda. La Lanta	Not Defined	Qda. Pasquingual	Rio Chayel	Rio El Coyal	Rio Conchagual	Marcala	Orungo	Sirima	Varsovia	Qda de Balas	Agalteca
Land Cover / Use Classes	P/C/V	P/C	B/C	B/C	B/C	B/C	C/P	B/P	B/P	B/V/P	C/P/V	P/C/V
Minimum Elevation (masl)	340	1264	963	1491	1325	1288	1324	1235	1434	665	1483	415
Area (ha)	73.24	470.81	168.09	480.92	975.82	370.17	1383.19	722.44	672.94	2664.23	620.47	630
GEMA Work Area	NWA	Ocotepeque	Cocoyagua	Erapuca	Celaque-Puca	Opalaca	La Paz	Santiago De Puringla	Mixcure	Santa Barbara	Santa Barbara	Santa Barbara
Municipality	Lapaera	San Francisco del Valle	Veracruz	La Union, La Encarnacion	Belen Gualcho	Belen Gualcho	Marcala	Santiago de Puringla	Intibuca, San Isidro	Taulabe	Las Vegas	Concepción del Sur / San Pedro Zacapa
GEMA Area of Influence	Celaque-Puca	Guisayote	Cocoyagua	Erapuca	Celaque-Puca	Montaña Verde	El Jilguero	Montecillos	Mixcure	Lago de Yojoa	Lago de Yojoa	Lago de Yojoa
Associated Protected Area (PA)	not applicable	None	none	nucleo of Erapuca	buffer of Montaña de Celaque	buffer of Opalaca	border of PA	North part in Montecillos Biological Reserve	nucleo of Mixcure	buffer of Cerro A. Meambar	Lago de Yojoa	Lago de Yojoa
Type of PA	na	Na	na	wildlife refuge	national park	wildlife refuge	area prod de agua	biological reserve	wildlife refuge	national park	mult use zone	mult use zone
Populated places in treatment /control	none	Rio Hondo	Cerro Cocoyagua, Yaruconte	none	El Suctal, Capucal	La Puerta del Ocote	six noted	Hornitos, Urungo	none	five noted	three noted	four
Population	none	76	500	none	339	93	2095	984	na	473	868	236
Beneficiaries present	none	None	none	none	none	none	none	none	none	12 cocoa	25 coffee	7 coffee
GEMA TAPs/ Medium Small or Micro Enterprise	few	few	tourism MSME	few	improved stove	25 improved stoves	Junta de Agua, 2 CODELs	2 Juntas de Agua	few	JA Cerro Azul, baseline resil	improved stoves, 2 CODEL, 2 MSME	45 improved stoves
Declared watershed(s) present	none	Las Golondrinas	none	none	none	none	none	none	certif emitido	declared Mcc Varsovia	Flores del Bijao	none
In order of areal coverage/importance: B = Bosque conífero/latifoliado (Forest: Broadleaf/Evergreen); P = Pastos y agricultura (Pasture and Agriculture); C = Café (Coffee) V = Vegetación secundaria (secondary vegetation)												

APPENDIX D: TABLE OF ATTRIBUTES OF CONTROL LEVEL I MICRO-WATERSHEDS

	1A	2A	3A	4A	5A	6A	7A	8A	9A	10A	11A	12A
Land Cover/Use Classes	P/C/B	P/B/C	C/P/V	P/C/B	C/P/B	B/C/P	P/B/C	B/P/C	B/C/P	B/P/V	P/V	P/C/B
Minimum Elevation (masl)	1039	921	746	736	1153	1118	1260	1533	1152	451	161	469
Area (ha)	327.86	487.32	219.51	576.15	992.78	357.68	1390.21	919.79	701.88	2273.82	720.49	814
GEMA Work Area		Ocotepeque	Cocoyagua	Erapuca	Celaque-Puca	Opalaca	La Paz	Santiago De Puringla	Mixcure	Santa Barbara	Santa Barbara	
Municipalidad	La Campa	La Labor	Trinidad de Copan	La Union	Corquin, B. Gualcho	Belen Gualcho	Santa Ana	Comayagua	Intibuca	Meambar	Santa Barbara	San Jose de Comayagua
GEMA Area of Influence	Cel-Puc	Cel-Puc	Guisayote	Cocoyagua	Erapuca	Cel-Puc	Montaña Verde	El Jilguero	Montecillos	Mixcure	Lago de Yojoa	Lago de Yojoa
Associated Protected Area	none	none	none	none	none	Opalaca	nucleo of El Jilguero	Nucleo Montecillos	none	nucleo of Meambar	none	none
Type of PA	na	na	na	na	na	reserva	area prod de agua	reserva biologica	na	nat. park	na	na
Populated places within treatment /control	La Campa, El Sitio	none	San Juan de Planes	La Laguna, El Armado	five	Rio del Naranjo	none	seven	none	Canchitas, El Cerron	none	none
Population	253	none	994	150	900	257	520	325	none	244	800	none
Beneficiaries present	1 coffee	none	none	none	none	none	none	none	none	none	none	JA
Declared watershed(s)	none	no	none	none	none	none	none	none	none	two	none	none
In order of areal coverage/importance: B = Bosque conifero/latifoliado (Forest: Broadleaf/Evergreen); P = Pastos y agricultura (Pasture and Agriculture); C = Café (Coffee) V = Vegetación secundaria (secondary vegetation)												

APPENDIX E: GPS LOCATIONS OF WATER INTAKES IN TREATMENT WATERSHEDS

	DEPARTAMENTO	COMUNIDAD	ID	X	Y	h
1	La Paz	1. Urungo	MC 8	0411429	1586725	1882
2	La Paz	2. Rancho de Jesus		ND	ND	
3	La Paz	1. Fátima	MC 7			
		• Fátima # 1		0388939	1558493	1754
		• Fatima #2		0389483	1558466	1719
		• Fatima #3		0389568	1558358	1749
4	La Paz	2. La Montañita (Plan del Naranjo)		0389248	1558400	1777
5	La Paz	3. Las Flores		0389333	1558379	1768
6	Lempira	1. Puerta del Ocote	MC 6	0348825	1607499	1746
7	Lempira	2. Agua Helada		0349508	1607040	1861
8	Lempira	1. Las Flores (Casco urbano)	MC 1	0328515	1628943	859
9	Lempira	2. Mongual		0328515	1628943	859
10	Lempira	3. Coalaca		0328515	1628943	859
11	Lempira	4. Piedra Pintada		0328515	1628943	859
12	Copan	1. La Unión (Casco urbano)	MC 3	0285705	1623276	1759
13	Copan	2. Los Arroyos		NA	NA	
14	Copan	3. El Trigo		NA	NA	
15	Copan	4. Las Minitas		0285705	1623276	1759
16	Ocotepeque	1. Santa Teresa	MC 2	0283889	1590513	1252
17	Ocotepeque	2. El Comedero		0283889	1590513	1252
18	Ocotepeque	3. Las Cuevas		0283889	1590513	1252
19	Ocotepeque	4. Río Hondo		0283328	1589671	1335
20	Copán	1. Pacayas	MC-5	0306716	1607820	1666

	DEPARTAMENTO	COMUNIDAD	ID	X	Y	h
21	Copán	2. Higueral		0306716	1607820	1666
22	Copán	3. Coyol		0306716	1607820	1666
23	Copán	4. Hichoal		0306716	1607820	1666
24	Copán	1. San Juan Planes	MC 4	0305653	1649986	1073
25	Copán	2. Quebraditas		0305872	1649953	1205
26	Santa Bárbara	1. El Planon	MC 11	0382511	1650350	1506
27	Santa Bárbara	2. Flores del Bijao		0382511	1650350	1506
28	Santa Bárbara	1. Agua Zarca	MC 12	03800268	1637091	469
29	Santa Bárbara	2. El Ocote		03800268	1637091	469
30	Comayagua	1. Cerro Azul	MC 10	0400614	1635984	1112
31	Comayagua	2. Varsovia		0400605	1635994	1116
32	Intibucá	1. San Isidro Centro	MC 9			
		• Boca toma principal		0375828	1607307	1692
		• Boca toma anexa		0375824	1607297	1670
33	Intibucá	2. Peña Blanca		0375513	1606653	1918
34	Intibucá	3. Macuelizo		0377167	1604877	1675

APPENDIX F: CONTROL WATERSHEDS GPS LOCATIONS OF WATER INTAKES

OBRA DE TOMA	MCC	UBICACIÓN GIS PROJECTED COORDINATE SYSTEM: Wideband Global SATCOM system 1984; Universal Transverse Mercator (UTM) conformal projection Zone 16N		UBICACIÓN	
		X	Y	DEPARTAMENTO	MUNICIPIO
1	1A	328338	1601348	LEMPIRA	LA CAMPA
2	2A	281585	1601195	OCOTEPEQUE	LA LABOR
3	3A	308394	1650767	COPÁN	TRINIDAD
4	4A	287989	1621304	COPÁN	LA UNIÓN
5		287324	1621655		
6	5A	300755	1604906	COPÁN	CORQUIN
7		301720	1605820		
8		301809	1605912		
9	6A	347734	1604940	LEMPIRA	BELEN GUALCHO
10	7A	399424	1557940	LA PAZ	SANTA ANA Y OPATORO
11		398045	1558100		
12	8A	411900	1592367	COMAYAGUA	COMAYAGUA
13	9A	347734	1604940	INTIBUCÁ	INTIBUCÁ
14	10A	407998	1645322	COMAYAGUA	MEAMBAR
15	11A	367659	1646495	SANTA BÁRBARA	SANTA BÁRBARA
16		367811	1646862		
17	12A	392504	1628701	TAULABE	COMAYAGUA
18		392294	1628579		
19		392174	1628488		

APPENDIX G: RESULTS OF EQI - FOREST COVER AREA IN TREATMENT & CONTROL WATERSHEDS

ID	TREATMENT WATERSHEDS: CLASS NAME	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
1	DISPERSED TREES	1	0	0	0	0	0	0	0	0	2	0	0
4	DENSE EVERGREEN FOREST	0	0	0	0	0	4	4	7	1	44	1	7
5	SPARSE EVERGREEN FOREST	0	0	0	0	0	5	2	1	1	1	0	0
6	HUMID BROADLEAF FOREST	5	129	88	439	512	187	347	366	530	833	62	70
7	DRY SECONDARY VEGETATION	0	0	0	0	0	0	0	0	0	0	0	1
8	MIXED FOREST	0	0	0	26	93	2	0	1	1	0	0	0
	TOTAL (HECTARES)	6	129	88	439	605	198	353	375	533	880	63	78
ID	CONTROL WATERSHEDS	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12
1	DISPERSED TREES	0	0	0		0	0	19	0	0	0	0	3
4	DENSE EVERGREEN FOREST	17	72	1	10	0	29	119	2	12	92	5	107
5	SPARSE EVERGREEN FOREST	11	18	0	6	0	5	14	5	1	1	0	6
6	HUMID BROADLEAF FOREST	38	1	5	8	250	225	130	392	314	1299	2	73
7	DRY SECONDARY VEGETATION	0	0	0	0	0	0	19	0	0	4	0	0
8	MIXED FOREST	0	0	0	0	0	0	119	5	0	1	0	0
	TOTAL (HECTARES)	66	92	6	24	250	259	14	404	327	1396	8	189

APPENDIX H: RESULTS OF IE 2A - AREA OF LAND COVER TYPES IN TREATMENT WATERSHEDS

ID	TREATMENT WATERSHEDS: CLASS NAME:	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
1	DISPERSED TREES	1	0	0	0	0	0	0	0	0	2	0	0
2	INLAND WETLANDS	0	0	0	0	0	0	0	0	0	3	0	0
3	COMMERCIAL AGRICULTURE	0	0	0	0	0	0	0	0	0	0	0	0
4	DENSE EVERGREEN FOREST	0	0	0	0	0	4	4	7	1	44	1	7
5	SPARSE EVERGREEN FOREST	0	0	0	0	0	5	2	1	1	1	0	0
6	HUMID BROADLEAF FOREST	5	129	88	439	512	187	347	366	530	833	62	70
7	DRY SECONDARY VEGETATION	0	0	0	0	0	0	0	0	0	0	0	1
8	MIXED FOREST	0	0	0	26	93	2	0	1	1	0	0	0
10	COFFEE	19	144	57	1	182	88	558	120	32	312	267	110
12	WATER BODIES	0	0	0	0	0	0	0	0	0	0	0	0
13	PASTURE AND AGRICULTURE	29	182	17	0	123	65	358	125	47	377	184	319
14	DEGRADED SOILS	0	0	0	0	0	0	0	0	0	0	0	0
15	SEDIMENTS	0	0	0	0	0	0	0	0	0	0	0	0
16	HUMID SECONDARY VEGETATION	17	1	0	1	39	8	72	82	42	824	85	89
17	DRY SECONDARY VEGETATION	0	0	0	0	0	0	0	0	0	21	0	32
18	URBAN AREAS	0	0	0	0	0	0	5	0	0	2	3	0
	TOTAL (HECTARES)	71	457	163	467	949	360	1348	702	654	2420	602	628

APPENDIX I: RESULTS OF IE 2A - AREA OF LAND COVER TYPES IN CONTROL WATERSHEDS

ID	CONTROL WATERSHEDS CLASS NAME	C1A	C2A	C3A	C4A	C5A	C6A	C7A	C8A	C9A	C10A	C11A	C12A
1	DISPERSED TREES	0	0	0	0	0	0	19	0	0	0	0	3
2	INLAND WETLANDS	0	0	0	0	0	0	0	0	0	0	1	0
3	COMMERCIAL AGRICULTURE	0	0	0	0	0	0	0	0	0	0	1	0
4	DENSE EVERGREEN FOREST	17	72	1	10	0	29	119	2	12	92	5	107
5	SPARSE EVERGREEN FOREST	11	18	0	6	0	5	14	5	1	1	0	6
6	HUMID BROADLEAF FOREST	38	1	5	8	250	225	130	392	314	1299	2	73
7	DRY SECONDARY VEGETATION	0	0	0	0	0	0	0	0	0	4	0	0
8	MIXED FOREST	0	0	0	0	0	0	0	5	0	1	0	0
10	COFFEE	61	43	51	38	413	53	145	103	203	42	2	117
12	WATER BODIES	0	0	0	0	0	0	0	0	0	0	2	0
13	PASTURE AND AGRICULTURE	172	323	141	492	279	33	870	295	113	280	387	424
14	DEGRADED SOILS	0	9	0	0	0	0	9	0	0	0	1	0
15	SEDIMENTS	0	0	0	0	0	0	0	0	0	0	0	0
16	HUMID SECONDARY VEGETATION	15	0	8	0	22	2	2	93	38	438	41	63
17	DRY SECONDARY VEGETATION	0	0	0	0	0	0	0	0	0	60	257	18
18	URBAN AREAS	3	7	7	5	0	0	45	0	1	0	2	0
	TOTAL (HECTARES)	318	473	213	560	966	347	1354	894	682	2215	700	811

APPENDIX J: EQ 2B – LAND COVER WITHIN 50 M OF WATER BODIES IN TREATMENT WATERSHEDS

ID	TREATMENT WATERSHEDS CLASS NAME	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
1	DISPERSED TREES	0	0	0	0	0	0	0	0	0	0	0	0
2	INLAND WETLANDS	0	0	0	0	0	0	0	0	0	2	0	0
4	DENSE EVERGREEN FOREST	0	0	0	0	0	0	0	0	0	2	0	1
5	SPARSE EVERGREEN FOREST	0	0	0	0	0	0	0	0	0	0	0	0
6	HUMID BROADLEAF FOREST	0	10	4	49	55	19	29	45	35	57	1	9
7	DRY SECONDARY VEGETATION	0	0	0	0	0	0	0	0	0	0	0	1
8	MIXED FOREST	0	0	0	0	1	1	0	0	0	0	0	0
10	COFFEE	4	17	6	1	21	0	70	18	5	30	30	8
13	PASTURE AND AGRICULTURE	0	33	6	0	8	18	37	7	4	94	20	30
16	HUMID SECONDARY VEGETATION	1	0	0	0	5	8	6	10	2	78	5	17
17	DRY SECONDARY VEGETATION	0	0	0	0	0	1	0	0	0	1	0	1
18	URBAN AREAS	0	0	0	0	0	0	1	0	0	1	1	0
	TOTAL (HECTARES)	5	60	16	50	90	47	143	80	46	265	57	67

APPENDIX K: EQ 2B – LAND COVER WITHIN 50 M OF WATER BODIES IN CONTROL WATERSHEDS

ID	CONTROL WATERSHEDS: CLASS NAME:	C1A	C2A	C3A	C4A	C5A	C6A	C7A	C8A	C9A	C10A	C11A	C12A
1	DISPERSED TREES	0	0	0	0	0	0	3	0	0	0	0	0
2	INLAND WETLANDS	0	0	0	0	0	0	0	0	0	0	0	0
3	COMMERCIAL AGRICULTURE	0	0	0	0	0	0	0	0	0	0	0	0
4	DENSE EVERGREEN FOREST	1	12	0	0	0	5	27	0	1	5	0	6
5	SPARSE EVERGREEN FOREST	0	1	0	0	0	0	1	1	0	0	0	0
6	HUMID BROADLEAF FOREST	2	0	0	0	26	29	10	20	46	111	0	7
7	DRY SECONDARY VEGETATION	0	0	0	0	0	0	0	0	0	1	0	0
8	MIXED FOREST	0	0	0	0	0	0	0	0	0	1	0	0
10	COFFEE	3	13			26	34	41	21	47	113		13
12	WATER BODIES	0	0	0	0	0	0	0	0	0	0	1	0
13	PASTURE AND AGRICULTURE	12	49	14	75	18	8	65	35	5	40	60	61
14	DEGRADED SOILS	0	0	0	0	0	0	0	0	0	0	0	0
15	SEDIMENTS	0	0	0	0	0	0	0	0	0	0	0	0
16	HUMID SECONDARY VEGETATION	1	0	1	0	3	1	0	13	2	48	0	7
17	DRY SECONDARY VEGETATION	0	0	0	0	0	0	0	0	0	5	16	1
18	URBAN AREAS	0	0	1	0	0	0	4	0	0	0	0	0
	TOTAL (HECTARES)	26	69	21	80	130	63	140	85	68	211	78	92

APPENDIX L: EQ 2C: LAND COVER AREAS WITHIN 250 M AROUND WATER SOURCES IN TREATMENTS

ID	INTAKE ID: CLASS NAME:	OT S1	OT S2	OT S3	OT S4	OT S5	OT S6	OT S7	OT S8	OT S9	OT S10	OT S11	OT S12	OT S13	OT S14	OT S15	OT S16	OT S17	OT S18	OT S19	OT S20	
4	DENSE EVERGREEN FOREST		1												0	0						
5	SPARSE EVERGREEN FOREST														16	16	11	11	13	20		
6	HUMID BROADLEAF FOREST	19	11	15	10	19		16		8	6	10	3									
10	COFFEE	0	1	1	2	1	9	3	4	7	12	10	6				2	2	1			10
13	PASTURE AND AGRICUL- TURE		3	2	7		7	0	15	1	1	0	1	16	1	1	2	2	1			5
16	HUMID SECONDARY VEGETATION			1	1	0	4	1		3	0	0	10	1	3	3	5	5	4			5
17	DRY SECONDARY VEGETATION													4								
18	URBAN																					0
	TOTAL HECTARES	19	16	19	20	20	20	19	20	19	20	20	20	20	19	19	20	20	19	20	20	20

APPENDIX M: EQ 2C: LAND COVER AREAS WITHIN 250 M AROUND WATER SOURCES IN CONTROLS

ID	INTAKE ID: CLASS NAME:	OT C1	OT C2	OT C3	OT C4	OT C5	OT C6	OT C7	OT C8	OT C9	OT C10	OT C11	OT C12	OT C13	OT C14	OT C15	OT C16	OT C17	OT C18	OT C19
4	DENSE EVERGREEN FOREST																	0	3	5
5	SPARSE EVERGREEN FOREST							0				1							0	1
6	HUMID BROADLEAF FOREST	3		6	4	11	6	4	4	19	6	13	5	20				4	3	1
10	COFFEE	3	12	9	15	8	6	8	8	1	4	4	6		0			4	2	2
13	PASTURE AND AGRICULTURE	13	7	1	1		7	7	7		10	2	7		14	12	16	5	4	6
16	HUMID SECONDARY VEGETATION	0		4	0		1	0	1				2		2		0	6	7	5
17	DRY SECONDARY VEGETATION														1	7	4			
18	URBAN	1																		
	TOTAL HECTARES	19	20	19	19	19	20	19	19	19	20	19	20	20	17	19	20	19	19	20

ANNEX N: SELECTION OF TREATMENT AND CONTROL WATERSHEDS

The physical geography of Western Honduras is such that the micro-watersheds are positioned sloping downwards from the hilltops. As rain falls on these peaks, it is soaked up by the soils, and then above soil runoff and subsoil water movements are combined to fill stream beds. Due to typical drainage patterns, those areas with the lowest elevations almost always have the lushest vegetation. Vegetation on hilltops and their slopes are often located within Honduran protected areas to minimize the improper use of their natural resources, especially by farmers converting forest to agriculture. In many of these high elevation areas, clashes occur between the livelihoods needs of coffee farmers and their families and environmental protection, as these higher elevation lands provide key ecosystems services via their forests and water resources.

Across the wide landscape of Western Honduras, some 55 priority watersheds were identified by GEMA for their interventions (TAPs) using national criteria. For the IE, from this set of 55 target areas, a comparison of GEMA's impacts on landcover and land use to evaluate impact required the identification of a smaller training and control set of micro-watersheds (MCC). The MCCs deemed suitable by GEMA were characterized as "Level 1" because the modeled drainage or "runoff" networks were unique (without tributaries) thus not a collection of other micro-watersheds. GEMA's Level 1 MCCs were generated using Archydro Tools, a hydrological modelling module of ArcGIS, whereas i-APS Level 1 MCCs were generated using QSWAT, a public domain tool that implements the SWAT code for QGIS to analyze potential treatment and control 1 micro-watersheds.

The IE team's Watershed Management and Remote-Sensing specialists collected the best available geospatial data, primarily prepared by CIAT and GEMA GIS staff for the W. Honduras region. The digital elevation data developed by GIS staff were used to diminish the chance of creating different drainage network models. GEMA's GIS unit identified a treatment set of 12 MCC applying project-based criteria, emphasizing their existing (as of June-August 2018) and planned working locations, and current field knowledge of potential threats, stakeholders, and TAP beneficiaries. The intention was to apply methods for watershed selection with the objective of delimiting areas that were comparable between treatments and controls. With these criteria in mind, i-APS remote sensing team identified a matching set of 12 MCC control sites not participating in GEMA's activities.

Selection Criteria Applied to Treatment and Control Watersheds

TREATMENT LEVEL 1 MICRO-WATERSHEDS SELECTION CRITERIA

- Inside of GEMA Work Areas, with a concentration of GEMA activities
- Maximum elevations around 1800 meters above sea level
- Locations in buffer zones, or near the nucleus zone, of a national protected area
- Representative distribution of treatment micro-watersheds across GEMA's Work Areas
- Existence of a significant number of Water Boards (Junta de Administrador de Agua) in the watershed
- Potentially some of the treatment sites may have protected zones with Declaration of Micro-watershed status and associated management plans

CONTROL LEVEL 1 MICRO-WATERSHEDS SELECTION CRITERIA

- Located outside the Work Areas, but inside Areas of Influence, with no or few GEMA activities
- Minimum elevation of micro-watersheds as high as the topography of the Areas of Influence allows
- Adjacent as feasible to a protected area if matched treatment was also adjacent to a protected area
- Comparable in size to a matching treatment Level 1 micro-watershed
- If possible, with similar vegetation types as the treatment, using the CIAT digital map of land cover and use

As described, 12 treatment Level 1 MCCs were selected to provide representative sample zones that are within the 12 Work Areas, with elevations above 1,800 masl, and whose areas comprise numerous GEMA TAPs. The IE team established these areas as a foundation for both the IE analyses of forest/land cover types and also for the work carried out by the PE team to implement a Household Survey and to conduct qualitative data collection. Note that control watersheds could not be selected outside of the Area of Influence, because no land cover or land use data were available outside of the Areas of Influence.

