

PASTORALIST LIVELIHOODS INITIATIVE

Livelihoods-based Drought Response in Ethiopia: Impact Assessment of Livestock Feed Supplementation



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Summary

Since the drought in some pastoralist areas of Ethiopia in 2005 to 2006, there has been increasing interest in the use of supplementary feeding for livestock as part of an integrated drought response. Over time, and with more attention to the need for early response, NGOs are working to intervene more rapidly and improve modes of implementation. In terms of the livelihoods-based approaches promoted by the USAID Pastoralist Livelihoods Initiative, the livelihoods objectives of livestock supplementary feeding are to protect the key assets of pastoralists and promote post-drought recovery. However, livestock supplementary feeding is not universally accepted as an appropriate drought response intervention. For those actors following a conventional humanitarian approach of saving human lives, feed for livestock might be regarded as a distraction from the core business of food aid for people. Livestock feed supplementation also involves considerable costs, with some workers suggesting that these costs are somehow excessive or inappropriate.

During the recent drought in Borena and Guji zones in southern Ethiopia, Save the Children US used funds from USAID and the UNOCHA Humanitarian Response Fund to implement an emergency livestock supplementary feed program. As cattle were particularly affected by the drought, the program focused on the establishment of cattle feeding centers where in consultation with communities, an agreed number of adult cows received concentrate feed and roughage. Ten feeding centers were established in the two zones, and a total of 6,750 cattle were fed in the two zones.

The impact assessment described in this report was conducted in mid to late May 2008, approximately six weeks after the onset of rains. The assessment was initially designed to measure mortality in 'fed' and 'unfed' cattle and thereby assess the impact of supplementary feeding in terms of cattle losses. Although the assessment did measure mortality trends, further benefits related to production, calf survival and milk supply were also measured. The assessment looked in detail at two feeding centers viz.

Bulbul and Web. In Bulbul 1,000 cows were fed for 22 days whereas in Web 800 cows were fed for 67 days.

The findings of the impact assessment were as follows:

- Prior to the onset of the feeding program, 49% of pastoralists interviewed were buying livestock feed from private suppliers. While this indicated a strong local demand for feed, the capacity of people to buy feed was hindered by a credit system for cattle sales which delayed the physical receipt of cash by herders, and as the drought continued, increasing livestock feed prices. Consequently, an insufficient quality and quantity of privately-acquired feed was fed to cattle.
- Mortality – in both feeding centers mortality was significantly lower in cows in the feeding centers relative to unfed cattle ($p < 0.001$).
- Body condition – relative to unfed cattle, cows in the feeding centers gained body condition, with up to 70% of cows moving from 'poor' body condition to 'moderate' body condition.
- Milk and calves – some cows gave birth while in the feeding centers and were able to rear calves until the start of the rains. A total of 198 calves survived in the two centers. In addition, some cows maintained lactation while in the feeding centers and this milk – amounting to 5,640 liters – was reported to have been fed to children.
- Benefit-cost analyses – in Bulbul the benefit cost of the intervention was 1.6 whereas in Web the benefit-cost was 1.9. Sensitivity analysis showed that the intervention was robust and the benefit-cost was not unduly affected by moderate to high changes in market conditions. For example, an increase in feed price of 250% was needed to push the benefit-cost below 1. These results indicate that despite the apparently high cost of livestock feed programs such programs perform well in terms of economic performance and are relatively low-risk.

Although the findings of the assessment were generally very positive, various timing,

implementation and policy changes remain to be addressed. These include the generally low availability of livestock feeds in Ethiopia and the limited capacity of concentrate producers to meet demand and maintain quality. Interventions which are solely funded by donors will also be limited in coverage according to budget, meaning that less than a core breeding herd can be supported.

However, given the increasing local demand for livestock feed among pastoralists there are opportunities to work more with the private sector and design interventions with more attention to cost recovery for feed, or,

feed supply through the private sector using approaches such as voucher schemes. Similarly, support is needed to more long-term approaches to fodder production and supply, such as irrigated fodder production along permanent water sources and management of dry-season grazing reserves.

The overall finding of the assessment was that emergency livestock supplementary feeding during drought of up to 67 days duration could be justified in terms of livelihoods objectives and economic rationale.

1. Introduction

This impact assessment aimed to measure the impact of an emergency livestock feed supplementation program implemented by Save the Children US during drought in pastoralist communities in Liben district (Guji Zone) and Arero district (Borena Zone), Oromia region. The drought had affected the area from April 2007 through to April 2008, and under the intervention in Borena 6,750 cattle were fed¹.

The assessment was initially designed to produce a quantitative analysis of the feeding program using cattle mortality as the main indicator of livelihoods impact. Under a livelihoods approach, this relates to the objectives of protecting key assets and assisting post-drought recovery. As the assessment began, other benefits were also apparent such as improved body condition of cows, calf survival and births, and milk production. Therefore, these indicators of impact were also measured.

Also at the start of the assessment it was evident that pastoralists were feeding cattle using feed from two different sources viz. private suppliers and SC US. The feed sourced from private suppliers was a private, commercial transaction between pastoralists and sellers of livestock feed, whereas the feed provided by SC US was paid for by the organization and given free of charge to selected households. In general, cattle in relatively good body condition were fed using the feed from private suppliers whereas cattle in poor condition were fed using the SC US feed. Therefore, the assessment did not aim to compare the impact of these two different feeding practices because different types of cattle were fed in each case. Herds and households were randomly sampled, and the assessment was conducted about six weeks after the end of the drought in May 2008.

The specific objectives of the impact assessment were to:

- Assess the impact of the 2007/8 drought on livestock resources.

- Assess the impact of the supplementary feeding intervention on the mortality and post-drought production performance of cattle.
- Draw lessons to inform future decision-making and planning for emergency livestock feed interventions.

2. Methods

2.1 Study design

The design of the study took account of feed supplied by both SC US and purchased locally from private suppliers, and the movement of some cattle to better grazing areas located away from the feeding centers. Therefore, the three main groups of cattle which were considered were as follows:

- Unfed cattle, being cattle moved to better grazing and receiving no supplementary feed.
- Cows fed using feed from private suppliers, relatively close to feeding center areas.
- Cows fed in feeding centers using feed supplied by SC US.

As the main objective of livestock supplementary feeding is to protect key assets, the study focused on measuring and comparing mortality in these three groups. However, an expected finding in the feeding centers was the return to milk production of some cows, and the delivery and survival of some calves. Therefore, these production benefits were also assessed.

2.2 Study area

Liben and Arero districts are found in the Guji and Borena zonal administrative divisions of the Oromia National Regional State. The people in the rural areas are Borena pastoralists who make their livelihoods largely from livestock. They tend mixed herds of cattle, small ruminants, donkeys and camels through seasonal movements between the wet and dry seasons grazing areas. Most of the areas in these districts are classified as lowlands, with ponds and wells serving as water sources for both people and livestock during the dry months.

In 2008 drought was affecting many of the study districts, especially the more extreme lowland parts. Cattle supplementary feeding programs were implemented by SC US,

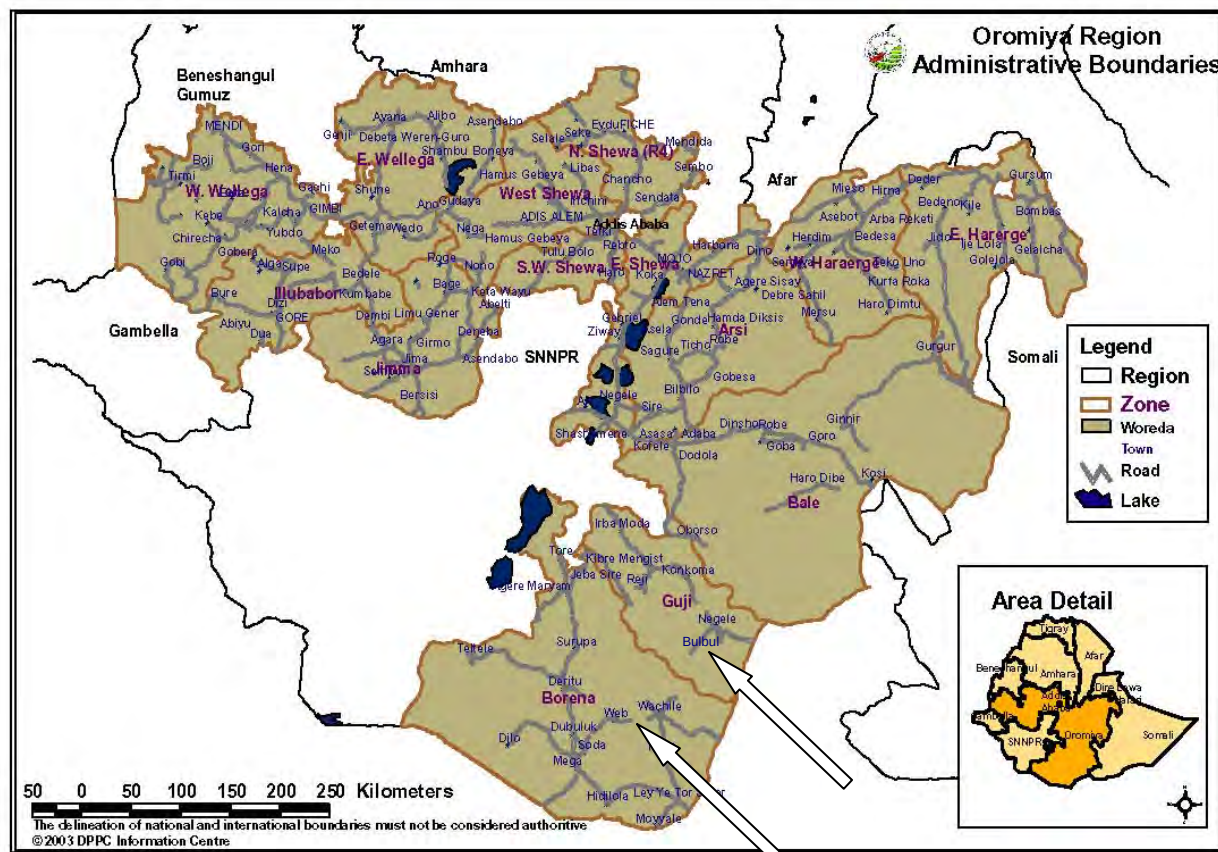
¹ The SC US program also covered Moyale and Hudet, but these areas were not covered in the assessment; the total number of cattle fed in all areas was approximately 8,000.

CARE, AFD, FAO and OPC. The SC US supplementary feeding in Arero and Dhas, and Liben was conducted between February

6th to April 16th, and from March 15th to April 13th, 2008.

Figure 1

Oromiya region showing locations of Bulbul and Web livestock feeding centers



2.3 Data collection

Both qualitative and quantitative research instruments were used, and were designed in consultation with SC US experts based in Addis Ababa who were involved in the design and implementation of the cattle supplementary feeding program. The impact assessment was conducted between 11th to 31st May 2008 by a researcher who spoke the Oromo language, and using participatory techniques and tools. Information was collected from key informant groups and individual informants as follows:

Individual informants – these informants provided quantitative data for measuring the impact of the drought and impact of the SC US program in terms of cattle survival and milk yield. Specifically, these informants explained:

- changes in herd size at the onset (May 2007) and end (May 2008) of the

drought, and the proportion of cattle leaving the herd for different reasons during this period

- the number of cattle receiving either feed supplied by SC US, or, feed purchased privately by their owners
- the mortality in cattle fed using SC US feed, cattle fed privately by their owners, and unfed cattle
- cattle movements to and from grazing areas

Key informant groups - were questioned on issues related to the causation and effects of the 2008 drought, and the general impact of the supplementary feeding program. A checklist was standardized in the field using first-hand information obtained from the SC US Negele and Arero field offices. The checklist required each group to:

- identify a normal year and define the rainfall period for the *genna* and *hagay*

season rains, and then using proportional piling, compare the relative importance of the rains based on the amount contributed to total annual rainfall

- show the variations in the timing and amount of rainfall in the 2006 and 2008 droughts
- describe major drought-associated events in 2008 including internal and external responses in their chronological orders
- comment on the emergency cattle supplementary feeding program and suggest improvement or better options
- identify contributory factors that might have aggravated the drought situation

2.4 Sampling method and sample sizes

Individual informants - SC US had established 10 cattle feeding centers, with three centers in Arero and seven centers in Liben. Two feeding centers were randomly selected, and these centers were in Bulbul and Web. In Bulbul 39 individual informants (herds) were randomly sampled from a list of 361 herds provided by SC US. In Web, 43 individual informants (herds) were randomly sampled from a list of 389 herds. Therefore, out of a total of 750 herds in these two feedings centers, 82 herds (10.9%) were sampled. The total number of cattle fed by SC US in these herds was 393.

Key informant groups - in each feeding site an informant group was formed of 10 men and two women.

2.5 Data analysis

Much of the data collected was summarized using descriptive statistics. As informants were able to provide absolute numbers of cattle fed in different ways and number of deaths, statistical comparison of mortality in cattle by type of feeding was conducted using Chi-square. The analysis was repeated for each of the two feeding centers, as the severity of drought and duration of feeding differed in the centers.

3. Results

3.1 Rainfall patterns preceding and during the drought in 2007/8

The Borena area has long been among the pastoral areas of Ethiopia most frequently affected by drought. The drought in 2007/8 was said to have started with comparative failure of the *genna* rains in March to April 2007. Local perceptions of the timing of the rains and rain failures, and the proportion of rain by season are shown in Tables 1 and 2 for the years 2003 (a good year), 2005 and 2007, and timelines for the two areas are presented in Figure 2.

Table 2
Timing of seasonal rains in normal and drought years

Area and season	Year					
	2003 ¹ Start of rain	End of rain	2005 Start of rain	End of rain	2007 Start of rain	End of rain
Arero: <i>Genna</i> <i>Hageya</i>	March October	May December	March No rain	April No rain	April No rain	April No rain
Liben: <i>Genna</i> <i>Hageya</i>	March October	May December	April October	May November	April Mid Nov	April Mid Nov

¹Most recent good year

Some key points were:

- In the ideal normal year of 2003 the rainfall period for the *genna* and *hageya* rains were said to be early March to end of May, and early October to end of December respectively.
- The 2007/8 drought was more serious in Arero with complete failure of rain in *genna* and *hageya* in 2007. This finding

was verified by the Guji Zone Emergency Task Force which declared an emergency situation in specific PAs in a letter to the Oromia regional authorities on 18th March 2008.

- The drought in Liben was less severe, with lower rainfall than ideal in terms of duration and amount of rain.

Table 3

Proportion of annual rainfall received in normal and drought years

Area and season	Year		
	2003	2005	2007
Arero:			
<i>Genna</i>	70 %	21 %	7 %
<i>Hageya</i>	30 %	0	0
Liben:			
<i>Genna</i>	77 %	62 %	46 %
<i>Hageya</i>	23 %	16 %	9 %

Figure 2

Chronology of key drought factored events in Liben and Arero

Liben / Bulbul cattle feeding site

Event	Time
➤ Poor performance of 2007 <i>genna</i> season rains; short duration and low intensity	April 2007
➤ In dry season grazing fields feed availability deteriorated critically	May 2007
➤ Livestock moved to wet season grazing fields	May 2007
➤ Pasture and cattle condition deteriorated critically	May 2007
➤ Dams that gave birth in <i>hageya</i> in October to December 2006 and their calves started dying	June 2007
➤ Pregnant cows and aged cattle especially <i>hawicha</i> /aged cows started dying	July 2007
➤ <i>Hageya</i> performed badly; uneven distribution and too short duration	Late November 2007
➤ Middle age groups started dying especially poor conditioned farming oxen	October 2007
➤ SC US launched supplementary feeding intervention	15 th March 2008
➤ <i>Genna</i> 2008 rains started	Early April 2008
➤ Feeding center closed	13 th April 2008

Event	Time
➤ Poor performance of 2007 <i>genna</i> season rains; short duration and low intensity	April
➤ In dry season grazing fields feed availability deteriorated critically	May 2007
➤ Cattle condition deteriorated critically	June 2007
➤ Strong cattle migrated	June 2007
➤ Cattle price dropped by 30% on average, from EB 2,000 to EB 1,400	June 2007
➤ Dams that gave birth in <i>hageya</i> , October to December 06, and their calves started dying	June 2007
➤ Pregnant and also aged cows/ <i>hawicha</i> started dying	July 2007
➤ <i>Hageya</i> season rains failed totally and cattle mortality increased.	October to December 2007
➤ Strong cattle moved to Dakhawata pasture, 80 km away from nearest water point	October 2007
➤ Pastoralists rented truck for 24,000 EB to water cattle at Dhakhawata	October 2007
➤ Geri and Borena conflict over the Dakhawata pasture field turned into gun fire	November 2007
➤ Feed price increased by 34%, hay from EB 35 to 47, concentrate from EB 130 to 140	November 2007
➤ Grain price rose 185%, from EB 200 to 570	
➤ SC US launched cattle supplementary feeding program	6 th February 2007
➤ <i>Genna</i> 2008 rains started	Mid April 2008
➤ Feeding center closed	18 th April 2008

Note - in all feeding centers established by SC US, the feeding period extended 7 days into the *genna* rains. Cattle owners were responsible for collecting feeds on a daily basis and arranging night shelter for the cattle brought to feeding centers.

3.2 Pastoralist's internal response to the drought

In response to the 2007/8 drought, pastoralists started to use their own resources to protect their livestock. The impact assessment showed that:

- *Movement to better grazing* - 54% (44) of the study households moved cattle to better grazing areas, especially Dhekhawata; approximately 39% of all cattle were moved.
- *Water supply* - a truck was rented for EB 24,000 to transport water from sources located 80 km away to Dhakhawata; this took place before the Geri and Borena conflict over the pasture field led to conflict.
- *Purchase of livestock feed* - 49% (40) of the study households purchased animal feeds. The feeds purchased included frushka, teff-straw/ched and hay transported from Sululta, and locally-harvested grass. Within those herds assessed, 32% of cattle were fed with

these different feeds purchased by their owners. The income needed to buy feed was acquired through cattle sales, with a mean of 14.0% (95% CI 7.5%, 21.0%) of cattle sales income spent on feed in Bulbul, and 35.9% (95% CI 24.0%, 47.8%) of cattle sales income spent on feed in Web.

According to informant group discussions, the problem of livestock feed shortage during the drought was exacerbated by changes to traditional grazing areas. For example, the good pasture located in the water-shed area called *Did-Liben* had been converted into farmland, and the wet season pasture on hillsides was now all-season pasture due to the development of water points by NGOs and local government. It was said that the wet season pasture, which used to be an asset to be exploited at times of critical drought, had become unusable in recent years. In addition to changes to grazing areas, in Arero conflicts with multiple tribes such as Geri, Guji and Gebra were emphasized to have restricted

normal movements (see Figure 3). Further factors which contributed to livestock feed problems were:

- Inadequate supply and high price of livestock feed inputs.
- Absence of an effective livestock marketing facility; a common complaint was that livestock traders used to collect livestock on a credit basis and so the payment was delayed by about three months.
- Extremely high grain prices and absence of food aid assistance was linked to the reduced capacity of herders to buy animal feed.

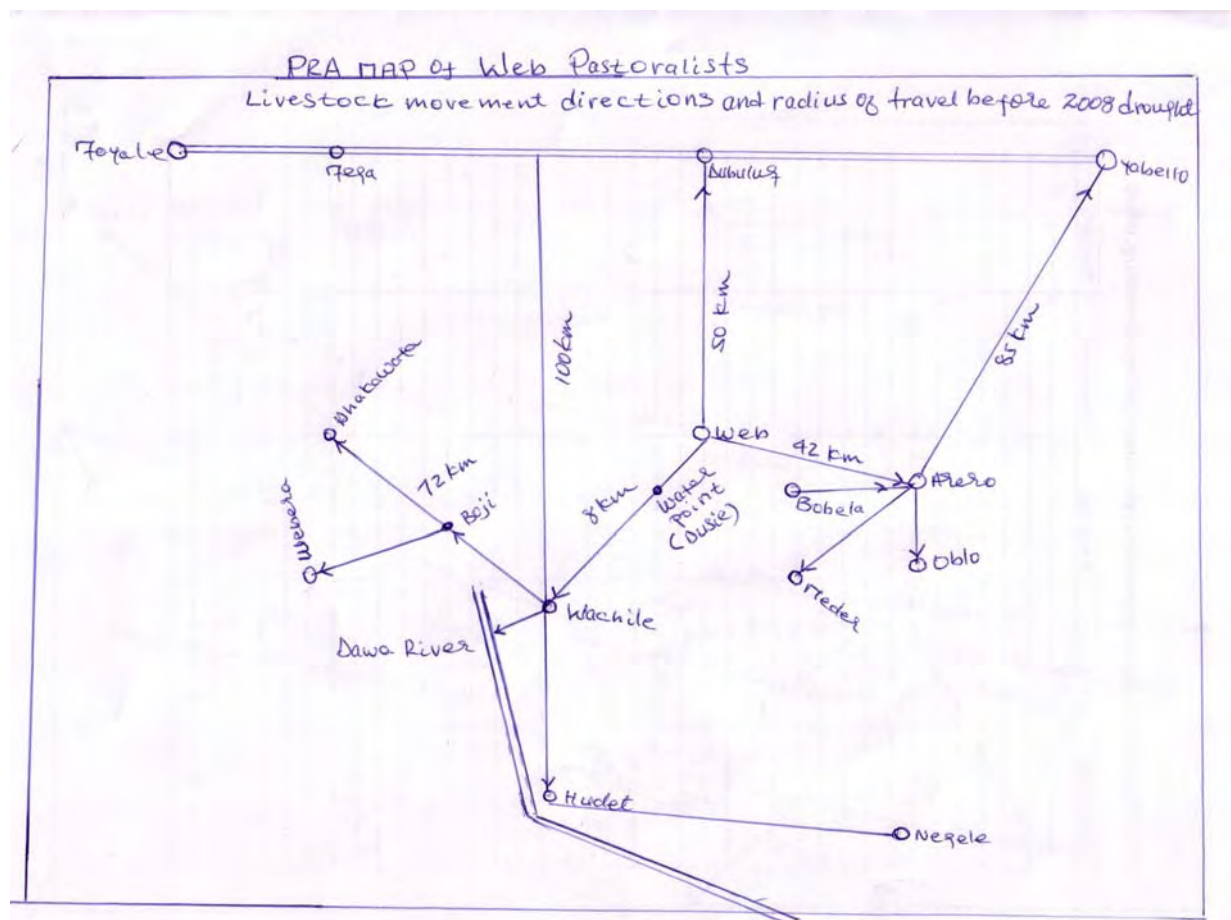
The concerns from pastoralists need to be viewed in the context of market practices

and other trends. In 2008 during drought the price of cattle was relatively higher than other years and in part, this could be due to the purchase of cattle using a credit arrangement.

Similarly, relative to other years with limited use of livestock feed, private sector actors such as the Elweya multi-purpose cooperative, grain trading groups supported by SC US, and livestock traders had supplied livestock feeds into the area from Addis Ababa. The Elweya multi purpose cooperative was selling a 20kg bale of hay for EB 38. After the initial purchase price of EB 21 in Sululta and taking account of EB 7 for transport and other overhead costs, the profit was EB 10 per bale.

Figure 3
Movement and conflict during the drought

a. Normal movements before the drought in 2008



b. Movements and conflict during the 2008 drought

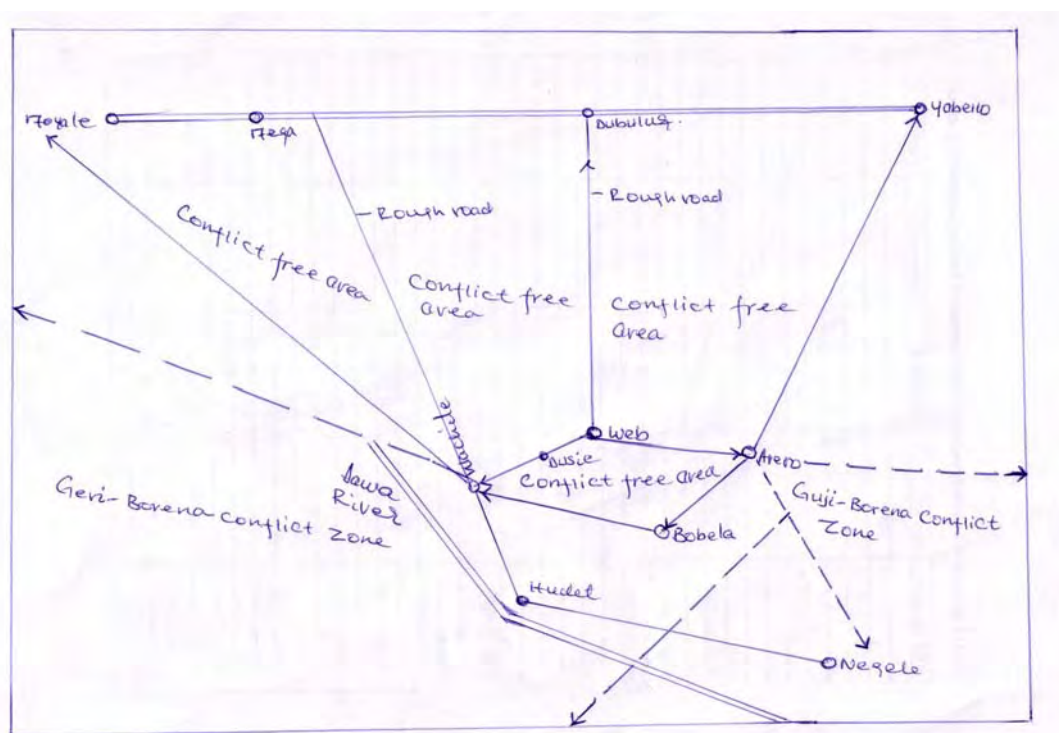


Table 4
Cattle and animal feeds price in local markets

Item	Average price (range)(EB)
Hay	40 (35-41)/bale
Concentrate	135 (130-140)/quintal
Bull (8-9 years of age)	1,700 (1,400-2,000)/head

Table 5
Amount and cost of feed ration for adult cows

Type of feed	Daily ration per head adult cow (kg)	Ration (kg) required for 60 days/head	Total feed cost per cattle head (EB)
Hay	2	120	81
Concentrate	1	60	273
Total			354

Note – using the figures in Table 4 and 5, the sale of an adult bull would feed 5 cows for at least 2 months

3.3 The Save the Children US supplementary feeding intervention for cattle

The SC US cattle supplementary feeding program was mainly a response to the failure of the *hageya* season rains. In Guji Zone, an emergency situation was declared in March 2008, and the Web and Bulbul feeding centers studied were opened on February 9th and March 15th, 2008

respectively; noticeably, the Web feeding center opened before the official declaration of an emergency.

The approach used by SC US was to prioritize the most drought-affected PAs based on the distribution of the *hageya* rainfall, cattle condition and cattle mortality. As a result, in Web and Bulbul feeding centers a total of 800 and 1,000 cows were fed for 67 and 22 days respectively (i.e.

for February 9th to April 16th in Web, and from March 15th to April 15th in Bulbul). However, in the majority of the more distant PAs the villages and households did not utilize their quota for feeding centers because cattle were too weak for the demanding trek to the centers. Consequently, people were forced to pass their quota to relatives based nearer to the

feeding centers. As a result of the transfer of quota to relatives and the allocation of quota to weaker cattle by community representatives, in some herds 10 to 30 cattle were fed. Further information on the design and implementation of the emergency feeding program is presented in Tables 6 to 8.

Table 6
Selection criteria for the cattle feeding program

Selection criteria	Ranking of criteria
Site for feeding centers:	
Availability of water	Essential
Center to PAs/villages intended to be served	Essential
High cattle population density	Secondary
Cattle selection:	
Female, 3-4/herd	Essential
Breeding	Essential
Poor conditioned	Secondary

Table 7
Number of cows fed at SC US feeding centers

Zone, site	Number of cows fed
Guji zone:	
Bulbul	1,000
Mesa	1,000
Nurahumba	1,000
Borena zone:	
Web	800
Borbor	900
Wachile	500
Kekello	450
Dhas	500
Walensu	300
Annole	300
Total cows fed	6,750

3.4 Impact of drought on the cattle population

Between April 2007 and May 2008 (the time of the assessment), the cattle population in the study herds declined as follows:

- In Bulbul the cattle population declined from 737 to 439, being a 40.4% reduction. The decline was attributed to 173 cattle deaths (58% of herd loss) and 125 cattle sales (42% of herd loss).

- In Web the cattle population declined from 1,057 to 603, being a 42.9% reduction. The decline was attributed to 288 cattle deaths (63% of herd loss) and 166 cattle sales (37% of herd loss).

These figures show the severe impact of the drought on the cattle population, and indicate that the SC US cattle supplementary feeding program was an appropriate response.

Table 8
Daily rations for cattle fed in SC US feeding centers

District	Teff-straw/ched (kg/head)	Hay (kg/head)	Frushka (kg/head)
Arero:			
Home fed approach	0	1	1.5
Feeding centers	0	2	1
Liben:			
Feeding center before arrival of hay and frushka	4	0	0
Feeding center after arrival of hay and frushka	0	2	1

3.5 Impact of supplementary feeding on cattle mortality

The impact of supplementary feeding on cattle mortality is shown in Tables 9 and 10. In both Bulbul and Web feeding centers, mortality in cattle which were fed using feed from SC US was significantly lower than mortality in either cattle moved to distant grazing areas, or cattle receiving feed purchased from private suppliers. In Bulbul, an area affected by moderate drought, cattle were approximately 3 times less likely to die if they received feed from SC US centers.

In Web, affected by severe drought, cows were 1.6 times less likely to die if fed by SC feeding centers. These differences were explained by the high quality and amount of feed used in the SC US feeding centers. In Bulbul, the use of private feed was not an effective way to reduce cattle deaths (mortality 37.1%) compared with moving

cattle to better grazing areas (mortality 25.4%). Cattle receiving private feed did not migrate and therefore, were highly dependant on this private feed. However, most of the feed purchased was teff straw and the ration used was far too low to sustain the animals.

In Web, the use of private feed was no more effective than moving cattle to grazing areas in term of reduced mortality. Although more concentrate feed was purchased privately in Web, these purchases took place only after cattle had returned from Dhakawat grazing area, and at this time they were stressed and in poor condition. At the same time, pastoralists were still waiting for payment for cattle sold earlier in the drought and the price of feed was increasing. This combination of factors led to small amounts of concentrate feed being used for cattle which were already in a very poor state.

Table 9
Mortality in cattle

Location/group	Mortality
Bulbul area - affected by moderate drought; 22-day feeding program started on 15th March 2008:	
Unfed cattle moved to grazing areas	108/425 (25.4%)
Cows fed using SC US feed	13/161 (8.1%)
Cows fed using private feed	56/151 (37.1%)
Web area - affected by severe drought; 67-day feeding program began on 9 th February 2008:	
Unfed cattle moved to grazing areas	139/407 (34.2%)
Cows fed using SC US feed	49/231 (21.2%)
Cows fed using private feed	142/419 (33.8%)

Table 10
Statistical analysis of mortality

Comparison	Chi-square
Bulbul area - affected by moderate drought; 22-day feeding program started on 15th March 2008:	
Unfed cattle vs. cows fed using SC US feed	21.4, $p < 0.001$
Unfed cattle vs. cows fed using private feed	7.5, $p < 0.01$
SC US fed cows vs. privately fed cows	38.1, $p < 0.001$
Web area - affected by severe drought; 67-day feeding program began on 9 th February 2008:	
Unfed cattle vs. cows fed using SC US feed	18.0, $p < 0.001$
Unfed cattle vs. cows fed using private feed	1.2, ns
SC US fed cows vs. privately fed cows	11.5, $p < 0.01$

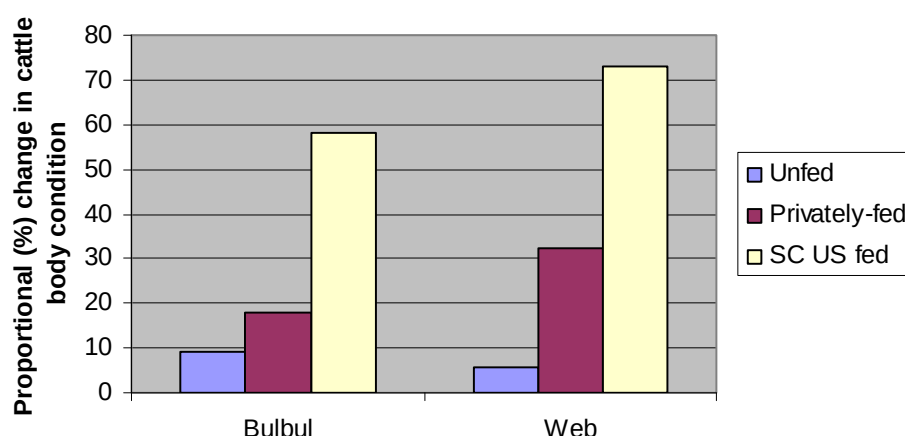
ns – not significant

3.6 Impact of supplementary feeding on cattle body condition

The impact of supplementary feeding on cattle body condition is illustrated in Figure 4. The graph shows the proportional change in cattle body condition at the onset of

drought in April 2007 and the situation six weeks after the end of drought (at the time of the assessment) in May 2008. The graph shows that in SC US feeding centers, a much higher proportion of cattle shifted from poor to moderate body condition relative to cattle receiving privately-supplied feed, or unfed cattle.

Figure 4
Increasing body condition in cattle by type of supplementary feeding



3.7 Impact of supplementary feeding on milk yield and calf survival

From the informant group discussions it was evident that the majority of the cattle deaths, especially at the early stage of the drought, occurred in milking dams and their calves, and pregnant cows. In the two SC US feeding centers assessed, 48.6% (191/393) of

cows either returned to milk production, or began milk production following the birth of calves while in the feeding centers.

- Calf births and deaths – in Bulbul a total of 93 calves were born and of these, 87 survived (mortality in calves of 6.5%); in Web a total of 118 calves were born and 111 survived (mortality in calves of 5.9%).
- Milk production - in Bulbul, the mean daily milk yield was 0.7 l/day (95% CI

0.44, 0.97; n=46) and the estimated total milk production was 2,276 liters while cows were fed in the feeding center. In Web the mean daily milk yield was 0.9 l/day (95%CI 0.64, 1.22; n=63) and the estimated total milk production was 3,364 liters while cows were fed in the feeding centers. Informants clearly underlined that this milk was fed to children.

3.8 Benefit-cost analysis of SC US supplementary feeding

A benefit-cost analysis was conducted for each of the two feeding centers covered by the assessment, and results are shown in Tables 11 and 12. The assumptions in the benefit-cost calculations were as follows:

- The market value of reduced cattle mortality could be derived from a comparison of mortality in unfed and SC-fed cattle, and an estimated market value of adult cows at the start of the drought of EB 1,500 (\$163)
- The market value of improved body condition of cattle in feeding centers

could be estimated by comparing the proportional increase in SC US-fed cows moving from 'poor' to 'moderate' body condition relatively to unfed cattle; the calculation assumed that cows in poor condition would be valued at an average price of EB 1,500 (\$163) whereas cows in moderate body condition were valued at EB 2,500 (\$272) i.e. an increased value of \$109. Although this is a theoretical calculation (because adult cows are rarely sold), there will be an economic benefit associated with having cows in better condition at the end of a drought because such cows will return to production relatively quickly, and produce calves and milk sooner than cows in poor body condition. However, this return to production requires a longitudinal study and so could not be directly measured in the impact assessment

- The market value of milk was estimated at EB 3.0 (\$0.33) per liter

Table 11
Benefit-cost analysis of supplementary feeding in Bulbul feeding center

Item	Amount (\$)
Costs	
Cost of cattle feed used 22 days x 1000 cows	19,273
Transport costs for feed	24,530
Loading and unloading costs	167
Vehicle rent	260
Enumerator and CAHW	407
SC US technical and admin staff costs	850
Other cost	892
SC US overheads	4,637
<i>Total costs</i>	<i>51,017</i>
Benefits	
Value of cattle losses prevented in feeding center = {(25.4% x 1000 cows) - (8.1% x 1000 cows)} ¹ x \$163	28,199
Value of improved body condition of cows, end May 2008 ² = 48.7% x (91.9% x 1000 cows) x \$109	48,783
Value of milk produced over 22 days in feeding center = 2276 liters ³ x \$0.33/liter	751
Value of calves delivered and survived in feeding center = 87 calves ³ x \$54.30	4,724
<i>Total benefits</i>	<i>82,457</i>
Benefit-cost ratio	1.62:1

Notes for Table 11

¹ From Table 9, this formula calculates the value of cows saved in SC US feeding centers relative to unfed cattle by using mortality rates in SC US-fed and unfed cattle; a value of \$163 is the value at the onset of drought.

² From Figure 4, section 3.6, this formula excludes cattle which died during the drought, and uses the proportional increase in body condition from 'poor' to 'moderate' in SC US-fed cows compared with unfed cattle; moderate condition value of \$272 less poor condition value of \$163 = \$109.

³ From section 3.7

Table 12

Benefit-cost analysis of supplementary feeding in Web feeding center

Item	Amount (\$)
Costs	
Cost of cattle feed used = 67 days x 800 cows	17,900
Transport costs for feed	13,326
Loading and unloading costs	0
Vehicle rent	260
Enumerator and CAHW	507
SC US technical and admin staff costs	666
Other cost	1,038
SC US overheads	3,369
<i>Total costs</i>	<i>36,067</i>
Benefits	
Value of cattle losses prevented in feeding center = {(34.2% x 800) - (21.2% x 800)} ¹ x \$163	16,952
Value of improved body condition of cows, end of May 2008 ² = 67.5% x (75.8% x 800 cows) x \$109	46,382
Value of milk = 3664 liters x \$0.33/liter, produced over 67 days in feeding center	1,209
Value of calves delivered and survived in feeding center= 118 calves x \$54.30	6,027
<i>Total benefits</i>	<i>70,570</i>
Benefit-cost ratio	1.90:1

¹ From Table 9, this formula calculates the value of cows saved in SC US feeding centers relative to unfed cattle by using mortality rates in SC US-fed and unfed cattle; a value of \$163 is the value at the onset of drought

² From Figure 4, section 3.6, this formula excludes cattle which died during the drought, and uses the proportional increase in body condition from 'poor' to 'moderate' in SC US-fed cows compared with unfed cattle; moderate condition value of \$272 less poor condition value of \$163 = \$109.

³ From section 3.7

Using results from the Web feeding center, sensitivity analysis was conducted on the BCR, as shown in Table 13. This analysis is important because a 'large' or positive BCR of say 10:1 may be highly sensitive to relatively small changes in intervention, market or impact factors. In such a situation, the intervention may be economically viable in crude terms but high-risk in terms of intervention or market changes.

While the BCR of 1.9 in Table 12 indicates that livestock supplementary feeding over a 67-day period is economically beneficial, the sensitivity analysis in Table 13 shows that the intervention is robust and not overly sensitive to the kinds of market changes which might occur during or shortly after drought. For example, in a scenario in which the cattle feed price increased by 20%, the BCR falls by only 9.5% to 1.72. Although not shown in Table 13, feed prices would need to increase by 250% for the BCR to fall below 1:1.

Table 13
Sensitivity analysis for the benefit-cost of supplementary feeding at Web

Changes in cattle mortality, condition and cost of feeding	Benefit-cost (proportional change relative to field model)		
	Field model	Cattle and milk market values at end of drought	
		Decrease by 10%	Decrease by 20%
Field model	1.90	1.71 (-10%)	1.52 (-20%)
<u>Cattle mortality</u>			
Increase by 10%	1.70 (-10.5%)	1.53 (-14.2%)	1.36 (-28.4%)
Increase by 20%	1.50 (-21.1%)	1.35 (-28.9%)	1.20 (-36.8%)
<u>Cattle body condition</u>			
Decrease by 10%	1.78 (-6.3%)	1.60 (-15.8%)	1.42 (-25.3%)
Decrease by 20%	1.65 (-13.2%)	1.49 (-21.6%)	1.32 (-30.5%)
<u>Cost of feeding</u>			
Increase by 10%	1.81 (-4.7%)	1.63 (-14.2%)	1.63 (-14.2%)
Increase by 20%	1.72 (-9.5%)	1.55 (-18.4%)	1.45 (-23.7%)

3.9 Future refinement of the supplementary feeding arrangements

Table 14 describes some of the limitations of the supplementary feeding program identified by stakeholders, how these limitations affected the program and suggestions for improvements or better options for future interventions. These are based on comments by stakeholders, including beneficiaries, SC US staff and researchers.

Table 14
Local stakeholder review of supplementary feed intervention

Limitation identified (source)	Outcome	Suggested options
The proportion of the cattle population targeted per district, PA and village was too low relative to the need (reported by beneficiaries).	In response to communities' requests, in Arero the project opened additional feeding centers in Annole and Qalqalo on March 18th and March 20 th , 2008.	Reduce reliance on feeding centers by increasing private sources of quality feed e.g. on a cost-recovery basis, which cattle owners can access in times of drought.
Few, scattered feeding centers, located far from some PAs and villages (reported by beneficiaries and staff).	Cattle were too weak to reach those feeding centers located 10-20 km away, resulting in many of the beneficiaries from the more remote villages passing their quota to relatives.	Distribute feeding centers more evenly across the PA and establish centers at village level.
The requirement that cattle owners should look after and prepare night shelters for the cattle brought to the feeding centers meant that they had to leave behind the rest of the herd, un-tended (reported by beneficiaries). Note that in the response to the 2006 drought, animals submitted to the feeding centers were fed and cared for by the project.	Many households did not have the necessary labor to be able to lift/transport weak cattle to the centers as well as manage the remainder of the herd, and found it difficult to meet the costs incurred e.g. in paying for food for cattle attendants at the centers. This resulted in some beneficiary households passing their quota to relatives.	Beneficiaries suggested distributing feed directly to households, rather than at feeding centers. This has not been done in the past for fear that feed would be shared amongst too many cattle. However, cattle owners said that if alternative sources of feed were available on a cost-recovery basis, emergency feed would be kept for the most vulnerable cattle.

Table 14 (continued)

The feeding center was open-air and was not fenced or controlled by project staff (<i>reported by project staff</i>).	The lack of control meant that cattle owners could substitute the registered cattle and/ or share feed with their other cattle once the former started to improve. In response, the project started to mark the registered cows.	The open-air design can reduce program overhead costs, but requires that additional supervisory staff is hired to manage and control cattle movements in the centers.
The emergency feed quota was only targeted at female cattle (<i>reported by beneficiaries</i>).	Although the cows were ready, breeding was limited because some of the bulls were too weak to mount.	Include breeding bulls and farming oxen in the emergency feeding program.
The amount of feed supplied per head of cattle was inadequate, particularly in the case of teff-straw, which has a low nutritional value (<i>reported by beneficiaries</i>).	Cattle survived rather than put on weight in the centers. Given the poor post-drought <i>genna</i> rain, owners considered that these cattle were still vulnerable and would be at risk in the next dry season.	Teff straw should be supplemented with the provision of higher quality concentrates such as nug-cake/fagulo.
In Dhas, the Oromia Pastoralists Development Commission (OPADC) also established a feeding program in the same village as the SC US feeding center (<i>information from beneficiaries and SC staff</i>).	Inconsistencies in feed supply for the OPADC program meant that SC came under pressure both from cattle owners and woreda administration to lend them feed from the SC feeding center.	More effort is needed to ensure that emergency interventions by different actors are adequately coordinated and resourced.
Veterinary drugs from FAO arrived late (<i>reported by project staff</i>).	There is no data relating to the impact of the delay i.e. none of the randomly sampled cattle died due to disease/ lack of drugs. However, late arrival of drugs should be avoided.	Consider alternative systems of drugs supply. For example, equipping CAHWs so that they are able to provide drugs and veterinary services as and when needed. Donor funds could then be used to replenish CAHWs' kits and pay for veterinary services provided to targeted cattle owners using a voucher system.

4. Discussion

Borena Zone in Oromia Region is one of the most frequently drought-affected pastoral areas in Ethiopia. The 2007/08 drought started with the comparative and complete failures of the *genna* and *hageya* rains respectively, and cattle-dependant households experienced serious economic decline due to cattle losses. In response to the drought, cattle supplementary feeding programs were implemented in Oromia by a number of NGOs, UN agencies and government bodies, both in Borena and Guji Zones. Program implementation methods varied from place to place, depending on the organizations involved. In the case of SC US, open air feeding centers were established in selected sites in each district.

Since the drought in some pastoralist areas of Ethiopia in 2005 to 2006, there has been greater interest in and use of livestock supplementary feeding. In the case of the 2007/08 drought, private feed sources included the delivery of relatively large amounts of hay and concentrate feeds from highland areas into pastoralist areas by private sector actors such as the Elweya multi-purpose cooperative, grain trading groups and livestock traders. Feed supply was also boosted by locally produced and harvested grass marketed mostly by women.

In terms of the demand for feed, almost half (49%) of the households sampled during the impact assessment had purchased livestock feeds. Within the herds assessed, 29% of the total drought survivor cattle population had been fed with purchased feed, whilst 26% had been fed using feed provided by SC US.

However, an increasing incidence of drought and the absence of reliable feed sources in the country may undermine the role of supplementary feeding in protecting pastoralists' key assets. Some of the challenges faced during the 2007/08 drought, included:

- While many pastoralists increasingly accept feed purchase as appropriate for protecting core stock, half of the families involved in the study could not afford to buy feed. This was partly due to the inflated grain price and the increase in price of livestock feed (34% over the period of the drought) along with the reduction in the price of cattle (30% over the period of the drought). Income from cattle sales was the main source of cash for the purchase of livestock feed.
- The local trading system for cattle also hindered the capacity of people to buy livestock feed. Traders purchase cattle on credit, and herders then have to wait to receive the cash. Payment is often delayed and no interest is provided, limiting the cash available for feed purchase.
- In the absence of food aid, poor families naturally prioritized the money obtained from sale of livestock for the purchase of human food items rather than livestock feed.
- Due to the low quality (and quantity provided) of most privately purchased feed, this was not found to be an effective way to reduce cattle deaths. In fact, in Bulbul, mortality was significantly higher in moderate condition cattle fed with an inadequate amount of low quality feed purchased by their owners such as teff-straw/ched and dry grass, than in cattle that were moved to better grazing areas.
- Particularly in the absence of reliable livestock and animal feed marketing facilities, moving cattle to better grazing could be promoted as a relatively successful means of coping with drought. However, this option has been highly undermined by the conversion of dry season pasture into farmland and the establishment of year-round water facilities in traditional wet season grazing areas. Previously, wet season pasture was exploited as a source of feed during critical periods, but year round grazing has left the pasture degraded and no longer an asset in a drought situation.

Some implications of the study are:

- Emergency livestock supplementary feeding during drought of up to 67 days duration can be justified in terms of livelihoods objectives and economic rationale.
- Donor-funded interventions alone cannot meet the need to support and maintain core breeding herds in a drought situation. Depending on the type of drought, targeting vulnerable milking and pregnant cows may be more appropriate than targeting breeding stock and will have beneficial side-effects in terms of milk production and calf survival.
- However, in the long term, in order to protect the livestock assets of pastoralists in areas prone to recurrent drought, it will be essential to ensure an adequate supply of affordable livestock feeds. This will require action on a number of fronts, for example, promoting private sector feed supply, investing in fodder production and the sustainable management of traditional grazing reserves. At the same time, mechanisms need to be developed whereby the most vulnerable livestock owners are able to purchase feed for example, through cost-recovery mechanisms or voucher schemes.
- For example, government policies could promote and encourage private livestock feed production and feed processing industries, provide tax-incentives for feed producers that trade and/or store feed in pastoralist areas, and ban the export of feed during drought periods.
- At the same time, aid agencies could play a role in establishing and strengthening sustainable local feed input sources by supporting existing grain trading groups and livestock traders, for example by subsidizing the cost of feed transportation in the short term.
- More support, in terms of enabling policies and practical support, is also needed for longer-term approaches to fodder production and supply such as irrigated fodder production along permanent water sources, and the sustainable management of traditional grazing lands. Land use policies for pastoral areas should limit the

conversion of watershed-based dry season pasture to farmlands and ban the establishment of year round water facilities in traditional wet season grazing areas.

- In relation to the demand side, given the increasing local demand for livestock feed among pastoralists, there are opportunities for aid agencies to work more with the private sector and design interventions with more attention to cost-recovery for feed, or, the supply of feed through the private sector using approaches such as voucher schemes targeted at the most vulnerable households.

- Financial institutions such as the Oromia Cooperative Bank could be supported to facilitate the provision of financial services (credit, seed money or revolving funds) to pastoralists that would allow them either to borrow feed 'in kind' or cash for feed purchase, to be repaid following the drought period.
- In terms of the provision of food aid, where such assistance is necessary for the most vulnerable households, food aid can allow scarce resources to be invested in protecting livestock assets e.g. through the purchase of feed.