



## 4.14 ECOLOGY

### 4.14.1 FLORA

A reconnaissance survey and detailed data collection of the vegetation composition, abundance, cover, physiognomy and other relevant ecological information of the core and buffer area was conducted at different locations in August 2007. The study has been carried out by experts from the University of Addis Ababa.

The following activities were conducted during the field investigation:

1. Extensive survey and sampling of the vegetation
2. Formal and informal discussions with the local communities living in and around the project area
3. Review of published literature and other relevant documents.

Transects were laid across the valley and twenty three plots representing the core and buffer zones were established to collect base line vegetation data. In each plot, the plant species encountered and percent cover of each species were recorded. Exotic plant species found in the area were also recorded. Cultivated plants on the field and those cultivated at other times were recorded with the help of informants. A total of 241 plant species in 79 families were encountered.

These were compared with the IUCN database for endemism and threat status. GPS coordinates of each plot together with altitude were also recorded. Contour Map of the area was obtained and both the GPS coordinates and the map were projected to UTM Adindan 37N.

#### 4.14.1.1 Landscape Description

The landscape and associated vegetation of the core (plant and quarry sites) and the buffer areas can be classified into the following:

1. Highland plateau
2. Valleys dissecting the plateaus
3. River and Stream tributaries of River Muger

#### 4.14.1.2 Highland Plateau

The plateau, which is found in the range between 2300-2450 m above MSL is composed of rolling landscape covering both the core and buffer impact zones. This altitudinal range is favorable for highland mixed cereal-livestock agriculture and supports a high population density. The farmlands are adjacent to each other and there is very little open land. There are grazing areas dotted among the farmlands. The dominant crops such as barley, beans, peas, wheat, and nigerseed are cultivated on the plateau and cattle, sheep, goats and equines are the common livestock component. The crops that are cultivated both in the highlands and the lowlands are presented in **Table 4.22**.

Sn	Species	Family	Status
1	Allium sativum	Alliaceae	Cultivated
2	Allium sepa	Alliaceae	Cultivated
3	Guizotia abyssinicum	Asteraceae	Cultivated
4	Cartamus tinctoria	Asteraceae	Cultivated
5	Helianthus annuus	Asteraceae	Cultivated
6	Ipomoea batatas	Convolvulaceae	Cultivated
7	Vicia faba	Fabaceae	Cultivated
8	Pisum sativum	Fabaceae	Cultivated
9	Cicer arietinum	Fabaceae	Cultivated
10	Lens culinaris	Fabaceae	Cultivated
11	Vicia benghalensis	Fabaceae	Cultivated
12	Trigonella foeniculum-graecum	Fabaceae	Cultivated
13	Linum urtissimum	Linaceae	Cultivated
14	Musa paradisiaca	Musaceae	Cultivated
15	Sesamum orientale	Pedaliaceae	Cultivated
16	Hordeum vulgare	Poaceae	Cultivated
17	Triticum aestivum	Poaceae	Cultivated
18	Sorghum bicolor	Poaceae	Cultivated
19	Eragrostis teff	Poaceae	Cultivated
20	Zea mays	Poaceae	Cultivated
21	Avena abyssinica	Poaceae	Cultivated
22	Solanum tuberosum	Solanaceae	Cultivated
23	Lycopersicon esculentum	Solanaceae	Cultivated

**Table 4.22 : Cultivated Species in the Core and Buffer Zones**

There is no continuous vegetation cover on the plateau except some patches or isolated trees, which are planted for various purposes. The plateau was covered by dry evergreen montane forest before human settlement. The current vegetation in this area is mainly dominated by herbaceous genera including Pennisetum, Sporobolus, Eleusine, Chloris, Aristida, Phalaris, Commelina, Trifolium, Alchemilla and Cyperus. Most of these are



**Fig. 4.29 : Barley farm on the plateau with eucalyptus trees in the background**

highly valuable pasture species. Trees species on the plateau are restricted to churchyards and isolated patches around homesteads such as *Euphorbia candelabrum*, *Juniperus procera*, *Acacia abyssinica*, *Hagenia abyssinica*, *Olea europaea* ssp. *Cuspidata*, and *Podocarpus falcatus*. There are about 12 exotic species including *Eucalyptus globulus*, *E. camaldulensis* and *Cupressus lusitanica* plantation sites in the plateau (**Table 4.23**).

Species	Family	Use and Status
<i>Agave americana</i>	Agavaceae	Fiber, hedge, cultivated
<i>Agave sisaliana</i>	Agavaceae	Fiber, hedge, cultivated
<i>Schinus molle</i>	Anacardiaceae	Shade, construction
<i>Casuarina equisetifolia</i>	Casuarinaceae	Construction
<i>Cupressus lusitanica</i>	Cupressaceae	Construction
<i>Acacia decurrens</i>	Fabaceae	Nitrogen fixation, construction, fodder
<i>Acacia melanoxylon</i>	Fabaceae	Nitrogen fixation, construction, fodder
<i>Sesbania sesban</i>	Fabaceae	Nitrogen fixation, construction, fodder
<i>Musa paradisiaca</i>	Musaceae	Food
<i>Bougainveillia</i> sp.	Nyctaginaceae	Ornamental
<i>Eucalyptus camaldulensis</i>	Myrtaceae	Construction, fuelwood
<i>Eucalyptus globulus</i>	Myrtaceae	Construction, fuelwood
<i>Grevellia robusta</i>	Sapotaceae	Construction, fuelwood

**Table 4.23 : Exotic Species Grown in the Study Area**

#### 4.14.1.3 The Valley and Inaccessible Hill Slopes

The steep slope of the valley precludes intensive agricultural activities except in some places where the slope is gentle. The vegetation cover is composed of dry evergreen thicket and shrubs and a few species of larger trees. This vegetation type is remnant of the degraded vegetation type found on the plateau.



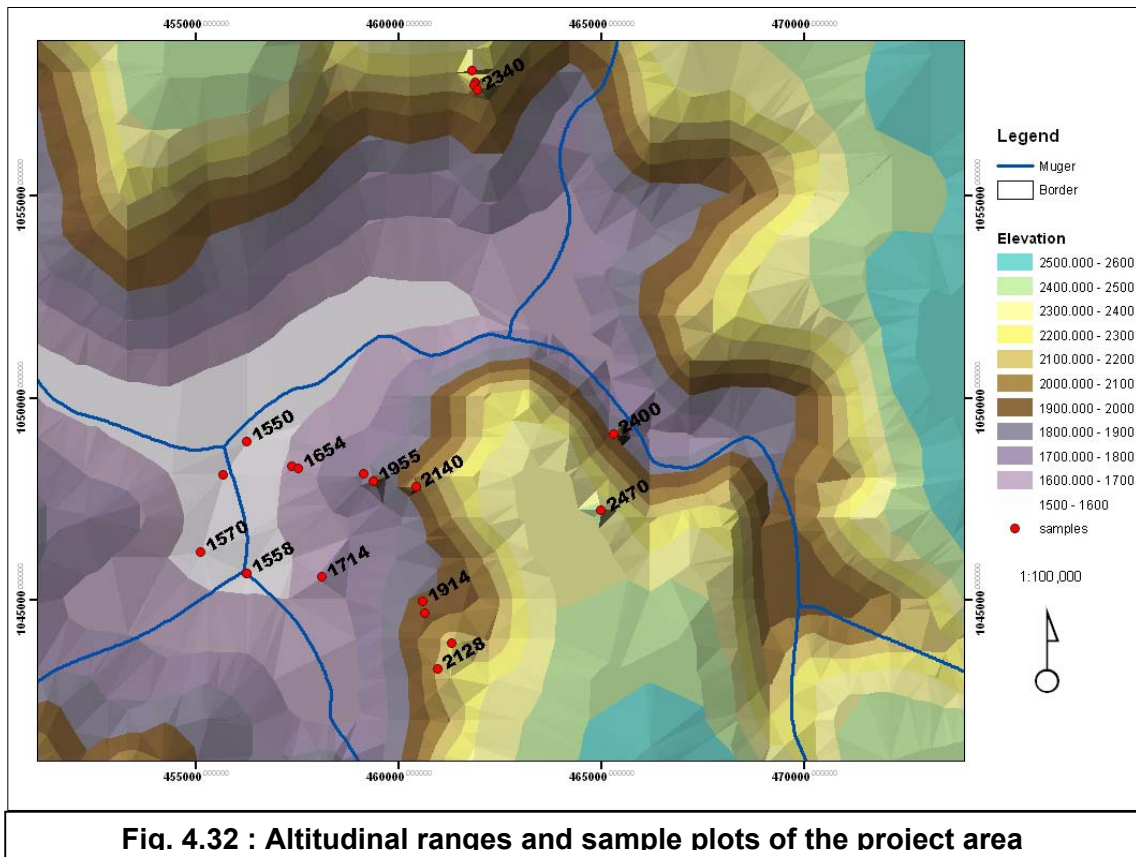
**Fig. 4.30 : Vegetation cover on the inaccessible hill-slope and farmlands on the more gentle slope of the Muger Valley**

In the valleys and hill slopes, the vegetation is dominated by shrub lands and scrublands with an average canopy height of 1.5 m. In most places of the valley, the vegetation is highly exploited for charcoal production and fuel wood. The valleys are major suppliers of charcoal to the highlands and the neighboring towns including Addis Ababa. Agriculture has encroached into the valleys and hill-slopes and marginal lands that are not favorable for crop cultivation reducing the vegetation cover in the hillsides.



**Fig. 4.31 : Charcoal Production in the Valley**

The vegetation in the valley varies in composition and abundance depending on altitude. The top of the valley is covered mainly by herbaceous and scrubby species such as *Carissa spinarum*, *Osyris lanceolata*, *Euclea racemosa*, and *Dodonaea angustifolia*. At lower elevations, there is a decline in herbaceous cover and an increase in woody shrubs such as *Rhus natalensis*, *Acacia* spp., *Balanites aegyptiaca*; and succulents such as *Opuntia-ficus indica* and *Euphorbia candelabrum*. The detailed description of the vegetation along the altitudinal range is given below. The species composition and abundance in the plots sampled both on the plateau and the steep slopes of the Muger valley are shown in **Annex 4.7**. The map showing the altitudinal range is enclosed as **Fig. 4.32**.



**Fig. 4.32 : Altitudinal ranges and sample plots of the project area**

1. 1500 - 1600 m altitudinal range - Average altitude for the plots is 1557 m.

*Acacia ehrenbergiana, Acacia gerrardi, Acacia tortilis, Acacia etbaica, Acokanthera schimperi, Balanites aegyptiaca, Cadaba farinosa, Calpurnia aurea, Clerodendrom myricoides, Combretum molle, Commicarpus grandiflorus, Commiphora schimperi, Euclea racemosa, Euphorbia candelabrum, Euphorbia tirucalii, Maerua triphylla, Maytenus arbutifolia, Opuntia ficus indica, Plectranthus sp., Rhus natalensis and Senna singuinea* were encountered in the plots.

Dominant species in this altitudinal range are *Acacia gerrardi, A. tortilis, Opuntia ficus-indica* and *Acacia etbaica*.

*Ficus sur, Ficus vasta, Acacia lahai, Coccinia abyssinica, Ficus thonningi, Urtica simensis, Grewia velutina, Acacia lahai, Calpurnia aurea, Maytenus senegalensis, Croton macrostachyus, Dichrostachys cinerea, Opuntia ficus indica, Acalypha sp., Euphorbia tirucalii, Achyranthes aspera, Albizia gummifera, Ficus thonningi, Grewia trichocarpa, Grewia flavescens, Commelina benghalensis, Grewia villosa, Commicarpus grandiflorus, Grewia ferruginea, Ziziphus mauritania, Lanena rivae, Acacia nilotica, Stereospermum kunthianum, Grewia arborea, Cadaba farinosa, Dichrostachys cinerea, Oxygenum sinuatum, species of Trifolium and Crotalaria, Abutilon sp., Euphorbia dumalis, and Justicia ladanoides* are also found around the plots in this range.

2. 1600-1700 m altitudinal range - Average altitude for the plots is 1647 m.



The species encountered in this range are *Acacia etbaica*, *Acacia gerrardi*, *Acokanthera schimperi*, *Asparagus africanus*, *Cadaba farinosa*, *Capparis tomentosa*, *Cissus rotundifolia*, *Combretum molle*, *Commiphora schimperi*, *Crorton macrostachyus*, *Dombeya torrida*, *Euphorbia candelabrum*, *Ficus sur*, *Grewia ferruginea*, *Hibiscus micranthus*, *Lannea sp.*, *Maerua triphylla*, *Opuntia ficus indica*, *Senna singuinea* and *Trema guneensis*.

Dominant species in this altitudinal class are *Euphorbia candelabrum*, *Commiphora schimperi*, *Opuntia ficus indica*, *Acacia gerrardi*, and *Combretum molle*.

3. 1700-1800 m altitudinal range - Average altitude for the plots is 1714 m.

*Balanites aegyptiaca*, *Schrebera alata* and *Senna singuinea* were found in this plot.

4. 1800-1900 m altitudinal range - Average altitude for the plots is 1840 m.

The species encountered in this range are *Ficus vasta*, *Ocimum lamiifolium*, *Schrebera alata* and *Impatiens rothii*. *Agave sisalana*, *Salix subserrata*, *Erythrina abyssinica*, *Cordia africana*, *Acacia tortilis* and *Euphorbia tirucalii* are found around settlement places.

5. 1900-2000 m altitudinal range - Average altitude for plots is 1951 m.

The species encountered in this range are *Acacia gerrardi*, *Acacia etbaica*, *Calpurnia aurea*, *Calpurnia aurea*, *Capparis tomentosa*, *Clerodendrom myricoides*, *Combretum molle*, *Commiphora schimperi*, *Dodonaea angustifolia*, *Euclea racemosa*, *Ficus sur*, *Maytenus arbutifolia*, *Osyris quadripartita*, *Pentas lanceolata*, *Premna resinosa*, *Rhus retinnochea*, *Scheffleria abyssinica*, and *Ximenia Americana*.

*Acacia gerrardi*, *Acacia etbaica* and *Maytenus arbutifolia* have dominant cover in this altitudinal range. *Stephania abyssinica*, *Maytenus heteromorpha*, *Euphorbia tirucalii*, *Acacia tortilis*, *Cordia africana*, *Croton macrostachyus*, *Commiphora schimperi*, *Pilostigma thonningi* and *Erythrina abyssinica* are also found around the plots in this elevation range.

6. 2000- 2100 m altitudinal range - No plots were established in this altitudinal range.

7. 2100 - 2200 m altitudinal range

The species encountered in this range are *Albizia gummifera*, *Alchemilla sp.*, *Calpurnia aurea*, *Carissa spinarum*, *Clerodendrom myricoides*, *Clusia abyssinica*, *Dichrostachys cinerea*, *Helinus mystacinus*, *Hibiscus sp.*, *Hypericum quartitianum*, *Phyllanthus sepialis*, *Rhus retinnochea*, *Rhus glutinosa*, *Rumex nervosus*, *Senna singuinea*, and *Tagetes minuta*.

8. 2200-2300 m altitudinal range - Average altitude for the plots of this range is 2240 m.

The species encountered in this range are *Aloe sp.*, *Carissa spinarum*, *Combretum molle*, *Commiphora schimperi*, *Impatiens rothii*, *Kalanchoe sp.*, *Lantana trifolia*, *Lipsea adoensis*, *Ocimum gratissimum*, *Ocimum lamifolium*, *Olea europaea*, *Otostegia integrifolia*, *Rhocissus tridentate* and *Rumex nervosus*.



*Impatiens rothii*, *Lantana trifolia*, *Lippea adoensis*, *Otostegia integrifolia*, *Rumex nervosus*, *Ocimum lamiifolium* and *Ocimum gratissimum* are relatively dominant in this altitudinal range. *Oputia ficus-indica*, *Euclea racemosa*, *Arthraxon species*, *Olea europaea*, *Ficus sur*, *Rhocissus tridentate*, *Schrebera alata* and *Abutilon sp.* are also found around the plots in this range.

9. 2300 -2400 m altitudinal range - Average altitude for the plots of this range is 2351 m.

*Acacia brevispica*, *Albizia gummifera*, *Calpurnia aurea*, *Carissa spinarum*, *Carissa spinarum*, *Epilobium hirusutum*, *Clerodendrom myricoides*, *Dodonaea angustifolia*, *Euclea racemosa*, *Heteromorpha trifoliata*, *Jasminum floribundum*, *Lantana trifolia*, *Maytenus addat*, *Maytenus arbutifolia*, *Osyris quadripartite*, *Premna schimperi*, *Pterolobium stellatum*, *Rhus natalensis*, *Rhus glutinosa*, *Rosa abyssinica*, *Rumex nervosus*, *Senna singuinea*, and *Steganotaenia araliaceae* are encountered in the plots. The species relatively dominating in this altitudinal range are *Albizia gummifera*, *Calpurnia aurea*, *Heteromorpha trifoliata*, *Dodonaea angustifolia*, and *Steganotaenia araliaceae*.

*Olea europaea*, *Solanum somalense*, *Solanum incanum*, *Verbascum sinaiticum*, *Cordia africana*, *Scheffleria abyssinica*, *Ricinus communis*, *Hypericum quartitianum*, *Phoenix reclinata*, *Ficus sur*, *Croton macrostachyus*, *Clusia abyssinica*, *Salix subserrata*, *Otostegia abyssinica*, *Aloe sp.*, *Asparagus sp.*, *Bersama abyssinica*, *Podocarpus falcatus*, *Clematis sinensis*, *Clausenia anisata*, *Plantago lanceolata*, *Rosa abyssinica*, *Eucalyptus globulus*, *Eucalyptus camaldulensis*, *Acacia melanoxylon*, *Sesbania sesban*, *Cupressus lusitanica*, *Acacia decurrens*, *Schinus molle*, *Croton dichrogamus*, *Leucaena leocarpa*, *Ricinus communis*, *Bougainvillia sp.*, *Solanum marginatum*, *Agave sisalana*, *Pterolobium stellatum*, *Agave americana*, *Grevillia robusta*, *Hagenia abyssinica*, *Casuarina equisetifolia*, *Vernonia amygdalina*, *Vernonia abyssinica*, *Senna singuinea*, *Ficus sycomorus*, *Rhus glutinosa*, *Ekebergia capensis*, *Embellia schimperi* and *Stephania abyssinica* are also observed in different spots.

9. 2400-2500 m altitudinal range - Average elevation of the plots established in this range is 2431 m.

The species encountered in this range are *Acacia abyssinica*, *Asparagus sp.*, *Carissa spinarum*, *Croton macrostachyus*, *Dovyalis abyssinica*, *Euclea racemosa*, *Euphorbia candelabrum*, *Hibiscus micranthus*, *Impatiens rothii*, *Lannea sp.*, *Lippea adoensis*, *Olea europaea*, *Osyris quadripartita*, *Plectranthus sp.*, *Rhus retinorrhoea*, *Rubus steudneri*, *Rumex nervosus*, *Salix subserrata* and *Scheffleria abyssinica*. The species occurring with high dominance are *Euclea racemosa*, *Rumex nervosus*, *Rhus retinorrhoea*, *Acacia abyssinica*, and *Lippea adoensis*. Other species observed around the plots in this range are *Cupressus lusitanica*, *Eucalyptus camaldulensis*, *E. globulus*, *Salix subserrata*, *Arundo donax*, and *Eucalyptus globulus*.

#### 4.14.1.4 Medicinal Plants

A total of 60 medicinal plants were recorded in the study area. **Table 4.24** gives a list of the medicinal plants found in the area.



Sn	Species	Family	Status
1	<i>Justicia schimperiana</i>	Acanthaceae	M
2	<i>Otostegia integrifolia</i>	Acanthaceae	M
3	<i>Otostegia tomentosa</i>	Acanthaceae	M
4	<i>Allium sativum</i>	Alliaceae	M
5	<i>Allium sepa</i>	Alliaceae	M
6	<i>Achyranthes aspera</i>	Amaranthaceae	M
7	<i>Agrocharis melanantha</i>	Apiaceae	M
8	<i>Ferula communis</i>	Apiaceae	M
9	<i>Acokanthera schimperi</i>	Apocynaceae	M
10	<i>Carissa spinarum</i>	Apocynaceae	M
11	<i>Artemisia abyssinica</i>	Asteraceae	M
12	<i>Vernonia abyssinica</i>	Asteraceae	M
13	<i>Vernonia amygdalina</i>	Asteraceae	M
14	<i>Vernonia leopoldii</i>	Asteraceae	M
15	<i>Balanites aegyptiaca</i>	Balanitaceae	M
16	<i>Impatiens rothii</i>	Balsaminaceae	M
17	<i>Stereospermum kunthianum</i>	Bignoniaceae	M
18	<i>Cordia africana</i>	Boraginaceae	M
19	<i>Datura strumarium</i>	Boraginaceae	M
20	<i>Opuntia ficus-indica</i>	Cactaceae	M
21	<i>Maerua angolensis</i>	Capparidaceae	M 2
22	<i>Combretum molle</i>	Combretaceae	M
23	<i>Commelina benghalensis</i>	Commelinaceae	M
24	<i>Kalanchoe sp.</i>	Crassulaceae	M
25	<i>Coccinia abyssinica</i>	Cucurbitaceae	M
26	<i>Croton dichrogamus</i>	Euphorbiaceae	M
27	<i>Croton macrostachyus</i>	Euphorbiaceae	M
28	<i>Euphorbia candelabrum</i>	Euphorbiaceae	M 1
29	<i>Euphorbia dumalis</i>	Euphorbiaceae	M1
30	<i>Euphorbia tirucalii</i>	Euphorbiaceae	M2
31	<i>Calpurnia aurea</i>	Fabaceae	M
32	<i>Senna occidentalis</i>	Fabaceae	M
33	<i>Senna singuinea</i>	Fabaceae	M
34	<i>Trigonella foenicum-graecum</i>	Fabaceae	M 2
35	<i>Clerodendrum myricoides</i>	Lamiaceae	M
36	<i>Leucas martinicensis</i>	Lamiaceae	M
37	<i>Ocimum gratissimum</i>	Lamiaceae	M
38	<i>Ocimum lamiifolium</i>	Lamiaceae	M



Sn	Species	Family	Status
39	Premna resinosa	Lamiaceae	M
40	Premna schimperii	Lamiaceae	M
41	Verbascum sinaiticum	Lamiaceae	M
42	Bersama abyssinica	Melanthaceae	M
43	Stephania abyssinica	Menispermaceae	M
44	Myrica salicifolia	Myricaceae	M
45	Maesa lanceolata	Myrsinaceae	M
46	Ximenia americana	Olaccaceae	M
47	Olea europaea	Oleaceae	M
48	Phytolacca dodocandera	Phytolaccaceae	M
49	Rumex abyssinicus	Polygonaceae	M
50	Hagenia abyssinica	Rosaceae	M
51	Rosa abyssinica	Rosaceae	M
52	Clausenia anisata	Rutaceae	M
53	Brucea antidysentrica	Simabouraceae	M
54	Solanum incanum	Solanaceae	M
55	Solanum marginatum	Solanaceae	M
56	Solanum nigrum	Solanaceae	M
57	Solanum somalense	Solanaceae	M
58	Lantana trifolia	Verbenaceae	M
59	Lippea adoensis	Verbenaceae	M
60	Rhocissus tridentata	Vitaceae	M

Note M: Medicinal, M1= Medicinal and widely distributed, M2= Medicinal in other places

**Table 4.24 : Medicinal Plants in the Study Area**



**Fig. 4.33: Impatiens rothii, a widely distributed medicinal and cosmetic plant species found in the area**



#### 4.14.1.5. Endemic and Threatened Species in the Area

The plant species encountered in the buffer zone include 15 endemic species of which 5 are highly endangered and 10 are of least concern. **Table 4.25** gives a list of endemic species found in the area. The species are designated as threatened as per Ethiopian classification.

<i>Endemic threatened</i>	<i>Least concern endemics</i>
<i>Crotalaria rosenni</i>	<i>Dombeya aethiopica</i>
<i>Hypericum gnidiifolium</i>	<i>Echnomps longisetus</i>
<i>Indigofera rothii</i>	<i>Erythrina brucei</i>
<i>Maytenus addat</i>	<i>Euphorbia dumalis</i>
<i>Satureja punctata</i>	<i>Lippea adoensis</i>
	<i>Milletia ferruginea</i>
	<i>Rhus glutinosa</i>
	<i>Senecio myriocephalus</i>
	<i>Vepris dainellii</i>
	<i>Vernonia leopoldi</i>

**Table 4.25 : Endemic and Threatened Species in the Study Area**

The Plant families and the number of species in the project area are given in **Table 4.26** the detailed list of flora species occurring in the area is enclosed as **Annex 4.8**.



Family	No. of species
Acanthaceae	6
Agavaceae	2
Alliaceae	2
Aloaceae	1
Amaranthaceae	1
Anacardiaceae	8
Apiaceae	6
Apocynaceae	2
Aquifoliaceae	1
Araceae	1
Arecaceae	1
Asparagaceae	1
Asphodelaceae	2
Asteraceae	20
Balanitaceae	1
Balsaminaceae	1
Bignoniaceae	1
Boraginaceae	3
Burseraceae	1
Cactaceae	1
Capparidaceae	4
Caryophyllaceae	1
Casuarinaceae	1
Celasteraceae	3
Combretaceae	1
Commelinaceae	2
Convolvulaceae	2
Crassulaceae	1
Cucurbitaceae	1
Cupressaceae	2
Cyperaceae	2
Ebenaceae	1
Euphorbiaceae	10
Fabaceae	40
Flacourtiaceae	1
Hypericaceae	2
Iacinaceae	1
Lamiaceae	8
Lamiceae	1
Linaceae	1
Malvaceae	4
Meliaceae	1

Family	No. of species
Melanthaceae	1
Menispermaceae	1
Moraceae	4
Musaceae	1
Myricaceae	1
Myrsinaceae	2
Myrtaceae	4
Nyctaginaceae	2
Ochnaceae	1
Olaccacaceae	1
Oleaceae	3
Onagaraceae	1
Pedaliaceae	1
Phytolaccaceae	1
Pittosporaceae	1
Plantaginaceae	1
Poaceae	15
Podocarpaceae	1
Polygonaceae	3
Ranunculaceae	2
Rhamnaceae	2
Rosaceae	5
Rubiaceae	6
Rutaceae	1
Salicaceae	1
Santalaceae	1
Sapindaceae	5
Sapotaceae	1
Simabouraceae	1
Solanaceae	5
Sterculiaceae	1
Tiliaceae	7
Ulmaceae	1
Urticaceae	1
Verbenaceae	2
Vitaceae	2
Total	79

**Table 4.26 : Plant Families and number of Species in the Study Area**



#### 4.14.1.6 Protected Areas

Ethiopia is making efforts to protect biodiversity and conserve resources through the creation of protected parks, wildlife resources, controlled hunting areas and Regional Priority Forest Areas. Based on the review of available national and regional conservation area maps issued by the Government and other competent authorities, it has been confirmed that the project area is neither contiguous with, nor in close proximity with any of these nationally protected areas.

There are many birds in the project area. However, according to Ethiopian Wildlife and Natural History Society (EWNHS, 1996), none of the 78 nationally designated Important Bird Areas are found anywhere near the project area.

#### 4.14.1.7 Conclusions

The study area of 10 km radius around the plant and mining sites is rich in species composition though the abundance and distribution is highly influenced by anthropogenic factors such as crop cultivation, grazing, charcoal production and wood cutting for domestic use. A total of 241 species in 79 families have been recorded. Most of these species are indigenous while a few others are exotic or naturalized. A total of 23 cultivated plant species were recorded. A total of 60 medicinal plants were recorded. The plant species encountered include 15 endemic species of which 5 are highly endangered and 10 are of least concern.

#### 4.14.2 FAUNA

A detailed faunal study has been carried out in the area by experts from the University of Addis Ababa. The general objective of the faunal study is to make a baseline survey of the fauna at the proposed DMC plant and mining site and:

- ❑ To inventorize and identify the faunal composition of wildlife, insects, birds, amphibians, reptiles, domestic animals and aquatic invertebrates at the proposed plant and quarry core and buffer zones of the project area
- ❑ To distinguish between the fauna found in the core zones (plant and quarry sites) and the buffer zones (around 10 km radius from the core centers)
- ❑ To determine the ecological status of the fauna according to the IUCN/ Ethiopian guidelines as endangered (critically), threatened, vulnerable, extinct, rare, etc

##### 4.14.2.1 Methodology

On-site observations were made and recorded at the plant and quarry sites, in both the core and buffer zones.

- ❑ Birds - Birds were identified based on direct observation and calls on site. For species identification, the guide of Williams and Arlott (1980) was referred.
- ❑ Wildlife - Local informants were interviewed about the past and present status of wildlife in the buffer zones. The quarry core area is very small and inhabited by the workers of Muger factory; so no wildlife exists there. The plant core site is close to Adero village and inhabitants of the village reported that the wildlife in the area was long ago decimated. The taxonomy of wildlife was checked with Kingdon (1997).
- ❑ Insects and butterflies - These were recorded from the valley and by the river banks and a few specimens were collected for verification. Cross checking was done with the



reference insect and butterfly collection of the Zoological Natural History Museum, Biology Department, Addis Ababa University.

- ❑ Reptiles - Informants were requested to describe the snakes they encounter as poisonous/ non-poisonous and using the local names, an educated guess was made about the scientific identity of the snakes. Lizards and turtles were rarely observed. Reference was made for further authentication to the draft paper prepared by Mohammed et al. (2001) on the terrestrial wild animals and protected areas in Ethiopia.
- ❑ Amphibians - Both on site observation and local information was used. Frog croaking was common in the Mughher River in the late afternoon.
- ❑ Fish - The rivers were in high flood at the time of the survey, so no fish was directly sampled. The local people confirmed that fish tend to hide in the riverbed or migrate elsewhere at this time. In the long dry season, however, local informants said that the rivers were full of fish. The scientific identity of the fish could easily be deduced from the fine description of the informants.
- ❑ People also claimed that they prepared different types of food from fish - dried and pound fish-soup, fillet, cooked, fried, but never ate raw fish as is commonly observed in the rift valley lakes.
- ❑ Other mammals - Besides wildlife, a lot of domestic animals were observed, including cattle, goats, sheep, chicken, donkeys, horses and dogs/cats.
- ❑ The ecological status of the fauna was determined according to the criteria recommended by IUCN using Internet resources and literature.
- ❑ Plankton samples - Algal samples were collected and preserved in Lugol's Iodine from backpools of some rivers, and ditches in Derba.

#### 4.14.2.2 Fauna in Project Core Areas

##### Core Plant Site - Becho

Table 4.27 shows the faunal composition at the core area of the proposed plant site. Because of human incursion in the area, most of the wild fauna has disappeared. Intensive cultivation has removed most of the original forest and the natural habitat of birds, insects, and butterflies has almost disappeared, which explains the poor faunal diversity in this area in general. There is a small spring from which the village of Adero draws water. It had no amphibian, reptile or fish specimens.

The fauna existing in the core zone of plant is given in Table 4.27.

	Scientific Name	Common name	Status as per IUCN	Status as per Eth. Wildlife
Mammals	<i>Tragelaphus scriptus</i>	Bush diuker	R	R
	<i>Geneta abyssinicus</i>	Genet cat	R	R
	<i>Theropitecus gelada</i>	Anubis baboon,	C	C
		Gelada baboon	R	R
	<i>Canis mesomelas</i>	Vervet monkey	R	R
	<i>Crococta crococta</i>	Jackal	R	R
		Hyaena	C	C



	Scientific Name	Common name	Status as per IUCN	Status as per Eth. Wildlife
Aves (Birds)	<i>Francolinus clappertoni</i>	Francolin	R	R
	<i>Corvus albus</i>	Pied crow	R	R
	<i>Accipiter rufiventris</i>	Sparrow	C	C
	<i>Vidua paradisaea</i>	Paradise whydah	R	R
	<i>Placoeus baglafechi</i>	Weaver	C	C
		Paradise flycatcher	R	R
		Guinea fowl	R	R
	<i>Terpisiphone viridis</i>	Tawny eagle	R	R
		Starling	C	C
		Yellow-billed Oxpecker	R	R
Pisces (Fish)		None in the Adero spring		
Amphibians		None observed		
Reptiles		Poisonous snakes		
Insects		Grasshoppers (Acrididae)	C	C
Butterflies		Family Lycaenidae Popillionidae Hesperidae Daniidae,	C	C
Plankton		Not sampled		

R = Rare; C = Common

**Table 4.27 : Faunal Composition at the Core Plant Site**

**Core Zone of Quarry Site at Mughher Valley**

**Table 4.28** gives the faunal composition at the quarry core site in the Mughher valley. This excavation site is 1.4 km away from the old quarry site of the state-owned Mughher factory. The area is a sparsely populated farmland with the rivers flowing far below on the north-eastern side. The long history of human encroachment for farming and charcoal production has decimated the forest and wildlife. Birds and insects are rare because of the deforestation. The area can be described as already depauperate in fauna.

**Core zone (Quarry)**

	Scientific name	Common name	Status as per IUCN	Status as per Eth. Wildlife
Mammals		Vervet monkey	C	C
		Anubis baboon	C	C
		Jackal	R	R
		Leopard	R	R



	Scientific name	Common name	Status as per IUCN	Status as per Eth. Wildlife
Aves (Birds)	<i>Ploceus baglafechi</i> <i>Accipiter rufiventris</i>	Weaver Sparrow	R R	R R
Pisces (Fish)		None observed		
Amphibians		None		
Reptiles		None		
Insects Butterflies		Butterflies, beetles (scarabid) and meadow grasshoppers	C	C
Plankton		Not sampled		

R = Rare; C = Common

**Table 4.28 : Faunal Composition at the Core Quarry site (Mugher valley)**

### River Floodplain

The five rivers in the Muger valley - Lebu, Bole, Duketu, Jemma, Sibilu and Muger - were at high flood season at the time of the survey. Therefore no plankton or macroinvertebrate collection was made, except for a few phytoplankton samples collected from backpools. Fish were not directly observed also; instead, the local people were interviewed about the status of fish during the long dry season.

The river floodplain is rich in both aquatic and terrestrial fauna. The presence of riparian vegetation and forest contribute to diverse insect and butterfly species. Fish and amphibians are common in the rivers. The Nile lizard (*Varanus niloticus*) is common in the Muger River, but the people say that crocodiles are absent, which explains why the local people frequently water their livestock, bath and even graze their cattle near the riverbanks. Some parts of the floodplain have even been converted into banana plantations and sorghum fields. Many farmers make charcoal by indiscriminately cutting the forest, thereby exposing the soil to erosion into the rivers and exacerbating habitat loss for birds and insects.

The bird diversity is high in the floodplain, and most of these birds migrate locally to the escarpment. The surrounding land is intensively farmed and attracts a lot of birds and monkeys. The heavy human encroachment may pose the most serious ecological challenge in the river floodplain than the operation of limestone quarries by the old and the new cement projects.

In general, this is a biodiversity-rich area, but already, this has been compromised by the intensive deforestation, wildlife hunting and other human activities, which have affected the natural resources in a very negative way.

### Buffer zone (Mine/Quarry)

	Scientific name	Common name	Status as per IUCN	Status as per Eth. Wildlife
Mammals	<i>Theropithecus gelada</i> <i>Canis mesolamis</i>	Anubis monkey Gelada baboon Jackal	C R R	C R R



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	Scientific name	Common name	Status as per IUCN	Status as per Eth. Wildlife
	<i>Potamochoerus porcus</i>	Bush pig	R	R
	<i>Panthera pardus</i>	Leopard	R	R
		Porcupine	R	R
	<i>Felis serval</i>	Serval	R	R
		Goats, sheep, donkeys, horses, chicken and cats/dogs	C	C
Aves (Birds)	<i>Francolinus clappertoni</i>	Francoline	C	Same category as IUCN
	<i>Numida meleagris</i>	Guinea fowl	R	
	<i>Euplectes franchiscus</i>	Red-headed bishop	R	
	<i>Ploceus baglafechi</i>	Weavers	R	
	<i>Terpsiphone viridis</i>	Paradise flycatcher	C	
	<i>Streptopelia senegalensis</i>	Dove	R	
	<i>Vidua paradisaea</i>	Paradise whydah	C	
	<i>Lagonosticta rufopicta</i>	(Nesting) Finches	C	
	<i>Serinus tristrianus</i>	Seed-eaters	R	
	<i>Uragenthis bengalus</i>	Red-checked cordon blue	C	
Pisces (Fish)		4 species of <i>Labeo</i> , <i>Barbus</i> , <i>Oreochromis</i> and <i>Clarias</i> (catfish)	C	C
Amphibians		Frogs ( <i>Bufo</i> sp.)		
Reptiles		(Family Boidae and Viperidae), Lizards (Agamidae) Crocodile in Muger downstream	C C R	C C R
Insects		Insects: Odonata (dragonflies and damselflies),	C C	C C
Butterflies		Beetles (Cuculionidae, Scarabidae, Elateridae), Crickets, Grasshoppers (Acrididae - <i>Acrida</i> and <i>Oxya</i> sp.) Praying mantis <i>Colotis</i> butterflies Millipedes Burrowing beetles (Noteridae),	C R C C C C C	C C R C C C C





	Scientific name	Common name	Status as per IUCN	Status as per Eth. Wildlife
		Velvet ants (Mutillidae) etc		
Plankton		Algae in backpools Macroinvertebrates and plankton not sampled	C	C

**Table 4.29 : Faunal Composition at the Buffer River Floodplain (Muger valley)**

#### 4.14.2.3 Habitat Integrity Rating of the Rivers

Rapid habitat integrity assessment was made of the five rivers using the criteria developed for the Rapid Bioassessment Protocol (RBP) of Barbour *et al.*, (1999). A few criteria were modified to suit the local conditions, such as pollution by dung and human wastes. Weights are assigned to different in-stream and riparian characters of the river reaches such as flow modification, exotic macrophytes, solid waste disposal, bank erosion and vegetation cover. The ten most important habitat components are considered for analysis with each component having a score of 10 points, adding up to a total of 100%. A range of score points describe the habitat integrity status of the river. High scores describe pristine or unimpaired conditions and low percentages apply to impacted rivers.

**Table 4.30** gives the criteria and the score of the habitat components considered for the ecological integrity assessment of the five rivers in the Muger valley. Rapid habitat assessment was done by visual scoring of both in-stream and channel features of each river and each component was assessed out of 10 points to make a total of 100 points. Category and interpretation was done according to Barbour *et al.*, (1999).

Habitat component (instream and riparian)	Lebu River	Bole River	Duketu River	Jemma River	Muger River
Substrate quality and quantity	10	10	10	10	10
Sediment and sand deposition	9	8	8	9	7
Channel alteration (modification)	10	10	10	9	7
Bank stability (canopy and erosion)	8	8	8	8	8
Riparian vegetation zone width	9	8	8	8	7
Frequency of riffles/bends	10	10	10	10	9
Manure/dung wastes	9	9	8	8	6
Velocity/depth regime	10	10	10	10	10
Water quality (appearance)	10	10	10	10	10
Exotic plants and animals introduction	10	10	10	10	10
Total habitat score	95	93	96	92	84
Interpretation Largely pristine with few modifications. A small change in natural habitats and biota may have occurred, but the basic ecosystem functions are predominantly unchanged (80-99% score)	B	B	B	B	B

**Table 4.30 : Habitat Integrity rating for the five rivers at the Muger Valley**



The main reasons for the lowered score of the habitat integrity of some of these rivers (especially Muger) could be the following:

- Bank erosion and modification due to cultivation on the river banks
- Channel modification for excavation purposes
- High level of cattle dung due to the large livestock and their daily watering at different sites of the rivers
- Some human encroachment especially at Muger river
- Impact of the Muger old town at upstream site
- Removal of riparian vegetation for cultivation and charcoal making.

### Adjoining Buffer Weredas

Wildlife data was collected from the local community and the Wereda offices of four adjoining buffer zone areas - Yayu Gulele, Adaberga, Wuchale and Sululta Weredas and shown in **Table 4.31**.

Common name	Scientific name	IUCN status	Ethiopian Statutes
Bush buck	<i>Tragelaphus scriptus</i>	R	R
Bush diuker	<i>Sylviacapra gramma</i>	R	R
Leopard	<i>Panthera pardus</i>	R	R
Civet	<i>Viverra civetta</i>	R	R
Vervet monkey		C	C
Gelada Baboon	<i>Theropithecus gelada</i>	R	R
Aardvark	<i>Orycteropus afer</i>	R	R
Serval	<i>Felis serval</i>	R	R
Warthog	<i>Phacochoerus aethiopicus</i>	R	R
Colobus monkey	<i>Colobus abyssinicus</i>	R	R
Porcupine	<i>Hystrix cristata</i>	C	C
Jackal	<i>Canis mesomelas</i>	R	R
Hyaena	<i>Crococta crocota</i>	C	C
Genet cat	<i>Geneta abyssinica</i>	R	R
Hamadryas Baboon	<i>Papio hamadryas</i>	C	C
Bush pig	<i>Potamochoerus porcus</i>	R	R
Cheetah	<i>Acinomyx jubatus</i>	R	R
Rock hyrax		R	R
Abyssinian hare	<i>Lepus abyssinicus</i>	R	R

R = Rare; C = Common

**Table 4.31 : Fauna in the Adjoining Buffer Weredas**

Algal samples were recovered from rock pools and mud slicks. The major groups found in their order of dominance, were *filamentous green algae, especially Cladophora and Spirogyra sp. and* some diatom species. These are the only plankton samples collected during this time of the year. During the dry season, they could potentially form algal blooms in backpools and impounded waters (perhaps causing problems for livestock and wildlife watering). The tangled mass of such algae can be a nuisance in potable water filters and can clog pipes and plant installations.



#### 4.14.2.4 Conclusions

Far fewer fauna were observed in the core zones as opposed to the buffer zones, even if the latter was already highly impacted by deforestation and wildlife hunting.

There are no faunal species recorded from the Muger valley area that can be categorized as endangered, threatened or vulnerable. The species encountered are common forms that are observed in other parts of Ethiopia. The adjacent Sululta plains on the other hand harbour the globally threatened white-winged flufftail and corncrake and the near-threatened Rouget's Rail, Pallid Harrier, Great Snipe and Abyssinian Long claw. The open plains are an important feeding area for blue-winged goose, spot-breasted plover, wattled ibis and red-chested swallows. The last were reported roosting in the Muger valley in addition to a few Egyptian geese in the Muger River. The Muger area could be a potential migration route (at least locally) for these threatened species from the Sululta plains. The endemic birds present in the Sululta plains (spot-breasted plover, Abyssinian longclaw and Abyssinian catbird) were not observed in the Muger valley.

People indicate that the forest cover and wildlife numbers were very high even as recently as three decades ago. The last few remaining forests on the escarpment should be supplemented with revegetation programs around the quarry and plant sites. This will help both to mitigate the impact of dust and noise emissions and enhance biodiversity level resulting in an improved situation from the baseline status.

### 4.15 CULTURAL, HISTORICAL & ARCHAEOLOGICAL FEATURES

A rapid archaeological survey was carried out in the project plant site and quarry area, and their environs from August 29 to September 1, 2007.

#### 4.15.1 PRIMARY DATA

The archaeological survey was carried out using the following methodology:

- Site Survey was conducted to search archaeological materials on the surface of the project area and its environs.
- Site recording of the study area by GPS and existing topographic maps.
- Photographic recordings of the landscape, sites and identified materials.
- Tape measurements of identified sites, artifacts and ruined structures.
- Informal Interview with local elders and officials.

Secondary data was obtained from written historic sources, maps, previous archaeological works, reports, and archival materials particularly from ARCCH (Authority for Research and Conservation of Cultural Heritage, Ethiopia).

The gathered data was analyzed qualitatively with standard risk assessment and evaluating format of preventive archaeology.

#### 4.15.2 BACKGROUND OF THE PROJECT AREA

Although a number of rivers are found in northwest of Addis Ababa in the environs of the study site, Sibilu and Gerbi Rivers, which converge and enter into Muger river, are the major ones. Muger River is one of the main tributaries of Abbay (Blue Nile) River. These rivers are located southwest of Debre Libanos Monastery of Abuna Teklehymanot. Abuna



Teklehymanot was a thirteenth century Saint of Ethiopian Orthodox Church, who carried out evangelical activities with his disciples in this part of the region.

The predominant population of the region is Oromo.

## History of the Region

### Ancient Period : 2800 BC – 1270 AD

During the ancient period (ca 2800 BC-1270 AD) the region was occupied by the ancient and medieval states, which were outside the occupation of the Aksumite Empire and the Zagwe dynasty. Though there are no available historic sources that mention that the region was under the two kingdoms during ancient time, other sources indicate that the region was partly the Shewa state and partly the anonymous state of Damot.

### Medieval Period : 1270 AD – 1524 AD

Historical references to the position of the study area and the medieval district of Muger indicate that the region was at the strategic position of Shewa where the fertile districts of Waj, Enarea, Indagabatan, Warab, and Damot were found. Tradition and written documents mention that the treasury and wealth of the medieval Emperors of Ethiopia were deposited in this part of Shewa. References to the region were available in relation to the invasion of Ahmad Gran and the movement of the Oromo.

Historical written sources indicate that the western side of Debra Libanos and the whole region of Muger were highly dominated by pagan religious practices before the advent of Christianity to the region. Indagebtan, Warab, Tsegagen, Slalish, Waj and Damot were most probably pagan. Of these the most widely known pagan kingdom was Damot. The rulers of Damot, and Meteolomi had fought against the Christian king in this region near Sibilu River.

Christianity was introduced in the region by Aba Tekele Haymanot in the thirteenth century.

Medieval historical sources indicate that the region northwest of Addis Ababa has occupied an important place in the history of Ethiopia. The region of Showa became the very centre of the Christian kingdom. The fertile districts of Muger attracted Christian settlers from the north. The region became the seat of the king and the abbot. Therefore palaces, churches, monasteries and residential houses flourished in the region. Still there are ancient monasteries in the region. A good example of these is Debra Semona, northwest of Sibilu River in the district of Wizero.

The region of Derba and Muger was a seat of the medieval emperors. Yekuno Amlak (1270-1283 AD) and his successors established their royal courts and important towns in this part of the region. The mountainous region of the north, which is traversed by Muger River, holds the town of Baquellat and the venerated church of Tekle Hawaiat. In this part of the region the lost town of Zaraah, where the Egyptian and Syrian Christian merchants dwelled was also found.

To sum up, oral tradition and historic written sources testify that the fertile districts of northwest Showa such as Muger, Wagda, Dinbi, Waj, Warab, Indagabtan and others, were located between Muger River and Indagabtan. Indagabtan was stretched eastward from the source of Awash to Debra Berhan. These districts were the seat of church and state. Thus royal palaces, churches, monasteries, markets and residential houses were highly concentrated in the region during the medieval period.



## The Oromo Movement

Since the sixteenth century, the Oromo tribes, Mecha and Tulema, have moved to and settled in the region of Derba and Muger. This movement has resulted in the assimilation and intermingling of the ancient settlers of the region with the Oromo.

### 4.15.3 PREVIOUS ARCHAEOLOGICAL RESEARCH IN THE AREA

Since the 16th century the map of the project area has changed dramatically. The ancient and medieval place names appear to be changed or distorted. The original inhabitants of the region might have been pushed further north, or assimilated into the present inhabitants of the area. Most inhabitants of the region neither remember nor claim the location and stories of the old monasteries, palaces and churches of the region. The only remnants that could testify the existence of the wealth and powerful states in this part of Ethiopia are archaeological materials, such as ruins of palaces, churches or monasteries, burial places and artifacts.

Based on these assumptions, experts from the ARCCH conducted archaeological survey and impact assessment in the environs of Chancho in connection with the Sibilu and Garbi dam sites reservoir and transmission lines. The study was conducted in 1996 based on the mutual agreement between AAWSA Stage III Water Supply Project and the Department of Archaeology and Anthropology of the CRCCH (now ARCCH).

The ARCCH survey team discovered largely two distinct cultural remains. These are megalithic and medieval cultures. Megalithic, which stretches back to the Neolithic, consists of standing stone (Stelae), tumulus and dolmen. Medieval structures consist of wall structures most probably constructed between the 10<sup>th</sup> to the 16<sup>th</sup> century. The team discovered traces of archaeological elements at Deneba, Gulele (probably Dinbi); Awaso-Daka, Fita, Didibe, Birbirtu (probably Barara), and Galiye Mana Abichu-Burka, Bodo and Boru.

The team finally concludes that they do not certainly know to whom these monuments belonged. They recommend proper investigation and excavation so as to trace their originator and reach to know their social, economic and political organizations, which in turn contribute a new knowledge to the history of Ethiopia.

In 2006, a team of Preventive Archaeology carried out field survey in two major archaeological areas: Dibdibe and Ochi Luncha, which are located in the environs of the project area. In Dibdibe the team found a total of ten archaeological areas. In Dibdibe the team discovered red and black potsherd, obsidians, tumuli and ruined structures. However, this site is nearly 40 km away from the DMC plant and mining sites.

Like Dibdibe the team also spent some days in Ochi Luncha area to carry out an archaeological ground survey. Six archaeological areas were found concentrated on farming and grazing areas with plain and slope land morphology. Five of these archaeological areas have potsherds and obsidians of different colour and thickness.

A tumuli and stelae have been found here. The standing basaltic rocks are found to the north of Dibdibe. It is the effect of natural phenomena. However, it seems that in the long past people were living on those basaltic rocks, managed part of the spaces and left some traces of archaeological elements on the surface; example, potsherd, obsidians. The stones were used by the people in the natural state. Here tumuli with standing stones were observed.

The locations of Dibdibe and Ochi archaeological sites are shown in **Fig. 4.34**.

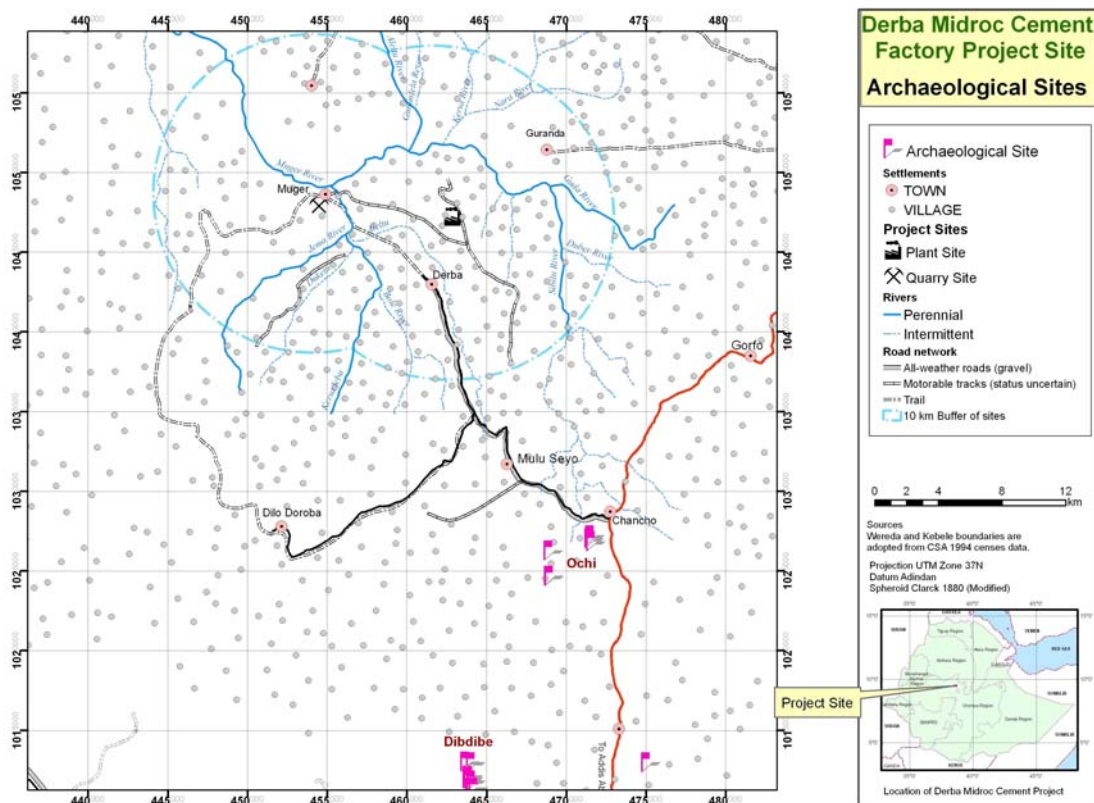


Fig. 4.34 : Archaeological Sites in the Area

#### 4.15.4 ARCHAEOLOGICAL SURVEY RESULTS

##### 4.15.4.1 Plant Area

The plant and camp sites were surveyed extensively on foot from south to north direction. The survey result revealed that there are no observable artifacts, features, and fossils in the plant site. Consultations with the project constructors and local farmers also justified that no observable ruined structure, standing stones, obsidian stone tools or ceramic fragments in the project area. Investigation was carrying out on the excavated materials, which were dug out for construction purposes. In some part of the plant site 2-4m deep trenches are observed. Excavated soils are also visible. Analysis on the excavated soils also confirmed no visible archaeological materials in the site.

Further survey was also conducted outside the plant site around the hills of Dibdibe. At a place called Gulbe, unknown age stone structure, which is similar to the ruined structure discovered by the preventive archaeology team in the other side of Dibdibe Mountain, is observed.

##### 4.15.4.2 Mining Area

Archaeological survey and observation of the landscape were carried out over the 1km<sup>2</sup> × 2km<sup>2</sup> quarry site and its buffer zone. Investigations were also conducted in 11 boreholes, drilled in the mining area.



**Church of Aba Tekle Haimanot**

**Foundation of the new church**

The excavated soils and sediments are thoroughly investigated. No stone artifacts, organic and inorganic archaeological materials are observed. No mega structures are also seen. Local informants also confirmed that there is no observable cultural remains in their region.

Although the Church of Aba Tekle Haimanot is located outside the quarry site, it is close to it. According to locals, the villages surrounding the church might be evacuated soon, which may isolate the church from the villagers. Since the church is placed close to the quarry site, the process of quarrying, transportation and other related activities would be affected directly or indirectly the church. Currently new construction is going on inside the church compound.

#### **4.15.5 CONCLUSIONS**

The results of methodical surface survey and evaluation in the actual plant and quarry sites of DMC demonstrate that no visible archaeological remains, which have scientific, cultural, public, economic, ethnic and historic significances, are discovered.

The construction of the plant as well as the excavations in the quarry site have no direct impact on the archaeological materials, which are placed particularly in the hills of Dibdibe, which are about 40 km away.

The risks value in both the plant and the quarry sites are very low, where no significant observable archaeological evidence is found. The sites have no archaeological importance. Thus, the preservation of the sites is not mandatory.

It may be advisable to consult with the authorities of Mugar Tekle Haymanot church about the future fate of the church and about the ongoing construction inside the church compound. It is recommended that the old church might be preserved as it is. But the site of the new church could be transferred to the nearby village.



## 4.16 SOCIO-ECONOMIC SCENARIO

The plant and quarry sites are located within the Sululta Wereda and the buffer zone covers a total of five administrative Weredas from two zonal administrations, namely, Sululta, Mullo, Yaya Gulele and Wichale from North Shoa zone and Adaberga from West Shoa zone (Refer **Fig. 4.35**). Within these Weredas there are twenty-eight Peasant Associations (PAs).

Although the Weredas consist of both urban and rural sections, the core zone (plant and mining sites) and the buffer zone (area within 10 km radius of plant and mining sites) are located in the rural settings of these Weredas. Therefore, the study focuses mainly on the associated rural parts of the Weredas.

### 4.16.1 STUDY OBJECTIVES

Basic demographic and socio-economic information on population and settlements that would be affected by the construction and operation of the proposed project have been gathered by a primary survey. The study area has been divided into core and buffer (within 10 km radius from center of plan and mining areas) zones.

### 4.16.2 METHODOLOGY

A combination of various methods, techniques and materials were used in this study, which aims to determine the socio-economic profile of the proposed project. Methods and materials used in this study include the following:

#### 4.16.2.1 Review of Literature and Maps

Various statistical and analytical reports published by Central Statistical Authority were extensively used to determine the socio-economic and demographic profile of population and settlements in the project area. Furthermore, topographic maps (Ethiopian Mapping Agency [EMA] 1984 and CSA 1994) were also used to identify and delineate villages, resources and facilities that are located within the core and buffer areas of the proposed cement plant scheme.

#### 4.16.2.2 Quantitative Level Survey

The quantitative survey has been carried out at Wereda, PA and Household level. The collection of baseline data from this focused groups had the following objectives:

- To collect statistical information on the socio-economic conditions and livelihoods bases of the households found within their respective administrations
- To identify and locate historical, religious, cultural and other important sites located around the immediate surroundings of the project area
- To identify current and planned public and private investments taking place within the project core and buffer areas
- As stakeholders, to make the local communities and their leaders aware about the proposed project
- To assess the response, expectations, fear and propose corrective measures for the negative impacts.



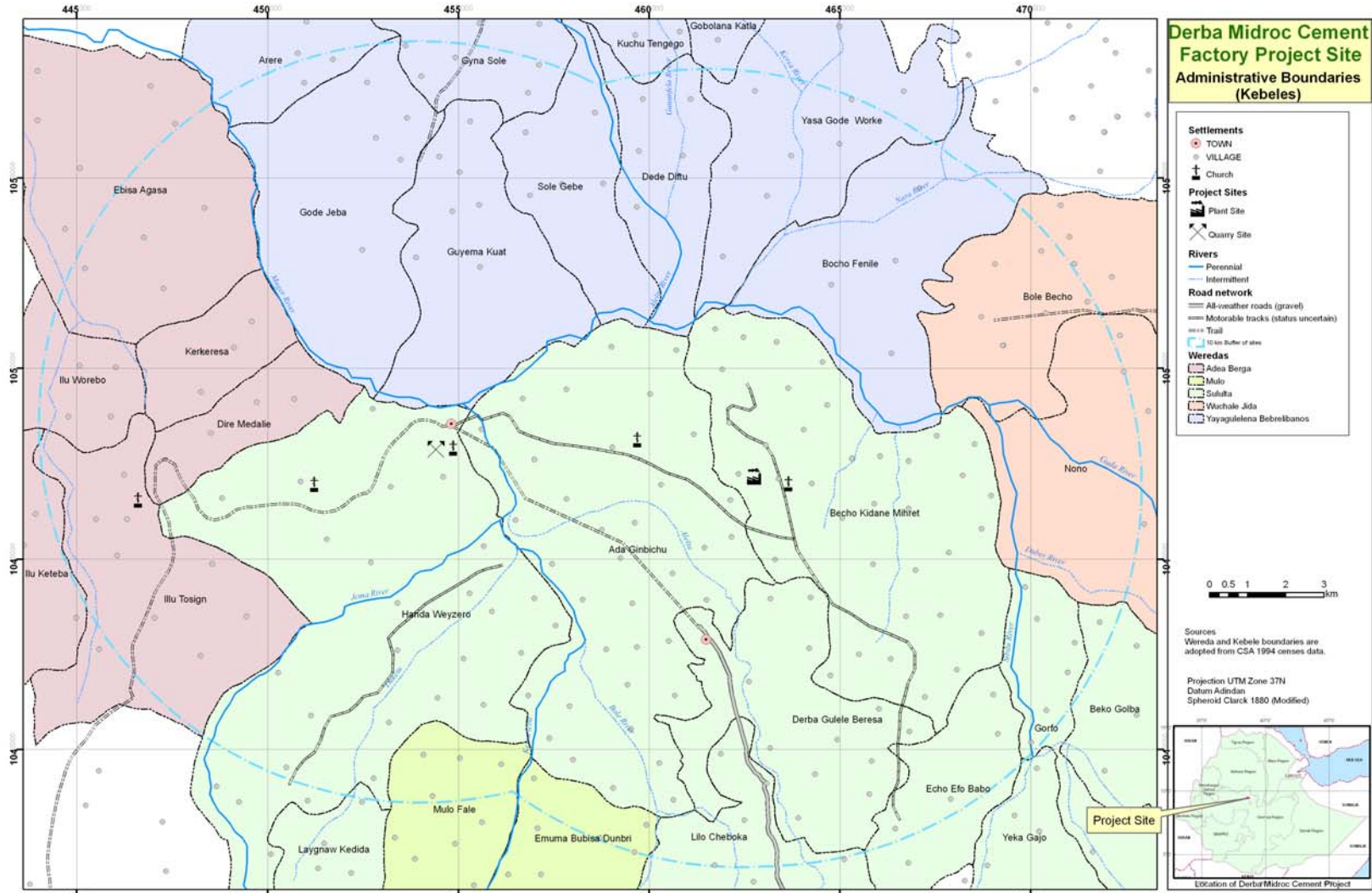


Fig. 4.35 : Administrative boundaries (Kebeles) in the Study Area



#### **4.16.2.3 Quantitative Wereda Level Survey**

All the five Weredas affected by the potential impacts of the project were surveyed by a structured set of questionnaires (Questionnaire is enclosed as **Annex 4.9**). The Wereda administrative bodies are the immediate and the primary responsible governmental bodies for any development activities taking place within their administrative boundaries. The participation of these governmental administrative bodies from the initial baseline survey through the construction and operation phases of the project benefits both the project affected communities and the project developer.

#### **4.16.2.4 Quantitative PA Level Survey**

All twenty-eight administration offices of the Peasant Associations (PAs) located within the potential impact zones of the project were surveyed through a structured set of questionnaires (Questionnaire is enclosed **Annex 4.10**).

#### **4.16.2.5 Quantitative Household Level Survey**

A quantitative survey was conducted using a structured set of Questionnaires (See **Annex 4.11**) on a statistically representative stratified random sample of about 1,000 households. The information was collected by random selection of households from various locations and topographical set up from the core and buffer areas.

#### **4.16.2.6 Qualitative Survey: Key Informant Interviews and Discussion**

In order to assess knowledge, perception and attitude of the communities about the proposed project and its potential impacts, several meetings, interviews and discussion were held with a number of community leaders and representatives of various offices. Moreover, discussions were held with local officials to assess official response and examine prospects and challenges for various mitigation strategies.

### **4.17 SOCIO-ECONOMIC PROFILE OF THE WEREDAS**

#### **4.17.1 DEMOGRAPHIC CHARACTERISTICS**

##### **4.17.1.1 Population and Settlement**

The population in the year 2007 within the five Weredas is estimated to be about 435,829 living in 76,562 families of which 50.1% were males and 49.9% were females. The estimated household size for the Weredas is 5.7 persons per family. Within the Weredas, household size ranges from 4.6 in Wuchale to 9.0 persons per family in Mulo Wereda.

The population is predominantly rural based with nearly 91.9% living in rural areas. The urban population is estimated to be only about 8.9%.

The average population density for the whole Weredas is 103.4 persons/ km<sup>2</sup> against a national population density of 50 persons/ km<sup>2</sup>. Within the Weredas, population density ranges from 91.3 persons/ km<sup>2</sup> in Wuchale to 110.3 persons/ km<sup>2</sup> in Ada Berga Wereda.

##### **4.17.1.2 Ethnic Composition**

According to the Wereda survey results, population of the project area is almost entirely of the Oromo ethnic group (97.2%) and Oromiffa is the major, if not the sole, language spoken in the area. Perhaps due to very low level of urbanization along with its



concomitants and predominantly agrarian nature of the local economy, among others, social intermingling of the population with other ethnic groups is very limited in the project area.

There are no known ethnic minorities that might require special protection effort by the proposed project.

#### **4.17.1.3 Religion**

Inhabitants of the proposed project area are predominantly followers of the Orthodox Christian religion (95.3%). Followers of the Muslim religion are only 2.6% and traditional believers are only 2.1% of the total population of the project area.

Traditionally, most of the houses in the project area were round-shaped wooden houses plastered with mud and roofs covered with grass. A recent development in the housing pattern in the project area is that farmers have moved away from construction of houses with thatched roofs to corrugated iron sheets perhaps due to rise in income and to save grass for livestock fodder.

#### **4.17.2 EDUCATION**

##### **4.17.2.1 General**

In the global poverty alleviation attempt education has become one major area of development intervention. As part of the Millennium Development Goals (MDG), by 2015 children everywhere will be able to complete a full course of primary schooling. Besides, under the MDG programme, gender disparity in primary and secondary education is expected to be eliminated.

The Government of Ethiopia has given due emphasis to the education sector with the introduction of new policy, strategy and sector program. Since 1994, after the new policy was enacted, the Government is pursuing a policy of regional decentralisation based on identified priorities. The policy is mainly geared towards re-addressing the problems of access, equity, quality and relevance of the entire education and training activities within the country.

The general situation in the project area indicates that most parts lack basic social infrastructure like education services. Inadequate access to schooling is a major socio-economic problem of the area.

##### **4.17.2.2 Literacy Rate**

The average literacy rate for the total population above the age of 10 years is very low (less than 31%) and this figure is 42% for urban and 30% for rural population. The literacy rate within the buffer area ranges from 22% to 60%. Yaya Gulele Wereda has a better education coverage compared to other Weredas, which have a very poor coverage level.

There is gender discrimination in education. About 33% of male and less than 28% of female population is reported to be literate.

##### **4.17.2.3 Education Facilities**

Under the newly adopted education policy, the entire education system is classified as basic, general, higher and specialised education in formal and non-formal education.

There are a total of 95 schools, 838 teachers and 43,915 students in the study area. Most of the schools are first and second cycle schools. At the project area level, student/ teacher



ratio is 52. The country level student/ teacher ratios are 60 and 46 for primary and secondary level education respectively.

In reference to the nation wide ratio, most Weredas in the project area have achieved a better student/ teacher ratio.

From the assessment of the school facilities in the project areas the following problems were observed:

- Though educational facilities are being expanded still they seem inadequate to cater to the needs of the growing student population within reasonable access distance, especially post primary schools.
- Insufficient class rooms
- Most of the existing schools are poorly equipped and lack adequate materials like desks, learning materials etc. Besides, absence of facilities like drinking water and toilets is common in several of these schools.
- Lack of budget for maintenance and proper handling of day to day activities
- Though there is an encouraging trend to enroll girls in schools, there is still gender imbalance between enrolment levels of boys and girls
- Due to poor access to services, there is a scarcity of good teachers, especially in post primary schools around the quarry site.

#### **4.17.3 PUBLIC SERVICES AND INFRASTRUCTURES**

##### **4.17.3.1 Roads**

In general, the road network in the project area is very poor. Apart from some dry and link roads to the main towns, most of the areas are inaccessible. The main Addis – DebreMarkos highway is one trunk road leading to and passing through the Sululta and Wichale Weredas. This is an asphalt road of 73 km length. Currently, there are a total of 585 km of roads (i.e. 321 km of dry weather road, 191 km of all weather road and 73 km of asphalt road).

The lack of an adequate transport network of all-weather roads and scattered settlements have left a majority of the people in and around the project area isolated. This has been an obstacle in the development of the area. Lack of access to basic domestic needs, social services and economic facilities has imposed unreliable transport burden and wastage of time, which could be otherwise used to productive activities.

##### **4.17.3.2 Type of Institutions**

On the basis of the estimates made on the data obtained from some Weredas, there are 37 Farmers' Service Cooperatives and five Farmers' Producer Cooperatives in the Weredas.

#### **4.17.4 ECONOMIC ACTIVITIES**

As in most parts of rural Ethiopia, subsistence agriculture with production of crops, cereals, pulses, oil seeds, fruit, vegetables and livestock characterizes the economic activities of the Weredas. Off-farm income generation and employment options are extremely limited primarily due to limited skills, experience, educational background, and small market.

95.7% of the economically active population of more than 10 years of age relies on mixed farming as their major source of employment and income. About 0.1% of the population is



employed as daily labourers while 1.9% are reported to have earned some level of income through trading. Other sources of income options contribute the remaining percentage.

#### 4.17.4.1 Agriculture

Ethiopia is a predominantly agrarian country and the majority of the population is engaged in agriculture contributing a substantial amount to the gross domestic product and export revenues. In general in Ethiopia, agriculture is characterised by a high fragmentation of land holdings, low productivity and traditional system of production. The Weredas in this project area are agricultural crop producers dominated by annual crops of mainly cereals, pulses, oilseeds, and spices.

#### 4.17.4.2 Agricultural Systems

The agricultural land in the five Weredas of the study area is mainly cultivated by means of traditional rainfed subsistence farming. The average farmland holding per household in the Weredas is about 1.9 ha. The total land utilization in the area by the type of crops grown in the area is given in **Table 4.32**.

No	Major crops	Agricultural Lands of the Weredas (ha)					Total
		Sululta	Wichale	Yaya Gulele	Mullo	Adaberga	
1	Cereals	35,183	22,585	24,644	12,889	38,608	133,909
2	Pulses	5,406	7,724	5,589	3,200	2,610	24,529
3	Oil Seeds	991	1,521	413	1,086	1,660	5,671
4	Spices	94	-	61	-	-	155
5	Vegetables	369	-	474	1,119	469	2,432
	Utilized	42,044	31,830	31,181	18,294	43,347	166,696
	Unallocated		6,929	1,327		1,920	10,176
	Excess	3,335			1,398		4,733
	Total Farm Lands	38,709	38,759	32,508	16,896	45,267	172,139

**Table 4.32 : Wereda wise Area covered by Agricultural Crops in the Project Area**

#### 4.17.4.3 Agricultural Crops Production

The agricultural production in the Weredas is dominated by cereals and pulses while spices, oil seeds and vegetables are available in relatively small quantities. Various cereals, namely, teff, maize, sorghum, wheat, barley, millets and oats are grown in the area. The production of crops also includes chickpeas, haricot beans, peas, beans, lentil and vetch. With regard to the production of oilseeds, sesame, nug, linseed, sunflower and rapeseeds are grown on a limited scale. The cultivation of spices (mainly Pepper) is also done on a small scale.

Vegetables are grown for local consumption. Potato, cabbage, onion and garlic are grown in the area.

The estimated annual volume of crop production amounts to 2,192,943 qt and the summary of the estimated volume of crop production is presented in the **Table 4.33**.



Sn	Major Crops	Production (qt)					Total
		Sululta	Wichale	Yaya Gulele	Mulo	Adaberga	
1	Cereals	407,437	168,713	330,902	177,514	746,217	1,830,783
2	Pulses	45,941	49,976	62,452	57	40,415	198,841
3	Oil Seeds	7,081	8,367	1,642	15	16,363	33,468
4	Spices	4,500	-	2,781	-	-	7,281
5	Vegetables	34,033	-	23,259	22,852	42,427	122,570
	<b>Total</b>	<b>498,992</b>	<b>227,056</b>	<b>421,036</b>	<b>200,438</b>	<b>845,422</b>	<b>2,192,943</b>

**Table 4.33 : Wereda wise Volume of Crop Production**

#### 4.17.4.4 Crop Productivity and Price

Peasants in the project area grow more than 28 types of crops of which cereals and pulse account for the majority. All of the five Weredas do not necessarily produce the same types of crops. The common crops grown in all Weredas are teff, which is a staple food crop of the area and for most of the population of the country, wheat and barley. The production of spices, pulses, oil seeds and vegetables is limited.

The price of agricultural products fluctuates over different months of a year. Peasants dispose many of the crops immediately after harvesting to meet their financial requirements and prices are lower at these post harvesting periods. The prices then increase and show significant increment from month to month. The prices furnished here relate to the average marketing price prevailing within the current time period. **Table 4.34** presents the yield and price level of the various types of crops grown in the five Weredas.



Sn	Major Crops	Sululta		Wichale		Yaya Gulele		Mulo		Adaberga		Average	
		Productivity (Q/ha.)	Unit Price (Birr)	Productivity (Q/ha.)	Unit Price (Birr)	Productivity (Q/ha.)	Unit Price (Birr)	Productivity (Q/ha.)	Unit Price (Birr)	Productivity (Q/ha.)	Unit Price (Birr)	Productivity (Q/ha.)	Unit Price (Birr)
1	Teff	8.0	450.0	5.2	450.0	10.5	450.0	9.7	450.0	7.7	480.0	8.2	456.0
2	Maize	15.4	260.0			21.2	260.0	0.5	260.0	33.0	180.0	14.0	192.0
3	Sorghum	15.2	350.0	6.4	350.0	18.9	350.0	10.6	350.0	14.7	190.0	13.2	318.0
4	Wheat	12.0	330.0	7.7	330.0	12.4	330.0	6.0	330.0	28.3	280.0	13.3	320.0
5	Barley	21.9	316.0	11.5	316.0	12.3	316.0	21.9	316.0	27.9	250.0	19.1	302.8
6	Millet	8.0	300.0									1.6	60.0
7	Oats	8.0	250.0	6.8	250.0			0.8	250.0			3.1	150.0
8	Chickpeas	16.2	440.0	11.0	-	13.5	440.0	0.6	440.0	8.7	600.0	10.0	384.0
9	Haricot Bean	8.0	390.0			12.0	390.0					4.0	156.0
10	Peas	8.0	390.0			12.0	390.0	0.1	390.0	8.7	400.0	5.8	314.0
11	Bean	8.0	363.0	4.9	-	10.6	363.0	0.0	363.0	17.5	400.0	8.2	297.8
12	Lentil	12.0	500.0	8.0	-	6.0	500.0	0.0	500.0	8.7	600.0	6.9	420.0
13	Vetch	8.0	290.0	6.4	-	11.6	290.0	0.1	290.0	10.4	320.0	7.3	238.0
14	Sesame	5.5	700.0			4.0	700.0					1.9	280.0
15	Nug	7.0	540.0	3.8	540.0	4.0	540.0	1.0	540.0	10.4	700.0	5.2	572.0
16	Linseed	7.0	536.0	5.6	536.0	4.0	536.0	0.0	536.0	8.7	650.0	5.1	558.8
17	Sunflower	5.0	600.0			3.5	600.0					1.7	240.0
18	Rape Seed	14.0	600.0			4.0	400.0			10.4	500.0	5.7	300.0
19	Red Pepper					37.2	1,176.5					7.4	235.3
20	Bessobila	48.5	13.3			9.0	3.0					11.5	3.3
21	Green Pepper	47.5	80.0			66.8	3.0					22.9	16.6



Sn	Major Crops	Sululta		Wichale		Yaya Gulele		Mulo		Adaberga		Average	
		Productivity (Q/ha.)	Unit Price (Birr)	Productivity (Q/ha.)	Unit Price (Birr)	Productivity (Q/ha.)	Unit Price (Birr)	Productivity (Q/ha.)	Unit Price (Birr)	Productivity (Q/ha.)	Unit Price (Birr)	Productivity (Q/ha.)	Unit Price (Birr)
22	Others					82.1	3.0					16.4	0.6
23	Sweet potato					43.3	-			25.0	116.0	13.7	23.2
24	Potato	88.2	167.3			29.1	-	100.0	167.3	120.0	7.0	67.5	68.3
23	Cabbage	136.1	70.0			59.3	-	0.9	70.0	127.5	188.6	64.8	65.7
26	Onion	77.6	35.0					-		71.1	225.3	29.7	52.1
27	Garlic					26.7	-	198.5	1,273.5	45.0	70.0	54.0	268.7

**Table 4.34 : Estimated Crop Productivity and Unit Price**





The annual estimated value of agricultural crops is Birr 672,595,326 with a significant contribution (86.6%) coming from cereals and pulses. **Table 4.35** depicts the value of the agricultural produces.

Sn	Major Crops	Value (Birr)					Total (Birr)
		Sululta	Wichale	Yaya Gulele	Mulo	Adaberga	
1	Cereals	132,158,772	59,665,414	121,364,890	58,511,025	210,551,120	582,251,221
2	Pulses	17,705,520	-	22,539,598	22,055	16,334,400	56,601,573
3	Oil Seeds	3,857,168	4,485,708	889,448	8,064	10,828,350	20,068,738
4	Spices	288,020	-	1,950,437	-	-	2,238,457
5	Vegetables	4,670,633	-	-	5,062,135	1,702,570	11,435,337
	Total	158,680,113	64,151,122	146,744,373	63,603,278	239,416,440	672,595,326

**Table 4.35 : Value of the Crops**

#### 4.17.4.5 Agro-Forestry

Fruit orchards are limited in the area. Bananas, oranges, papayas, coffee, chat, apples and inset are grown on a relatively small scale.

As in most of the country, eucalyptus is grown on a large scale and is highly preferred due its fast maturing and multipurpose economical benefits. There are around 8,875,000 eucalyptus trees in these Weredas and people generate substantial economic benefits from them.

#### 4.17.5 CONSTRAINTS IN CROP PRODUCTION

Various interrelated reasons are identified to be the causes of low productivity of crops in the area. The various constraints in crop production include.

- Insufficient land holdings
- Lack of improved farm implements
- Insufficient and uneven distribution of rainfall
- Inaccessible surface and ground water irrigation
- Lack of agro-chemicals and fertilizer
- Lack of improved seeds
- Weak agricultural extension services
- Loss of soil fertility
- Crop diseases and insects
- Weed infestation
- Lack of improved seed practices

#### 4.18 LIVESTOCK

##### 4.18.1 LIVESTOCK POPULATION

The main livestock populations found in the five Weredas are cattle, sheep, goats, poultry and equines. The largest type of livestock population consists of oxen, cows, bulls and calves and their presence is vital for undertaking agricultural activities.



**Table 4.36** presents the type and number of livestock population of the Weredas. As presented in Table 2.5 among the five Weredas of the project area the highest livestock holding per family (5.0) is found in Wuchale Wereda and the lowest (2.3) is in Adaberga Wereda. The average livestock holding per family is 3.4.

Sn	Livestock	Sululta	Wichale	Yaya Gulele	Adaberga	Mulo	Total
1	Cattle (Oxen, Cows, Bulls, Calves)	180,566	135,092	75,262	116,331	66,852	574,103
2	Sheep	82,130	132,032	48,014	39,702	66,517	368,395
3	Goats	15,070	2,234	15,065	19,145	2,739	54,253
4	Equines (Horse, Donkey, Mule)	37,030	36,729	9,102	27,020	8,114	117,995
5	Poultry (Mainly Chicken)	77,230	149,401	28,458	63,175	45,901	364,165
	<b>Total</b>	<b>392,026</b>	<b>455,488</b>	<b>175,901</b>	<b>265,373</b>	<b>190,123</b>	<b>1,478,911</b>

**Table 4.36 : Livestock Population of the Weredas**

The predominant varieties of livestock belong to the indigenous type but lately exogenous varieties are also being introduced. Livestock are raised as an important part of the mixed farming system in the Weredas. Cattle as a dominant livestock group are kept primarily for the production of draft oxen, replacement stock and milk. Sheep and goats are kept as source of cash income and sometimes for meat during holidays and festivals. Other products obtained from livestock include dung used for fuel, skin and hides.

The common characteristic of the indigenous cattle is their low productivity. It takes about 4-5 years for calves to reach maturity with calving intervals of 1.5-2 years. Milk production does not exceed about 1.5 lt/day/cow and average maturity live weight is about 250 kg/head. Sheep and goats have smaller live weight ranging between 25-40 kg/head. Average kidding rate is about 1.5/year, and reproduction rate for sheep does not exceed 1/year.

#### 4.18.1.1 Livestock Feed

Livestock in the five Weredas entirely depend on grazing and browsing in low crop areas and crop residues. Grazing sources and their condition ranges from fair to good. There is no seasonal migration of livestock in the five Weredas of the two Zones.

Based on the current available livestock population and the grazing land the average carrying capacity of the land for the five Weredas indicates that there is relatively higher number of livestock population as compared to the grazing land at present. One possible reason for the large number of livestock especially that of cattle in these Weredas could be directly associated with mixed crop livestock farming system whereby large numbers of cattle/oxen are used for crop cultivation. Greater cultivation of cropland, which necessitated the use of more cattle/oxen for draft power, has been a common feature. This has been because of increase in human settlement over the last few years.

#### 4.18.1.2 Livestock Diseases

The prevalence of livestock diseases is a serious concern in the area of study. The major livestock diseases in terms of economic importance are internal parasites, external parasites and infectious diseases.



At present, taking the livestock resources into account, the animal health services rendered in the five Weredas are not adequate. In general, veterinary personnel and facilities are inadequate for the livestock population that requires these health services.

#### 4.18.1.3 Livestock Marketing

Livestock and livestock products are marketed in small sized open markets where buyers and sellers bargain on specific items. Animals are usually taken to the market when farmers have surplus to their requirement or when they are in need of cash for home expenditure, such as purchase of agricultural inputs, consumer goods as well as payment of taxes. In addition, farmers, also sell livestock either when prices are attractive or during severe drought and animal disease outbreaks in order to avert and minimize their risk.

#### 4.18.1.4 Constraints to Livestock Raising

The major constraints to livestock in the area include inadequate feed, poor genetic make-up, animal health and diseases, lack of adequate health services, lack of market infrastructure, increased population pressure, lack of finance, and shortage of trained manpower.

#### 4.18.2 APICULTURAL PRODUCTION AND INCOME

Apiculture, i.e., bee keeping is also being practiced in the study area on a small scale. Existence of such off farm activities assists the population in generating additional annual income. The methods of production include both the traditional and the modern system and bee keeping has a good prospect for growth in the future. Honey consumption and the associated price are increasing with time especially in the urban centres of the Wereda and other places. This demand arises from the multipurpose usage of the product including the manufacture of a local drink called Tej. The apicultural production and income is given in **Table 4.37**.

Sn	Description	Quantity and Income of Honey Production					
		Quantity in kg			Income in Birr		
		Urban	Rural	Total	Urban	Rural	Total
<b>I</b>	<b>Apiculture production</b>	595	23,035	23,630	10,710	345,525	356,235
1	Number of Local Beehives	560	11,410	11,970	10,080	171,150	181,230
2	Number of Unimproved Beehives	35	11,625	11,660	630	174,375	175,005
<b>II</b>	<b>Average Apiculture Products</b>	3,000	37,460	40,460	54,000	561,900	615,900
1	Honey in Kg	2,800	37,110	39,910	50,400	556,650	607,050
2	Wax in Kg	200	350	550	3,600	5,250	8,850
	<b>Total</b>	3,595	60,495	64,090	64,710	907,425	972,135

**Table 4.37 : Quantity and Income from Apiculture Production**



## 4.19 SOCIO-ECONOMIC SCENARIO OF THE STUDY AREA

### 4.19.1 BACKGROUND

The population, settlements, social service facilities and infrastructure in the twenty eight PAs falling within the study area of 10 km around the proposed project site and villages of the five Weredas will be partially affected by the realization of the proposed project.

The household level socio-economic baseline survey of the project area has been conducted during August 2007 through random sampling. The overall sample size is 956 households and this represents over 7% of the households in the buffer area. Larger sample size is taken from the quarry, plant and access road sites whereas the sample size is lower in the other places relatively distant from these core areas. The 85.5% of the surveyed household heads are male and the remaining 14.5% are female. The age category of the surveyed household heads ranges from the minimum of 15 to over 65 years and 90% of the surveyed household heads are economically active (having less than 65 years of age).

The findings of the primary survey are presented below.

### 4.19.2 DEMOGRAPHIC CHARACTERISTICS

#### 4.19.2.1 Population

The total population within the buffer area of 10 km radius around the plant and mining sites is estimated to be about 76,228 of which 49.6% were males and 50.4% were females in the year 2007.

The average family size of 5.5 persons per household for the surveyed households is considerably higher than the national average and slightly smaller than the Wereda average. The details of the population are given in **Annex 4.16**.

The average population density for the buffer area is 153.7 persons/km<sup>2</sup> against the Wereda and national population density of 103.4 and 50 persons/km<sup>2</sup> respectively. Within the buffer area, population density ranges from 31.6 persons/km<sup>2</sup> in Becho Kidane Mihiret to 818.6 persons/km<sup>2</sup> in Kerkercha PA (Refer **Fig. 4.36**).

A total number of 52 births and 23 deaths occurred during the previous year. The corresponding birth, mortality and natural growth rate thus amounts to 5.44%, 2.41% and 3.03% respectively. At the current growth rate, secondary impact zone/ buffer area's population is expected to reach from 76,228 in 2007 to more than 155,000 by the year 2025.

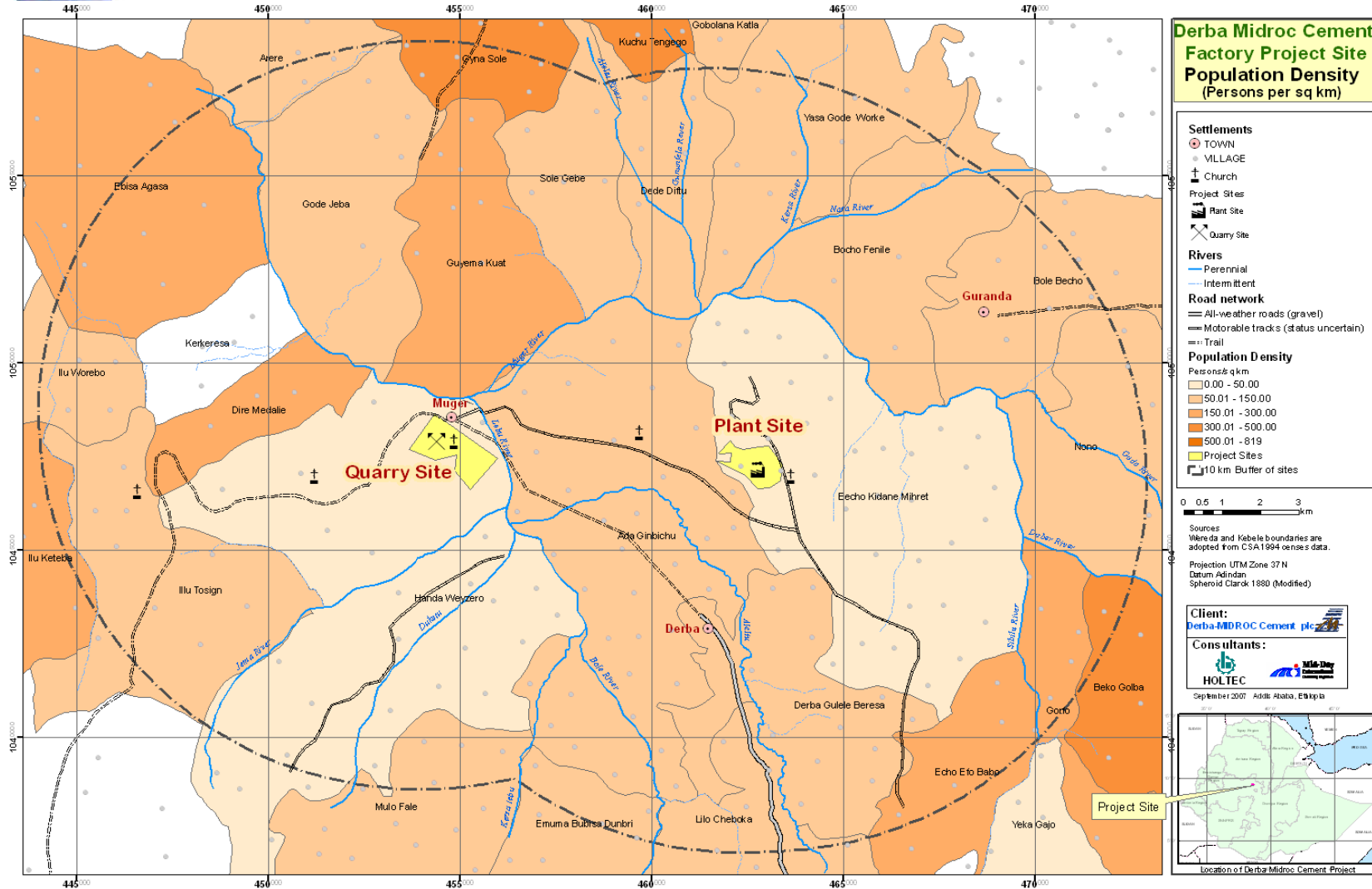


Fig. 4.36 : Population Density of the Study Area



Sn	Wereda	PA	Population Number			HHH Number			Average Family Size	Population density (Pop /km <sup>2</sup> )
			Male	Female	Total	Male	Female	Total		
	Sululta		63,149	64,103	127,252	14,057	2,365	16,422	7.7	101.9
1		Becho Kidane Mehret	804	872	1,676	269	18	287	5.8	31.59
2		Handa Weizero	891	1,611	2,502	514	235	749	3.3	33.62
3		Ada Ginbichu	1,318	1,520	2,838	576	556	1,132	2.7	54.87
4		Gorfo	1,453	866	2,319	350	65	415	5.6	223.57
5		Beku Golba	1,268	1,468	2,736	104	56	160	14.2	435.33
6		Lilo Chebeka	1,392	1,424	2,816	370	97	467	6.0	92.88
7		Derba Gulele Beresa	1,825	2,065	3,890	1,161	107	1,268	3.1	147.46
8		Eko Efo Babo	524	430	954	287	253	540	2.1	258.78
		TOTAL	9475	10256	19731	3631	1387	5018	3.9	
	Mulo Wereda		17,761	18,021	35,782	3,178	783	3,961	9.0	101.9
9		Amuma Bebisa Dunburi	1,038	1,214	2,252	286	48	334	7.0	185.44
10		Mulo Fale	800	600	1,400	169	30	199	5.2	196.96
			1838	1814	3652	455	78	533	6.9	
	Wichale		47,740	43,486	91,226	16,474	3,174	19,648	4.6	91.3
11		Bole Becho	1,370	1,375	2,745	580	155	735	3.7	100.26
12		Becho Faneli	1,360	1,400	2,760	410	110	520	5.3	91.33
13		Nono	1,690	1,570	3,260	617	128	745	4.4	56.50
		TOTAL	4420	4345	8765	1607	393	2000	4.4	
	Yaya Gulele		32,967	34,377	67,344	11,224	1,797	13,021	5.2	113.4
14		Arere	529	771	1,300	204	55	259	5.0	92.79
15		Gobolana katila	119	121	240	40	8	48	4.9	500.00
16		Goda Jaba	1,005	905	1,910	317	63	380	5.0	63.43
17		Gyna Sole	3,592	3,338	6,930	437	30	467	14.8	362.64
18		Kuchuna Tengego	983	947	1,930	284	39	323	5.8	305.18
19		Guyamana Kuwat	3,324	2,436	5,760	556	556	1,112	5.2	223.60
20		Sole Gibe	817	573	1,390	242	36	278	5.0	86.01
21		Dede Diftu	987	842	1,829	248	172	420	4.4	122.92
22		Yasa Gode Wereke	1,207	1,105	2,312	457	60	517	4.5	76.86
			TOTAL	12563	11038	23601	2785	1019	3804	6.2
	Adea berga		56,755	57,470	114,225	19,999	3,511	23,510	4.9	110.3
23		Kerkerecha	2,031	1,830	3,861	390	30	420	15.3	818.57
24		Elu Keteba	1,910	3,570	5,480	399	40	439	12.5	289.03
25		Elu Tosigne	1,699	1,679	3,378	405	118	523	6.5	107.68
26		Dire Medale	130	125	255	40	8	48	4.8	210.70
27		Elu Werebo	746	588	1,334	187	23	210	6.4	113.15
28		Debisa Agasa	2,992	3,179	6,171	853	82	935	6.6	152.03
			TOTAL	9508	10971	20479	2274	301	2575	8.0
		TOTAL OF ALL PAs	37,804	38,424	76,228	10,752	3,178	13,930	5.6	153.7
		TOTAL OF ALL WEREDAS	18,372	17,457	435,829	64,932	1,630	76,562	5.7	

Table 4.38 : Population, Family size & Density of the Study Area by PAs & Weredas

#### 4.19.2.2 Marital Status

95.9% of the household heads were married and the remaining 1.4 and 0.8% were single and widowed respectively. Marriage in the study area could be considered stable with reported divorce cases being less than 1.9%.

Male household heads is the dominants the households by about 77.2% while female headed households constituted only 22.8%. Male to female ratio is nearly 1:1 for the whole buffer area.

#### 4.19.2.3 Religion

Residents of the project area are predominantly followers of the Orthodox Christian Religion (99.9) and only 0.1% are followers of Islam.

#### 4.19.2.4 Ethnicity

According to surveyed results, population of the buffer area is almost entirely of the Oromo ethnic group (97.3%) and Oromiffa is the major, if not the sole, language spoken in the area. The remaining 2.7% of the total households belong to Amhara ethnic group. None of the Project Affected Persons belong to ethnic minority groups.

### 4.19.3 EDUCATIONAL STATUS OF THE POPULATION

According to findings of the survey results, overall literacy rate is very low for the surveyed population. 67.3% of the total population was illiterate and only the remaining 32.7% were literate. Of this, less than a quarter of the population had formal education of which the majority was only at the primary level.

Literacy rates were also disproportionate between sexes. For instance, while 69.4% of females were illiterate, the figure was 65.2% for males. This figure is very low compared to the Wereda average. Literacy rates were consistently higher for men than women throughout all levels of education.

### 4.19.4 HOUSING AND SETTLEMENT

On the basis of the sample survey result, there are an estimated 15,081 residential main houses that belong to the 13,930 household heads. The majority of surveyed household heads own only one main house and the remaining household heads have got more than a single main house (1.1 houses per household).

An estimated 32.7% of the households surveyed had a separate guesthouse. The presence of separate houses for kitchen and cattle shed purposes is one indicator of better sanitation practices. In addition to this, people have got houses for other unspecified purposes.



**View of the houses in Adero village**



#### 4.19.4.1 Housing Conditions

Traditionally, most of the housings in rural areas are ‘tukuls’ and temporary shelters/structures made of twigs, rugs, mud and roofs covered with grass. A recent development in the housing pattern in the project area is that farmers have moved away from construction of houses with thatched roofs to corrugated iron sheets perhaps due to rise in income. Most of the houses are without partitioned rooms and poorly constructed windows for ventilation and daylight. They are often smoke-filled and dark inside and with earth floors.

There are over 5 persons living in such one-roomed, smoke-filled, earth-floored and unventilated tukuls and shelter-like structures. These unhealthy dwelling houses are favourable environment for the transmission of communicable diseases like pulmonary tuberculosis, ARI, louse-borne diseases (typhus and relapsing fever), skin infections, etc.

#### 4.19.5 AGRICULTURE

##### 4.19.5.1 Average Landholding

Further analyses of the survey results revealed that land is a scarce resource in the project area and accordingly, a total of 956 households had 2418.7 ha of farmland. This translates into an average of 2.58 ha per household.

Both landlessness and inequality in landholding is still a serious problem in the project area. For instance, the size of the maximum landholdings reaches 24.5 ha of farming land whereas the minimum being only 0.125 ha. While the land-poor 36.5% of the households owned only 15.0% and the land-rich 36.6% of the households owned nearly 63.7% of the total farmland available (see **Table 4.39**).

The majority of landless people gain access to land through some internal arrangements including leasing, share-cropping and other land sharing arrangements at family level. In response to the growing problem of landlessness, parents allot small plots of land from their scarce resource, to their children.

Landholding (hectares)	Households		Total Landholding	
	Number	Percent	Hectares	Percent
Landless	2	0.002		
<= 1	116	12.3	76.1	2.6
1.1 to 2.0	231	24.2	359.8	12.4
2.1 to 3.0	257	26.9	621.6	21.4
3.1 & More	350	36.6	1853.6	63.7
<b>Total</b>	<b>956</b>	<b>100.0</b>	<b>2811.1</b>	<b>100.0</b>

**Table 4.39 : Size of Landholding among the Surveyed Households**

##### 4.19.5.2 Agricultural System

Agriculture (crop production and livestock rearing) is the sole economic opportunity available to farmers in the project area. Despite some efforts launched recently to introduce improved agriculture, agricultural techniques adopted in the study area were by and large traditional rainfed subsistence farming.



The land use in the buffer area is dominated by the production of annual crops and followed by grazing land. The proportion of land used for agro-forestry, is comparatively very small. Exact land utilisation pattern as collected from the surveyed households is presented in **Table 4.40** and is believed to give a comparable picture for the rest of the project area.

Land Use	Total (ha)	Average
Farming	2418.7	2.58
Grazing	913.8	1.14
Residential	337.4	0.39
Tree	0.58	0.58
Others	11.33	0.6

**Table 4.40 : Land Use Pattern in the Buffer Area (in ha)**

The total area of land utilized for the production of crops is estimated to be 74,228 ha of land exceeding the estimated 55,732 ha of farmland by 18,556 ha or by 133%. The possible reason for this increment is that people use the same area of land more than once during the two different production seasons in a give year. It is also possible that people owning land along rivers could produce more than once using river waters. With respect to crop production, people grow almost sixteen types of crops dominated by cereals.

The average farmland holding of about 2.58 ha per household and is greater than the 1.9 ha per household average for the total Weredas. The major crops of the buffer zones are as shown in **Table 4.41**. The main crops in the buffer areas are cereals in crop rotation after two or three cereal cultivation periods. The amount of cereal crops is about 87.6% of the area occupied by the individual farms.

Sampled Village	Teff	Maize	Sorghum	Wheat	Barley	Oats	Chickpeas	Bean	Nug	Garlic	Others	Total
Becho Dibdbe	1.29	0.03	0.15	0.35	0.01	0.03	0.16	0.2	0.05	0.03	0.01	2.3
Botoro	1.00	0.24	1.26	0.21			0.01					2.7
Gimbchu	1.13	0.50	1.00	-								2.7
Average	1.09	0.35	1.03	0.12		0.0	0.02	0.02	0.01			2.6
% of crop utilization	41.4	13.3	38.9	4.5		0.1	0.7	0.7	0.2	0.1		100.0

**Table 4.41 : Areas under Major Crops in the Buffer Area (ha)**

The average yield of crops is given in **Annex 4.14**. The average selling price of crops is given in **Annex 4.15**.

#### 4.19.5.3 Agro-forestry Practices

There are different kinds of perennial trees (banana, orange, mango, coffee, chat and eucalyptus) under the ownership of the surveyed households and eucalyptus tree is the dominant tree species. However, the estimated volume of production and associated level of income from tree production per surveyed households is only 1,948 birr/ year. The



estimated volume of production and associated level of income from tree production is estimated and presented in **Table 4.42**.

Sn	Type of Trees	Number of Trees	Production		Income in Birr
			Unit of Measurement	Quantity	
1	Banana	137,508	kg	112,241	396,670
2	Mandarin	102	kg	-	2,186
3	Orange	12,152	kg	25,198	61,479
4	Papaya	131	kg	1,137	4,153
5	Avocado	175	kg	58	583
6	Mango	146	kg	4,080	5,391
7	Coffee	27,641	kg	22,925	395,344
8	Chat	1,661	Zurba	3,497	30,672
9	Eucalyptus	9,137,118	Nr	1,427,796	7,619,233
	<b>Total</b>	<b>9,316,635</b>		<b>1,596,932</b>	<b>8,515,711</b>

**Table 4.42 : Estimated Number of Trees and Income**

On the basis of the survey result, there are several constraints facing tree production within the buffer area and these include:

- Shortage or absence of improved seedling variety and nursery.
- Landslides and cracking caused by difficult topography.
- Attack from worms, ants, fire ants and other insects. In such places, the area is marginally appropriate for Eucalyptus trees only.
- Most of the land area is rocky and not suitable for tree planting
- Scarcity of land.
- The awareness of the people towards the importance of tree plantations is very low at large.

#### 4.19.5.4 Constraints to Crop Production

It was also reported that the sector's productivity has been in a steady downward spiral for decades now. According to some farmers, the problem of agricultural productivity in the area is so severe that produce of the majority of the farmers (80%) is inadequate to support their families throughout the year.

The majority of farmers in the surveyed households perceived the following as the most pressing agricultural problem in the buffer area.

- Shortage of finance for the purchase of farming inputs, lack of improved agricultural inputs and these include seeds, fertilizers (UREA and DAP), insecticides and miscellaneous inputs. The reasons accountable for this limitation are mainly higher purchase price as well as transportation cost.
- Human labour is used in crop production and most of it comes from family members. During the seasonal peaks, they generally help one another on a non-cash basis while in the mean time seek hired labour. However, shortage of labour is acute especially for the elders and women headed households. Major use of the unskilled labour is accounted for by land preparation, weeding, harvesting and post harvesting operations.
- Use of traditional farming methods- The predominant technology used by farmers is the traditional plough drawn by pair of oxen. The farmers use the bullock power mainly for



land preparation and threshing. The topography and the non-availability of modern technology limit the growth of crop production in the area. Besides this, there is shortage of oxen in the area. Due to land scarcity the land is farmed without leaving the land fallow in between and this has led to loss of soil fertility.

- ❑ Crop attack from monkeys, apes, rats and other wild animals are the other dominating factors affecting agricultural crop production.
- ❑ The topography is rugged and hilly and is not appropriate for ploughing using oxen. In such places, people dig the land using hoes, which is less productive.
- ❑ Shortage of oxen in the area.
- ❑ Prevalence of frequent worm attacks, various types of weeds, crop diseases, insects and pests.

Among other things, shortage of farmland, compounded by loss of soil fertility, erratic rainfall and inadequate supply of inputs are major problems that have been consistently eroding farmers' coping capacity and made them so vulnerable. The level of poverty and associated vulnerability in the study area is such that even smallest shocks can cause considerable damage to people's livelihoods. Therefore, in order to avoid undesirable and potentially impoverishing impacts of its realization, it is very important for the proposed project to make conscious efforts (over and above simple 'compensation for lost assets') aimed at building asset-bases for and capacities of the affected population.

#### 4.19.6 LIVESTOCK

Livestock, which serves as source of energy, food and income and means of transport, occupies a central location in the local economic life of the people in the project area. With suitable agro-ecology that provides adequate pasture and water, for farmers in the project area, life without livestock is inconceivable.

Livestock is composed of cattle, sheep, goats, equines, poultry and beehives. The livestock population within the project area is 210,807 and is shown in **Table 4.43**. As shown in the table, among the different livestock species of the project area, cattle rank first (76,479) followed by sheep and goats (60,059), poultry (31,896) and equines (28,006) population. However, the number of beehives (14,367) is relatively smaller in the area.

Wereda Location of the Buffer Area	Cattle (Oxen, Cows, Bulls, Cows)	Equines (Horses, Donkeys, Mules)	Sheep and goat	Poultry (mainly Chicken)	Beehives	Grand Total
Adaberga	8,816	1,588	6,899	4,867	8,072	30,242
Mullo	7,825	1,282	7,329	4,532	1,399	22,367
Sululta	37,516	21,070	31,973	14,323	3,453	108,335
Wichale	6,499	1,384	3,934	2,084	408	14,309
Yaya Gulele	15,824	2,681	9,923	6,091	1,035	35,554
Total	76,479	28,006	60,059	31,896	14,367	210,807

**Table 4.43 : Number of Domestic Animals**

Among the surveyed households disparity in ownership of livestock is remarkable. On an average, the surveyed households owned 5.6 cattle, 2.0 equines and 4.4 sheep and goat. Based on the survey results the estimated livestock holding per family is 11.8, which ranges between 3.5 (at Elu Werabo PA) and 29.2 (Mulo Fale PA). Ownership of poultry and beehives was not significant.



The overall livestock density of the project area is 298.6 cattle/ km<sup>2</sup>. The highest livestock concentration is observed in Dire Medale (854.9 cattle/ km<sup>2</sup>) with the least in Elu Werebo (62.3 cattle/ km<sup>2</sup>).

There are many factors that limit the quantity and quality production of domestic animals in the area and the respondents have reported the following constraints:

The major constraints for livestock development in the area include inadequate feed, poor genetic make-up, animal health and diseases, low standard management, lack of market infrastructure, increased population pressure, lack of finance, drought and shortage of trained manpower. On the other hand, the resource base, previous project experience, market outlet etc. are potential aspects that could be exploited for the benefit of livestock development.

The majority of the surveyed households perceived the following as the most pressing livestock problems:

- Shortage of animal feed and grazing land.
- The grazing area is located far from the residential houses requiring more travel time.
- There are various types of cattle diseases such as Aba-Gorba and Abasenga, sheep and goat fox, foot-mouth that result mostly in their deaths. The cattle do not get immediate medical treatment due to the shortage of veterinary clinics. There are also various types of worms (Leach, Mice, Black leg, Anthrax and bacterial diseases) that suck their blood as well as flies that attack the cattle.
- Lack of improved variety of cattle and also lack of awareness towards the importance of modern cattle raising system.
- Shortage of drinking water.
- Difficult topography and lack of access to potential grazing lands has caused frequent deaths and injuries to cattle. Inaccessibility of the grazing land i.e. roads get frequently damaged by floods prohibiting easy access to cattle.
- Frequent attack by wild animals.

#### **4.19.7 EMPLOYMENT AND SKILL**

##### **4.19.7.1 Primary Occupation**

Mixed agriculture (crop production and livestock rearing) is the sole source of employment, and hence, livelihood in the project area. Results of the survey clearly confirmed that not only 98.5% of the heads of households interviewed were farmers, but also 92.5% of them had neither the experience nor the opportunity to work and earn a living outside agriculture. Agriculture is the only source of employment and livelihood and it plays a pivotal role in the local economy.

There are limited types of economic activities taking place by the households. The identified primary occupations of the people include farming, factory employment in the Mughar cement factory, guards and trading activity. The majority of the households comprising of over 98.5% are engaged in the primary occupation of farming whereas the remaining 1.5% are involved in factory employment, guards and trading.

##### **4.19.7.2 Secondary Occupation**

An estimated 7.5% of the households have got supplementary activity like carpentry, daily labour, guarding, priest, trading, tailoring, etc. other than their primary occupation. These



are a source of additional income to the people. The implementation of the project can also bring more type of economic activities to the people located near the project area.

#### 4.19.7.2 Division of Works

Due to the fact that the population is mainly agricultural based, the division of labour relates to the types of activities of the rural communities. Various types of economic activities are performed by family members at different levels of magnitude. All of these activities involve the participation of male and female population of the household heads, children and hired people and is done with all the groups of society.

Ploughing and seed sowing are largely performed by male population with marginal assistance received from child and female labour. In particular, females cover only about 0.5% of the labour requirements of these activities. The types of activities in which all types of the available labour of the family are involved are land preparation, crop harvesting, hoeing/ weeding, threshing/ shelling crops, fodder collection, marketing of agricultural products and conducting of trading activities of any kind. Caring of children, food preparations, marketing of household items, milking of animals and cleaning of livestock sheds are largely the responsibility of the females. In all types of the activities, child labour has an important place.

#### 4.19.8 TYPE OF HUMAN FEED AND ANNUAL CONSUMPTION LEVEL

People in the area like the rest of the country depend mainly on agricultural products for their daily meal. The level of consumption depends on the interaction of the family size and the economic status of the particular family. However, the average consumption level was computed and estimated from the collected sample size. The result shows that the annual per capita consumption level amounts to about 2.5 quintals of crops, one poultry, one sheep or goat, 3 kg of beef, one kg of butter, 5 litre of milk, 1.4 kg of cheese, 3.9 kg of vegetables and 1.3 kg of fruits. The listed types of food consumption contain balanced nutritional contents.

The people were also interviewed whether they are food deficit or not. Accordingly, the majority of the respondents (68%) experience food shortages and the remaining 32% stated that they don't have food shortages.

#### 4.19.9 ANNUAL HOUSEHOLD INCOME

The major source of employment and income in the project area is mixed farming, i.e. crop production and livestock. However, apart from the heads of the households who are often the breadwinners of the family, other family members also contribute to family income through employment in farming and off-farm activities.

The most important income accounting for over 90% originates from agricultural and related activities mainly from the production of crops and vegetables, perennial crops, domestic animals and its products, agro-forestry products and renting of farming lands. The remaining activities i.e. trading, employment, handicrafts and others represent the remaining income of the people. On the bases of the survey result, the annual per capita income of the people is computed as Birr 12,450.84 (refer **Table 4.44**).

Income Source	Average Annual Per capita Income (Birr/HHH)	%
Crop (Grain and Vegetables)	8,696.75	69.8
Perennial crops	611.32	4.9
Animals	1163.04	9.3



Income Source	Average Annual Per capita Income (Birr/HHH)	%
Animal products/ by products	556.18	4.5
Agro-forestry products (including firewood charcoal)	241.44	1.9
Land Rent/ leasing	56.47	0.5
Petty trading	230.28	1.8
Governmental permanent employment of family members	123.87	1.0
Labor of family members	157.17	1.3
Handicraft/ trade by family members	80.95	0.7
Family Trading Activity	198.16	1.6
Financial support by family members & relatives	21.10	0.2
Pension	10.22	0.1
Others	303.90	2.4
<b>Total</b>	<b>12,450.84</b>	<b>100.0</b>

**Table 4.44 : Annual Income**

The annual minimum and maximum incomes of the households in each PA are given in **Annex 4.12 & 4.13** respectively.

#### 4.19.10 ANNUAL HOUSEHOLD EXPENDITURE

The structure of household expenditure reflects the subsistence level of the rural economy. The consumption line of expenditures consist of about 62.3% of home consumption, 2.6% of farm inputs, 0.6% of taxes, social and cultural and about 12.9% of other expenses. Moreover, the average saving rate of the community is estimated to represent 9.5% and medical expenses account for only 5.1% of the annual income (refer **Table 4.45**).

Consumption Items	Total Per capita Annual Consumption (Birr /HH)	%
Consumables	4,999.70	40.2
Medical care	636.42	5.1
Education	456.42	3.7
Clothing	863.54	6.9
House maintenance/ building	583.94	4.7
Energy	57.57	0.5
Water	15.13	0.1
Transport	143.49	1.2
Farm tools	104.75	0.8
Farm inputs	320.43	2.6
Hiring labor	154.07	1.2
Land Rent	155.65	1.3
Food for livestock	220.13	1.8
Animal Health	57.58	0.5
Purchase of Animals	389.16	3.1
Taxes	82.48	0.7



Consumption Items	Total Per capita Annual Consumption (Birr /HH)	%
Debt Repayment	159.79	1.3
Saving	1187.72	9.5
Social/ Religious Ceremonies	258.82	2.1
Others	1604.04	12.9
<b>Total</b>	<b>12,450.84</b>	<b>100.0</b>

**Table 4.45 : Annual Consumption and Saving**

#### 4.20 SOCIO-ECONOMIC CHARACTERISTICS OF THE CORE AREA

##### 4.20.1 BACKGROUND

In the previous section global demographic profile of population of the project area based on the Wereda level survey results was presented. As the information from the survey was available only at higher level and it does not also cover key areas of interest, it was found necessary to conduct fresh and thorough survey that is focused on population and settlements that would be affected by the proposed project. Thus, a quantitative household survey was conducted on a carefully selected stratified random sample of 244 households from the project affected villages.

This section describes the social and demographic characteristics of the would-be affected population in more detail.

##### 4.20.2 DEMOGRAPHIC CHARACTERISTICS OF THE HOUSEHOLDS

###### 4.20.2.1 Population

The Plant and Quarry sites are located close to Becho Dibdibe and Gimbchu villages within Becho Kidane Mehret and Handa Weizero PAs respectively (see **Fig. 4.35**).

Results of the household survey showed that there were a total of 2,027 people living in the 619 households surveyed. Females constitute 62.4% of the total population. Out of the total 244 heads of households interviewed only 12.3% were female-headed households. Proportion of female-headed households here is considerably higher compared to 2.1% average for the Weredas as a whole.

Average family size of 5.3 persons per household for the survey households is slightly lower than the average of 5.7 persons per family for rural households in the Weredas.

Sn	Project Component	PA	Affected Village	Population			Household Heads		
				Male	Female	Total	Male	Female	Total
1	Plant Site	Becho Kidane Mehret	Dibdibe	88	90	178	21	2	23
2	Quarry Site	Handa Weizero	Botero	290	272	562	81	18	99
3	Access Road	Ada Gimbchu	Gimbchu	257	308	565	112	10	122
Total				635	670	1,305	214	30	244

**Table 4.46 : Population of the Project Area**



#### **4.20.2.2 Marital Status**

98% of the households surveyed were married and the remaining 0.8% and 1.2% were divorced and widowed respectively.

#### **4.20.2.3 Religion**

Residents of the project area are predominantly followers of the Orthodox Christian Religion (98.4%).

#### **4.20.2.3 Ethnicity**

According to surveyed results, population of the project affected area is almost entirely of the Oromo ethnic group (97.5%) and Oromiffa is the major, if not the sole, language spoken in the area. The remaining 2.5% of the total households belong to Amhara ethnic group. None of the Project Affected Persons belong to ethnic minority groups.

#### **4.20.2.4 Education**

According to findings of the survey results, the overall literacy rate is very low for the surveyed population and 81.5% of the people were illiterate and only 18.5% were literate. Of this, less than a quarter of the population had formal education of which the majority was only at primary level.

Literacy rates were also disproportionate between sexes. For instance, while 88.5% of females were illiterate, the figure was 69.8% for males. This figure is very low compared to the Wereda average. Literacy rates were consistently higher for men than women throughout all levels of education.

#### **4.20.2.5 Housing and Settlement**

On the basis of the sample survey result, there are an estimated 2,007 residential main houses that belong to the 619 household heads. The majority of surveyed household heads own only one main house and the remaining household heads have more than a single main house.

The people usually construct separate house entirely reserved for the guests coming from distant places. These people could be relatives, friends or having any type of relationship. An estimated 20% of the households had separate guesthouses. The presence of separate houses for kitchen and cattle shed purposes is one indicator of better sanitation practices. In addition to this, people have got houses for other unspecified purposes.

Traditionally, most of the houses in the project area were round-shaped wooden houses plastered with mud and roofs covered with grass. A recent development in the housing pattern in the project area is that farmers have moved away from construction of houses with thatched roofs to corrugated iron sheets perhaps due to rise in income.

### **4.20.3 AGRICULTURE**

#### **4.20.3.1 Average Landholding**

Further analyses of the survey results revealed that land is very scarce resource in the project area. According to the survey results, a total of 244 households had 680.1ha (refer **Table 4.47**) of farmland. This translates into an average of 2.8ha per household. However,





this figure does not include landless farmers and those households who share their land with their family members. The majority of landless people gain access to land through some internal arrangements including leasing, share-cropping and other land sharing arrangements at family level. In response to the growing problem of landlessness, parents had allotted small plots of land from their scarce resource, to their children. Both landlessness and inequality in landholding is still a serious problem in the project area. For instance, while the land-poor 21.7% of the households owned only 15% and the land-rich 43.9% of the households owned nearly 62.3% of the total farmland available.

Landholding (ha)	Households		Total Landholding	
	Number	%	Hectares	%
Landless				
<= 1	15	6.1	7.0	1.0
1.1 to 2.0	38	15.6	55.3	8.1
2.1 to 3.0	84	34.4	194.3	28.6
3.1 & More	107	43.9	423.6	62.3
<b>Total</b>	<b>244</b>		<b>680.1</b>	

**Table 4.47 : Size of Landholding among the Surveyed Households**

#### 4.20.3.2 Agriculture System

The land use in the core area is dominated by the production of annual crops and followed by grazing. The proportion of land used for agro-forestry, is comparatively very small. Exact land utilisation pattern as collected from the surveyed households is presented in **Table 4.48** and is believed to give a comparable picture for the rest of the Project Area.

Sub PA	Farming (ha)	Grazing (ha)	Residential (ha)	Tree & Others (ha)	Total (ha)
Becho Dibdbe	2.2	0.5	0.3	0.1	2.5
Botoro	2.5	0.5	0.2	0.0	2.7
Gimbchu	2.6	0.7	0.0	0.3	2.9
%	2.5	0.6	0.1	0.2	2.8

**Table 4.48 : Land Use Pattern in the Core Area**

The project area is mainly cultivated by means of traditional rainfed subsistence farming. The average farmland holding of about 2.5 ha per household and it is higher than the Weredas (1.9 ha). The major crops of the core area are as shown in **Table 4.49**. The main crops in the core areas are cereals in crop rotation after two or three cereal cultivation periods. The amount of perennial crops is about 98.2% of the area occupied by the individual farms.



Sampled Village	Teff (ha)	Maize (ha)	Sorghum (ha)	Wheat (ha)	Barley (ha)	Oats (ha)	Chickpeas (ha)	Bean (ha)	Nug (ha)	Garlic (ha)	Others (ha)	Total (ha)
Becho Dibdbe	1.29	0.03	0.15	0.35	0.01	0.03	0.16	0.2	0.05	0.03	0.01	2.3
Botoro	1.00	0.24	1.26	0.21			0.01					2.7
Gimbchu	1.13	0.50	1.00	-								2.7
Average	1.09	0.35	1.03	0.12		0.0	0.02	0.02	0.01			2.6
% of crop utilization	41.4	13.3	38.9	4.5		0.1	0.7	0.7	0.2	0.1		100.0

**Table 4.49 : Areas under Major Crops in the Core Area**

It goes without saying that agriculture (crop production and livestock rearing) is the sole economic opportunity available to farmers in the project area. Despite some efforts launched recently to introduce irrigation, agricultural techniques adopted in the study area were by and large traditional.

The majority of farmers in the surveyed households perceived shortage of farmland as one of the most pressing agricultural problem in the proposed project area. Among other things, shortage of farmland, compounded by loss of soil fertility, erratic rainfall and inadequate supply of inputs are major problems that have been consistently eroding farmers' coping capacity and made them so vulnerable. The level of poverty and associated vulnerability in the study area is such that even smallest disturbances can cause considerable damage to people's livelihoods. Therefore, the proposed project could help in building up asset base in the area to address the prevalent problems of:

- ❑ Shortage of finance for the purchase of farming inputs, absence of improved inputs and these include seeds, fertilizers (UREA and DAP), insecticides and miscellaneous inputs. The reasons accountable for this limitation is mainly higher purchase price as well as transportation cost.
- ❑ Shortage of labour- Human labour is used in crop production. Most of the labour comes from family. However, during the seasonal peaks, they temporarily help one another generally on a non-cash basis while in the mean time seek hired labour. Shortage of labour is acute especially for elder and women headed households provided that there is an active family member in it. Major use of the unskilled labour is accounted for by land preparation, weeding, harvesting and post harvesting operations.
- ❑ Use of traditional farming methods- The predominant technology used by farmers is the traditional plough drawn by a pair of oxen. The farmers use the bullock power mainly for land preparation and threshing. The topography and the non-availability of modern technology limit the growth of crop production in the area. Besides this, there is shortage of oxen in the area. Due to land scarcity the land is farmed without any gap to leave the land fallow and this leads to loss of soil fertility.
- ❑ Crop attack from monkeys, apes, rats and other wild animals are the other dominating factors affecting agricultural crop production.

**4.20.3.3 Agro-forestry Practices**

There are different kinds of perennial trees (banana, orange, mango, coffee, chat and eucalyptus trees) under the ownership of the surveyed households and eucalyptus tree is



the dominant tree species. However, the estimated volume of production and associated level of income from tree production per surveyed households is only 178 Birr/ year.

On the basis of the survey results, there are constraints facing agro-forestry practices and these include scarcity of land and shortage or absence of improved seedling variety and nursery.

#### **4.20.4 LIVESTOCK**

Livestock, which serves as source of energy, food and income and means of transport, occupies an important place in the local economic life of the people in the project area. With suitable agro-ecology that provides adequate pasture and water for farmers in the project area, life without livestock is inconceivable. As discussed above, among the surveyed households farming techniques are traditional and disparity in ownership of livestock is remarkable. On the average, the surveyed households owned 5.6 cattle, 1.0 equines and 4.5 sheep and goats. Based on the survey results the estimated livestock holding per family is 11.2. Ownership of poultry and beehives was not significant.

#### **4.20.5 TYPE OF HUMAN FEED AND ANNUAL CONSUMPTION LEVEL**

People in the core zone like the rest of the country depend mainly on agricultural products for their daily meal. The level of consumption depends on the interaction of the family size and the economic status of the particular family. However, the average consumption level was computed and estimated from the collected sample size level. The result shows that the annual per capita consumption level amounts to about 2 quintals of crops, one poultry, one sheep and goat, 7 kg of beef, 1.8 kg of butter, 6 litre of milk, 2.3 kg of cheese, 12 kg of vegetables and 5 kg of fruits. This type of food consumption contains balanced nutritional contents. During the primary survey, 61% of the people responded that they experience food shortages.

#### **4.20.6 DIVISION OF WORKS**

The population of the area is mainly agricultural based. Ploughing and seed sowing are largely performed by the male population with marginal assistance received from child and female labour. Land preparation, crop harvesting, hoeing/ weeding, threshing/ shelling crops, fodder collection, marketing of agricultural products and trading activities are carried out by all members of the family. Caring for children, food preparation, milking of animals and cleaning of livestock sheds are largely the responsibility of the female. In all types of the activities, child labour input has a great place of importance.

#### **4.20.7 ANNUAL HOUSEHOLD INCOME**

The major source of employment and income in the project area is mixed farming, i.e. crop production and livestock. However, apart from the heads of the households who are often the breadwinners of the family, other family members also contribute to family income through employment in farming and off-farm activities.

The most important part of income accounting to over 88.5% originates from agricultural and related activities mainly from the production of crops and vegetables, perennial crops, domestic animals and its products, agro-forestry products and renting of farming lands. The remaining activities, i.e., trading, employment, handicrafts and others account for the remaining income of the people. On the bases of the survey result, the annual per capita income of the people is computed as Birr 10,287.62. (Refer **Table 4.50**).



Income Source	Average Annual Per capita Income (Birr/HH)	%
Crops (Grains & Vegetables)	8,093.32	78.7
Perennial crops	177.72	1.7
Animals	649.28	6.3
Animal products/ by products	184.96	1.8
Agro-forestry products (including firewood charcoal)	325.36	3.2
Land Rent/ leasing	4.57	0.4
Petty trading	33.32	0.3
Governmental permanent employment of family members	0.38	0.0
Labor of family members	75.34	0.7
Handicraft/ trade of family members	17.70	0.2
Trading Activity	1.89	0.0
Financial support by family members and relatives	1.23	0.0
Pension		
Others	686.54	6.7

HH : Household

**Table 4.50 : Annual Income****4.20.8 ANNUAL HOUSEHOLD EXPENDITURE**

Structure of household expenditure reflects the subsistence level of the rural economy. The consumption line of expenditures consist of about 50.5% of home consumption, 1.8% of farm inputs, 0.6% of taxes, social and cultural expenses and about 2.8% of other expenses. Moreover, the average saving rate of the community is estimated to represent 7.6% and medical expenses account to only 3.6% of the annual income (refer **Table 4.51**).

Consumption Items	Total Per capita Annual Consumption (Birr /HH)	%
Consumables	5,190.58	50.5
Medical care	370.89	3.6
Education	75.06	0.7
Clothing	959.43	9.3
House maintenance/ building	796.97	7.7
Energy	53.35	0.5
Water	13.96	0.1
Transport	68.52	0.7
Farm tools	92.24	0.9
Farm inputs	189.96	1.8
Hiring labor	146.50	1.4



Consumption Items	Total Per capita Annual Consumption (Birr /HH)	%
Land Rent	69.84	0.7
Food livestock	111.89	1.1
Animal Health	21.06	0.2
Buying Animals	465.76	4.5
Taxes	59.42	0.6
Debt Repayment	236.50	2.3
Saving	777.33	7.6
Social/ Religious Ceremonies	300.62	2.9
Others	287.74	2.8
<b>Total</b>	<b>10,287.62</b>	<b>100.0</b>

HH : Household

**Table 4.51 : Annual Consumption and Savings**

#### 4.21 POVERTY PROFILE OF THE STUDY AREA

##### 4.21.1 INCOME/ CONSUMPTION DIMENSION OF POVERTY

###### 4.21.1.1 Consumption/ Expenditure

The results of the household survey reveal that the per capita consumption expenditure of the household and the population in the project area is estimated to be Birr 9214.37 and Birr 1722.77 respectively. According to the 2002 Development and Poverty Profile of Ethiopia the real per capita consumption expenditure of North and West Shoa zone, the area where the project is located, amounts to Birr 1087.2. The figure revealed by the primary survey is higher than the figure recorded for North and West Shoa Zones. This may partly be attributed to the time gap and price used in the calculation of the data.

In accordance with the 2002 Development and Poverty Profile of Ethiopia, the proportion of people in absolute poverty is about 31.7% in North and West Shoa Zones. From this it can be inferred that a substantial portion of the households in the study area live in absolute poverty. This is by far better than the National and Oromiya region absolute poverty figures (39.9% and 44.2%).

As indicated by the survey a significant portion of the expenditure is incurred on food. Food expenditure on average accounted for 56.4% of the household budget. The other expenses make up 43.6% of the household budget. Within non-food category, clothing and house maintenance accounted for greater share of total expenditure (10.5 and 8.7%). Medical care and education budget contributed 4.0 and 0.8 % of the total household budget respectively.

###### 4.21.1.2 Income

The major source of employment and income in the project area is mixed farming, i.e. crop production and livestock. However, apart from the heads of the households who are often the breadwinners of the family, other family members also contribute to family income through employment in farming and off-farm activities.

The most important income accounting to over 88.5% originates from agricultural and related activities mainly from the production of cereals and vegetables, perennial crops,



domestic animals and its products, agro-forestry products and renting of farming lands. The remaining activities, i.e., trading, employment, handicrafts and others represent the remaining income of the people. On the bases of the survey result, the annual per capita income of the house hold and population is computed to be Birr 10,287.62 and 1923.4 respectively.

#### **4.21.2 NON-INCOME/ CONSUMPTION DIMENSION OF POVERTY**

##### **4.21.2.1 Education Level**

According to findings of the socio-economic survey results, overall literacy rate in the project area is very low, about 81.5% of the surveyed household heads are illiterate whereas the remaining 18.5% are literate. Of this, less than a quarter of the household heads had formal education of which the majority was only till primary level.

Literacy rates are also disproportionate between sexes. For instance, while 88.5% of females are illiterate, the figure is 69.8% for males. This figure is very low compared to the Wereda average (31%). Literacy rates are consistently higher for men than women throughout all levels of education.

Of the total household heads in the project area, 3.5%, 4.0%, 7.6%, and 1.5% and 1.5% have attained Lower Primary (1-4), Primary (5-8), and Secondary (9-10), Technical school and above grade 10 level education respectively.

##### **4.21.2.2 Demography**

Females constitute 51.3% of the total population. Out of the total surveyed household heads (244) only 12.3% were female-headed households.

Average family size of the project area is about 5.3. This is classified as larger family size, which mostly indicates the character of a poor family. About 98% of the households surveyed were married and the remaining 0.8% and 1.2% were divorced and widowed respectively.

##### **4.21.2.3 Farm Assets**

The main source of livelihood in the project area is agriculture. Under such circumstances, therefore, land ownership in the project area becomes an important determinant of welfare.

According to the survey results, the total interviewed households had 680.1ha of farmland. An average size of land of the surveyed household is found to be 2.8 ha. The majority, nearly 90.9% of the surveyed household own more than 2 ha of land.

The entire surveyed households in the project area own land. In general the size of individual land holding of the farmer in the study area is better than the region and country. This implies that the farmers in the study area are likely to have better welfare status.

Another important input in the agricultural production in the Ethiopian context is the availability of traction power. This is mainly done with the use of oxen in the country. Thus, a household owning oxen would be in a better position in cultivating the land. The results of the socio-economic survey indicate, on an average the surveyed households own 5.6 cattle. Majority of the surveyed households, i.e., about 95% the farmers in the project area own cattle.

##### **4.21.2.4 Housing and Sanitation**

Status of shelter is one of the indicators of well being of society. The average number of rooms per household in the study area is 1.2. This is very low for an average family size of 5.3 people per household.



The sanitation situation of the area is very poor. An overwhelming majority (97.5%) of the surveyed households in the study area use open fields while only the remaining 2.5% use dry pit latrines.

## 4.22 PUBLIC HEALTH IN THE STUDY AREA

A detailed Public Health survey has been carried out in the project area during the period Aug-Sept 07 to assess the existing health situation within the various Weredas in and around the project area.

### 4.22.1 METHODOLOGY

The following study methods were utilised.

**Literature Review:** Before the study relevant documents, official reports, etc. were reviewed. In addition, documents related to National policies and strategies, annual reports of the Ministry of Health (MoH), etc. were also assessed and reviewed thoroughly.

**Questionnaires:** Prior to the launching of this study, a questionnaire was designed to collect data at the Wereda-level governmental offices, particularly from Wereda Health Offices and individual health facilities.

### 4.22.2 PREVAILING HEALTH SITUATION IN THE PROJECT AREA

#### TEN TOP DISEASES AND ENDEMIC DISEASES

In general, the health status of the community especially children below five years and pregnant women can be described as poor. Due to deficient sanitation, and crowded and low cost housing, communicable diseases are prevalent in the project area (both rural and urban). The situation is related, either directly or indirectly, to a lack of adequate and safe drinking water and sanitation, low living standards and poor nutrition.

Prevalent communicable diseases in the project areas, as diagnosed by the existing different health facilities, mainly hospitals and health centres, are as follows.

- Upper acute respiratory tract infections (URTI)
- Intestinal parasites (all types)
- Diarrhoea (all types), including bacillary dysentery (bloody diarrhoea)
- Typhoid fever
- Infection of the skin and subcutaneous tissue
- HIV/ AIDS

These diseases are not only among the top-ten diseases diagnosed in the health facilities, but most of them are also the leading causes of hospital admissions and hospital deaths.

The ten top diseases reported by the health institutions in the five Weredas are presented in **Table 4.52**. However, the prevalence of the disease differs from one Wereda to the other.

Adaberga Wereda				Wuchale Wereda			
	Type of Diseases	No.	%		Type of Diseases	No.	%
1	Pneumonia	1020	17.3	1	Pneumonia	4655	35.7
2	URTI / Other Respiratory Infection	1001	17.0	2	Diarrhea	1794	13.7



Adaberga Wereda				Wuchale Wereda			
	Type of Diseases	No.	%		Type of Diseases	No.	%
3	Skin and subcutaneous tissue infection	869	14.7	3	Intestinal Parasites	1357	10.4
4	Intestinal Parasites	632	10.1	4	Rheumatism	1044	8.0
5	Gastric	561	9.5	5	Infection Wound	900	7.0
6	Injuries due to fights	539	9.0	6	Gastric	898	6.9
7	Typhoid	513	8.7	7	Tonsillitis	680	5.2
8	EPTB	448	7.9	8	Injuries	636	4.9
9	UTI	308	5.2	9	Eye Diseases	612	4.7
				10	Anemia	464	3.5
Mulo Wereda				Yaya Gullele Wereda			
1	Injuries due to fights	806	27.2	1	URTI and other Respiratory Infection	792	24.8
2	URTI/ other Respiratory Infection	783	26.5	2	Injuries due to fights	484	15.1
3	Diarrhea	369	12.5	3	Intestinal Parasites	457	14.3
4	Intestinal parasites	228	7.7	4	Diarrhea	408	12.8
5	Eye Disease	171	5.8	5	Gastric	343	10.7
6	Gastric	165	5.6	6	Tooth disease	274	8.6
	Type of Diseases	No.	%		Type of Diseases	No.	%
7	Tonsillitis	147	5.0	7	Arthritis	259	8.1
8	Rheumatic Pain	112	3.8	8	Skin and subcutaneous tissue Infection	178	5.6
9	Tooth disease	95	3.2				
10	Common cold	80	2.7				
Sululta Wereda							
1	Pneumonia	2007	24.0				
2	URTI/ other Respiratory Infection	1531	18.3				
3	Gastric	1531	18.3				
4	Intestinal Parasite	617	7.4				
5	Bacillary Dysentery (CDD)	521	6.2				
6	Conjunctivitis	467	5.6				
7	Anaemia	467	5.6				
8	Skin and subcutaneous tissue infection	426	5.1				
9	Tonsillitis	451	5.0				
10	Rheumatism	397	4.5				

Source: Wereda Health Office of each Wereda

**Table 4.52 : Ten Top Diseases Diagnosed in the Five Weredas in the Study Area**





#### 4.22.1.1 HIV/ AIDS

HIV/ AIDS is one of the fastest growing diseases in Ethiopia. The number of persons living with HIV/ AIDS in the country (Ethiopia) and Oromiya region is estimated to be 1,320,000 and 318,000 respectively in the year 2005. (“AIDS in Ethiopia”, Sixth Report Fact sheets). The same sources indicate that the prevalence rate of HIV/ AIDS stood at 3.5 and 2.4% in the country and Oromiya region respectively.

The available information also shows the prevalence of the disease in the five Weredas of the project area. However, the blood test result figures may not be representative and can show only the overall picture of the project area because these figures represent only those patients who visited the Health Centre and some volunteers. The blood test results obtained from the project area are presented in **Table 4.53**.

Sn	Wereda	Total Blood Samples Examined in 2006	Positive Results	
			No.	%
1	Ada Berga	753	245	33.0
2	Mulu	368	5	1.4
3	Yaya Gulele	596	18	3.0
4	Sululta		2,035	

Source: Wereda Health Offices

**Table 4.53 : Prevalence of HIV/ AIDS & Results of Blood Tests in the Study Area**

The Weredas in the project area are carrying out the following activities to control and prevent the spread of STDs particularly HIV/ AIDS:

- Provision of education and creating awareness
- Early Diagnosis and Treatment of STD
- Condom distribution
- Provision of VCT services

#### 4.22.1.2 Malaria

Due to the elevation of the area, malaria is not a major health problem in the project area and not reported around the plant site (on the plateau). 44% of the Peasant Associations located within the 10 km radius are identified as malaria free area.

However, in the Muger valley malaria is a threat to the population farming and residing in the area. In year 2006 about 621 malaria cases were identified in Yaya Gulele Wereda and few additional cases were also reported from Ada Berga Wereda.

#### 4.22.1.3 Malnutrition

Food insecurity and malnutrition are chronic health problems in the project area. Malnutrition weakens resistance to infection and makes recovery from infection more difficult. Malnutrition afflicts the poorest sections of the community and children who are especially at risk. Malnutrition related diseases, (such as Kwashiorkor, Marasmus, vitamin A and mineral deficiencies) are one of the major continuing health problems in Ethiopia. Extensive studies conducted by the Ethiopian Nutrition Institute (ENI) found underweight rates between 40-60% of children <5 years of age. The MoH statistical report shows that malnutrition is one of the ten leading national health problems and is the seventh leading cause of hospital deaths.

Malnutrition together with poor environmental health conditions (poor water quality and inadequate sanitation) further exacerbates the already poor health conditions within the



population, pre-disposing the population to a range of serious epidemic diseases such as typhus, relapsing fever and other house-borne diseases.

#### 4.22.1.4 Diseases of Women and Children

The survey attempted to assess the common diseases related to women and children prevalent in the area. The most common diseases affecting the women (age 15-49 years) include the following:

- STDs and HIV/ AIDS
- Malnutrition
- Intestinal parasites
- Anaemia (due to iron deficiency)
- Diseases associated with complication of pregnancy and child delivery
- Pneumonia
- Urinary tract Infection (UTI)

The most common diseases affecting children (< 5 years of age) include the following:

- Measles
- Pert sis (Whooping cough)
- Diarrhea
- Malnutrition (Kwashiorkor, Marasmus, etc)
- Intestinal parasites (e.g. Amoebiasis, Giardiasis, Ascariasis, Hookworm, etc)
- Pneumonia
- Eye diseases
- Tonsillitis

#### 4.22.1.5 Harmful Practices of the Communities

The findings of the survey revealed the existence of harmful practices in the project area, which is mainly attributed to the lack of awareness and wrong belief of the people. Some of these harmful practices prevalent in the project area are:

- Cauterization of body (with very hot metal rod/ knife), incising the skin and letting out blood as a treatment for pyrexia, headache, chest pain, etc
- Scrubbing of tonsils and tonsillectomy for children when they develop diarrhoea
- Uvuloectomy, i.e., cutting of the uvulae of children as a treatment for fever and, diarrhoea
- Rape and pre-marital sexual practices
- Early marriage and abduction
- Massage of pregnant women
- Using local medicine and tattooing
- Extramarital sex and unsafe sexual practices
- Female circumcision and genital mutilation

#### 4.22.1.6 Problem of Health Services in the Study Area

The results of the survey identified and outlined the major constraints prevailing in the health facilities of the project areas. These include:



- Shortage, high attrition rate and uneven distribution of health professionals (in quality and quantity).
- Shortage / lack of buildings and rooms for medical procedures (e.g. laboratory and X-ray rooms, drug stores, offices, etc.).
- Shortage of drugs, equipment, laboratory reagents and chemicals, X-ray films and other medical supplies.
- Lack of adequate budget for drugs.
- Lack/ shortage of Vehicles/ Ambulance

## 4.23 EXISTING HEALTH FACILITIES AND PROFESSIONALS

### 4.23.1 HEALTH SERVICES

The Health Bureau is responsible for providing health care in the region and operates a comprehensive health care network within the limits of the available resources. In addition to the Health Bureau, some NGOs and Other Governmental Agencies (OGAs) are involved in the Region.

The general policy of the Ministry of Health proposes the following basic health services to be installed in each Zone in order to allow minimum health services to be provided to the population.

- Central referral hospital
- Regional hospitals
- Rural hospitals
- Health care centres

The health professionals working in different health facilities of the project area are mandated to carry out routinely preventive, curative and rehabilitative health services to the community they are assigned to serve according to the information gathered from the Wereda Health Offices. These services comprise all of the following specific types of health care for the community:

1. **Medical Services:** For outpatients and inpatients, medical and physical examination, diagnosis and treatment of the diagnosed ailments, Advice/ therapy, etc.
2. **Family Health Services:** The family health services include antenatal and postnatal care for the women during their pregnancies and deliveries, Family planning services, which include advice and convincing the couples and administration of different contraceptive methods and treatment of sick children (under 5 years of age) and child growth monitoring services.
3. **Expanded Programme for Immunisation (EPI)**
4. **Laboratory Diagnostic and Radiography (X-ray)**
5. **Communicable Diseases Prevention and Control Services:** Treatment and control measures of diseases such as HIV/ AIDS /STDs, tuberculosis, leprosy, trachoma (prevention of blindness).
6. **Information, Education and Communication (IEC):** The services are rendered regularly to create community awareness on the prevention and control of diseases, childcare and child nutrition, personal and domestic hygiene and Sanitation, family planning, etc. Malaria and Other Vector-Borne Diseases Control Services



**7. Environmental Health and Sanitation Services:** In these services, communities are given health education and training, demonstration on the construction and proper use of pit latrines, ventilated-improved-pit (VIP) latrines, proper disposal of refuse, protection of springs for safe water supply with community participation in the protection work, and inspection of public eating and drinking establishments, like hotels, bars, tea-shops, abattoirs, meat-shops, etc. The workers in such establishments are also given medical examination for any infectious and communicable disease; and those found to have the disease are treated immediately.

Besides the above listed activities, the health professionals in the Wereda provide health education in relation to HIV/ AIDS, STDs, communicable diseases, environmental, sanitation, personal hygiene and family health in school and prisons. They also give some other health program/activities related to TT vaccination program in school.

Pills, injections and condoms are commonly promoted contraceptive methods in the health units of the project area. The contraceptive prevalence rate for Yaya Gullele, Mulu, and Sululta Wereda estimated to be 17%, 40.4%, and 26% respectively.

#### 4.23.2 HEALTH FACILITIES

Currently available health facilities in the project areas are depicted in **Table 4.54**. As shown, there is no hospital in all of the five-surveyed Weredas. The result of the survey indicates that 6 Health Centres, 20 clinics, 27 health posts, 19 pharmacies and 5 drug stores exist in the five Weredas of the study area.

Description	Wereda in the project area					Total
	Ada Berga	Wuchale	Mulu	Yaya Gullele	Sululta	
<b>Health Facilities: Population</b>	<b>126,832</b>	<b>95,756</b>	<b>39,417</b>	<b>75,464</b>	<b>140,694</b>	<b>478,163</b>
Health Centre	2	1	1	1	1	6
-Health Station (Clinic)(Govt. & NGO)	2	2	-	2	2	8
-Private Clinic	6	3	1	2		12
Health Post	5	3	5	2	12	27
-Pharmacy (Govt)	1	1	-	-	1	2
-Pharmacy (Private)	6	2	-	-	8	16
-Drug Stores (Shops) (Govt)	1	-	1	1	1	4
-Drug Store (Private)	-	1		-		1
<b>Ratios</b>						
Population to Health Centre Ratio (Target: 1 Health Centre to serve 25,000)	63416	95756	39417	75464	140694	79693
Population to Health post Ratio (Target: 1 Health Post to serve 5,000 people)	25366	31919	7883	37732	11725	17709
<b>Health Service Coverage Ratio</b>	<b>100%</b>	<b>52.2%</b>	<b>24.1%</b>	<b>63%</b>	<b>68%</b>	

Source: Wereda Health Office and primary survey

**Table 4.54 : Existing Health Facilities in Weredas within the Study Area**

According to the information obtained from Wereda offices, the total population that is served by these existing health facilities and drug-outlets in the five Weredas is estimated to be 478,163. The result of the ratios of population to health centre is indicated in **Table**



**4.55.** The available health facilities are far below the standards stipulated by the Ministry of Health (MOH). This shows that the health facilities in the project area are poor.

In terms of health facilities, Sululta and Ada Berga Wereda have relatively better health service than the other Weredas in the study area and Mulu Wereda registered the lowest health service coverage.

#### 4.23.3 HEALTH PROFESSIONALS

The total number of currently available health professionals and the ratios of population to health professional in the five Weredas of the project area are given in **Table 4.55** below. The number of health facilities and workers is unevenly distributed among the Weredas in the project area. For instance, the Sululta Wereda has relatively larger number of health workers and facilities than the other Weredas.

Except the Ada Berga Wereda, all the other Weredas in the project area have no physicians (Medical Doctor). As indicated in the table the ratios of population to doctor, nurses and sanitarians in the five Weredas of the study area is also far less than the standard set by the Ministry of Health (MOH). This figure indicates the serious shortage of health workers in the project area. This implies that much remains to be done to attain the standard set by the MOH.

Description	Zones in the project area					
	Ada Berga	Wuchale	Mulu	Yaya Gullele	Sululta	Total
<b>Population</b>	126,832	95,756	39,417	75,464	140,694	478,163
<b>Health Facilities:</b>						
Physicians (all types)	1	-				1
Health Officers	1	1		1	1	4
Nurses (all types)	13	11	5	8	17	54
Sanitarians	1	1	1	1	2	6
Lab. Technicians						
Pharmacists Technicians	2	1	1	2	2	8
Health Assistants	6	2	2	2	6	18
Community Health Workers	85		18			103
Health Extension program workers	26	19	7	16	26	94
<b>Ratios</b>						
Population to Doctor Ratio (Target: 1 Doctor to serve 10,000 population)	63,416	95,756	39,417	75,464	140,694	95,633
Population to Nurse Ratio (Target: 1 Nurse to serve 5,000 Population)	9,756	8,705	7,833	9,433	8,276	8,854
Population to Sanitarian Ratio	126,832	95,756	39,417	75,464	70,347	79,693

Source: Wereda Health Office (2007) and Own calculation

Note: The calculated result of population to Doctor Ratio include Health officers

**Table 4.55: Currently Available Health Professionals in the Study Area**

#### 4.23.4 PROPOSED HEALTH FACILITIES



The Weredas in the project area have planned to build various health facilities so as to improve health coverage and the quality of health service in the project area. As depicted in **Table 4.56** a total of 14 different types of health facilities will be constructed within the next five years. It is expected that these health facilities will serve an estimated 317,776 people living in and around the project area. This will significantly improve the health coverage and quality of health services in the project area.

Sn	Wereda	Type of Health Facility			
		Health Centre	Upgrade Clinic to Health Centre	Upgrade Health Centre to Hospital	Health Post
		No.	No.	No.	No.
1	Yaya Gulele	1			1
2	Wuchale	1	1		2
3	Mulu				2
4	Sululuta	1		1	4
	Total	3	1	1	9

**Table 4.56 : Health Facilities Planned in the next 2-5 years in the Study Area**