TECHNO-INSTITUTIONAL REGIMES AND RANGELAND MANAGEMENT IN ETHIOPIA: THE ROLE OF INFORMATION TECHNOLOGIES IN DEVISING SUSTAINABLE STRATEGIES

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Findings of the Field Survey

I) The Borana Plateau

Population

There is no precise data on the exact number of people[2] in the Southern pastoral areas of Ethiopia. The latest census carried out in 1994 in the *Liiban* district indicates the number of people to be about 117,700 of which 27,147 were urban and 90,558 were rural. Populations aged 0-14,15-64 and 65+ years accounted for 47.4%, 49.4% and 3.2% respectively. Average family sizes for rural and urban areas were 5.4 and 4.9 persons respectively. The crude population density of the district is estimated at 13 persons per km^2 (Oromiya, 2000). The human population in the study area have been about 7 people/ km^2 in 1982 was estimated to be growing at 2.5% per year (Coppock 1993).

The adjusted 1994 figures by the presumed[3] population growth rate to derive figures for the year 2003 are 148388. Some studies argue at the time when most of the pastoral communities have been suffering an acute crisis is somewhat illogical.

The three largest Pastoral groups of *Booran*, *Garri* and *Digodi* are both trans-national having clansmen living across colonial boundaries. The traditional territories of the *Garri*, *Digodi* and *Booran* clans extend to adjacent areas in northeastern region of Kenya. Moreover, *Garri* land extends further to southern Somalia. There are also smaller groups (*Marehan*, *Gabbra*, *Ajuran*, *Kranle* and *Gurre*) living in the area. The *Booran* are predominantly followers of traditional religion. They believe in Waq. This is equivalent to God is the ultimate force of everything. The *Digodi*, *Garri* and *Marehan* are Muslims.

There is no accurate data to provide about human population changes mainly due to the fact that region has been racked by conflict and has experienced large inflows and outflows of refugees. A large number of returnee from Somalia and Kenya displaced people fleeing from Somalia's civil strife has substantially increased the number of population in recent years. *Fitu* and *Liiban* districts attracted this exodus because it previously has acted as an official entrance point to Ethiopia from Somalia.

Herd Structure And Species Composition

Herd management is the principal means of sustaining livelihoods. The *Liiban* district has 573,576 cattle, 279,304 sheep, 775,198 goats, 28,984 equines, 328,080 camels and 1,818 poultry in the district (Oromia, 2000). The *Booran* maintain at least three combined livestock species, which include cattle, goats, sheep and sometimes camels and donkeys. The average livestock-holding household before

[2] Filtu district had about 117261 population in 1999
[3] 4.11% and 2.23% population growth rate for rural and Urban.

the drought (1990) was estimated to be 43 cattle (43%), 24 sheep (24%), 19 goats (19%), 2.1 camel (2%) and 13 equine (13%). Of the total cattle holdings, cows made up 40 per cent, calves 3 per cent and other adult cattle 43 per cent. This multi-species composition of livestock holding has the advantage of utilizing both browse and grass species in the plane community, and hence providing a continuous supply human food. The selective maximization of livestock population to a given ecological condition is geared towards solving the problem of human food supply, given the availability of animal feed supply, particularly in moisture deficit seasons. Furthermore, different livestock species have different adaptive and/or genetic merits to resist disease. At present there is an increasing tendency to raise camels since the existing *Booran* ecology favors camel production. While for *Digodi*, the most important species of livestock herded according to their number are camels, cattle, goats and sheep. They also possess donkeys in minor percent. Livestock husbandry is traditional extensive with herd division and seasonal movements in search of pasture.

The groups of pastoralists in Filtu were asked to analyze changes over time in milk production of their stock with the aim of identifying broad trends in production levels for camels. In order to do this they were asked to consider the milk yield from an average camel comparing three time periods. These were 1960 (Somali independence) to 1974 (drought); 1974 to 1991; and 1992 to present. These years were chosen after consultation with participants to give time periods roughly similar in length bounded by dates with which all were familiar. The intention was to understand perceptions in changes over time in the relative per head milk yield.

Similarly we undertook participatory exercise with *Booran* elders to know the perception of patoralists about trend in a livestock wealth. We attempted to investigate the trend in livestock holding per capita of a rich and poor household. Pastoralists perceived a negative trend in livestock wealth. A member of the elder participating in the discussion noted that his forefather used to own about 2000 cattle, while his father owned 800 cattle and he now has 22 heads. The pastoral communities perceived the increased number of households owning no cattle.

Food Habits

The staple food of both the *Booran* and *Degidi* is comprised of milk, blood and meat, supplemented with porridge made from maize and/or sorghum, and milk is obtained from cows, goats and camels. However, camel food products are taboo for some *Booran* clans. At present there is an increasing tendency to raise camels since the existing *Booran* ecology favors camel production. Blood is often taken from live animals, with the utmost care for their health. In times of crisis, women also collect wild fruits and other forest products to supplement the food supply. Human diets were normally dominated by cow milk (55%) and cereals (32%) on a gross energy basis sufficient for maintenance and growth in average rainfall years. This shifted to a situation drought in which cereals dominated

(52%) compared with mike (14%) and meat and blood combined (2%), with an average per capita caloric deficit of 27%.

Indigenous Rangeland Management In Borana

The Borana Plateau is dominated by a semi-arid climate. Annual mean temperatures vary from 19 to 24^{0}C with little seasonal variation and these decrease 1^{0}C with each 200-m increase in elevation. At least two consecutive dry years constitute a drought. The region is also dominated by savannah vegetation containing mixtures of perennial herbaceous and wood vegetation. Several native species of grasses and woody plants provide excellent forage.

The Borana Plateau is characterized by a general scarcity of surface water. There are over 540 hand-dug wells and these occur in some 40 clusters largely to the west. These wells provide over 95% of the permanent water points and about 84% of the total accessible water in a typical dry season. The wells also provide about half of the annual water requirements for people and livestock, with the remainder provided by ephemeral and permanent ponds.

The Borana Plateau represents part of the remaining core area or cradle land of the southern highlands and rangelands from which the original Oromo culture expanded and conquered half of present-day Ethiopia during the 1500s. The Core rangeland area contains historical Oromo shrines still worshipped by the population. The Borana territory has been reportedly shrinking since the early 1900s, largely because of habitat change and Somali encroachment from the east. Livestock management in Borana reflected three principles identified by Jahnke (1982):

i) Adaptation to the environment in the attempt to ensure subsistence;
ii) Averting risks by the adoption of special management strategies, and;
iii) Adaptation to the institutional environment characterized by customary land rights of the grazing land.

The principles governing pasture and water use in the Borana rangeland are as follows. In a normal dry season when water is adequate, the cattle are watered every third day. Watering frequency might extend up to the fourth day depending on the performance of the wells.

A given village has got a grazing zone "restricted" to grazing on watering days. This zone is known as mataa *tikaa*, literally "the gead of grazing", as it is the head of all accessible grazing areas in terms of range abundance, i.e., the best grazing area.

Karaa which literally means a path, is the route leading to a water point where the herd gets watered. There is always a route that leads to a well or pond for

watering livestock in a dry season. Hence grazing along this route is controlled so that the herd will have enough to graze on the obaa. Of the principles that establish a restricted access to the communal pasture among the Borana is *Kaloo-w* reservation of part of the grazingland for later use. The Borana pastoralists put restriction on a particular grazing area in order to reserve a portion of the communal pastureland-usually part of the foot of a mountain or valley often demarcated by a footpath. The restricted area was called *seera* before its replacement by the term *kaloo*. The reserved land is meant for later grazing by the most drought-vulnerable sections of livestock (such as calves, weak and sick animals) at the time when pasture resource is scarce.

Pasture

Fitu district has got good rangelands suitable for pastoralism. The vegetation is mixed type with grassland, shrubs and bush. Several species of grasses and woody plants are common that provide excellent-forage for livestock especially during the rainy seasons. During the rainy season the availability and amount of pasture is sufficient. The bush encroachment is moderate and is not in a state to influence the pastoralists.

With the exception of *Siru* area, the pastoralists use the pasture in the central part of the district during the wet season and for the first two months after the rainy seasons, the water sources being surface rainy water, shallow wells and ponds. The pasture at river reserved for times when water becomes scarce during which time the pastoralists utilize as water sources.

Grazing pattern of the *Liiban* is different. In the *Liiban* Wareda, the grazing cycle is towards the *Diid Liiban*s system during the wet season, while during the dry season grazing is into the valleys of *Dawa* river. Movements between the wet season and the dry season involves the whole family. As compared to other *Booran*s in the Dirre and the *Arero woredas*, the *Liiban Booran* are nomadic compared to their counterparts. The *Diid Liiban* system is key resource. Its rich perennial grasslands and the haya soil-licks are crucial for successful livestock management. The *Dawa* River in the *Golba* serves as a dry resource during droughts. However, it is avoided during the wet season because of the tsetse and mosquitoes.

Splitting The Herd Into Wet Versus Dry Herds

The *Booran* pastoralists have adopted strategies that are passed on from generation to generation to solve problems related to watering and grazing by dispersing their livestock herds into *worra* (milking herd) and *Forra* (dry or non-milking herd) groups, based on the frequency of watering, and the availability of good grazing and browsing grounds.

The *worra* herds spend much of their grazing time within a circular area not very far from villages (ollas) and water wells, while the *Forra* herds travel much further from the water wells and villages to graze a much larger area. Greater herd

dispersal for grazing and increased concentration of the herd for watering is major adaptive strategies of the *Booran* pastoralists, which enhance the efficient utilization of limited resources.

Social Organization, The Water Wells, And Community Labour

Three basic water sources for the Borana: Occasional water, temporary water and dry season wells. Ponds (haroo) and perennial wells (eela) respectively, come under the categories of the second and third major sources.

The social and labour organizations of Borana pastoralists, which center around water wells and grazing land, are as follows. The Boran achieve consensus on important community issues through open, participatory assembly. Consensus and enforcement of social norms is achieved under the umbrella of the "Peace of the Boran", which refers to traditional values and laws. Two peer-group structures for males, the age-set system (*Hariya*) and a generation system (*Gada*) figure in the distribution of social rights and responsibilities and/or regulation of human reproduction. These two systems share many similar attributes and ultimately are complementary in function.

The *tula* wells of Borana people are impressive feats of indigenous engineering. Animals and people enter the well sit by traveling down a long (i.e. 50 to 150m) narrow ramp flanked by high earthen walls. An individual on duty regulates entry. The drinking area for animals is a large flat platform (*dargula*) some 5 to 10 meters below the ground surface. The *dargula* also has a supervisor who helps keep the watering process. The well proper consists of several parts. The water source (*madda ella*) is accessed by a shaft up to 30 m deep, which may be 1 to 3 meters in diameter. At the top of the shaft is a large storage basin (of hundreds of liters capacity) called fetchana. A chain of 5 to 20 people (usually males and referred to as a gogessa) stands on lashed wooden platforms or rocky protrusions in the shaft and pass water from the *madda ella* to the fetchana. Water is passed using small durable leather buckets (2to 5-litre capacity). With the increased scarcity of these wildlife species, plastic or metal containers are more commonly used nowadays.

Lifting water begins early in the morning to first fill the *fetchana*. After this a steady flow of water is maintained from the madda ella to the *fetchana* and from the fetchana to the watering trough (naninga); this whole task is physically intense and is spurred by rhythmic chanting. After a few hours the work crews are replaced. Rates of water extraction have been estimated as 2.4 to 7.5 m^3/hour. During periods when water discharge is low or the number of animals to be watered is high, watering may continue through the night aided by light from torches.

A continuous and coordinated supply of labour is thus essential to the smooth functioning of tula wells. The users of each well supply labour. In contrast to the demand for labour to herd cattle whereby one herder can manage some 50 cattle

at least, the demand for labour to lift water is more of a direct linear relationship between numbers of people and animals and may underscore a key management constraint in the system. Members of poorer households may supply labour to water larger herds of the wealthy, and in exchange the poor receive food and an occasional promise of a future calf. Labour is also needed to regulate animal traffic, constantly sweep the ramp and platform of loose soil, and collect manure and to repair the naninga each morning with fresh clay.

Water rights indirectly confer grazing rights by virtue of gained access to nearby forage. Lactating herds (*loni warra*) based at olla reportedly have the grazing priority over satellite herds of dry cows and males (loni forra). A herd already occupying a given grazing area has priority over others that want to enter.

The labour required to lift water places a very high demand on the population during dry periods regions may be required to lift water from various wells on a given day in the warm dry season.

Well are usually located within a two to four hour walk from encampments or villages. *Olla* can have anywhere from 4 to 60 households, but average 10 to 15. Many *olla* form a circle or semicircle within a 10 to 16-kmrasius of a given well group. In the dry season cattle are commonly watered once every three days, small ruminants once every five days and camels once every 8 to 14 days. These watering regimes represent an attempt to optimize labour input in livestock management.

Well council composed of well users formulates the watering schedule. Every well belongs to a particular clan. Clans are intermediate levels of organization in the kinship system. There are about 17 clans in the Borana system divided between two social *moieties*. In the classic sense, the clan in Borana is composed of families claiming descent from a common male ancestor. The clan affiliation of a particular well corresponds to the identity of the *abba ella* or well father. The responsibilities and accompanying duties that underpins the relationship between and *abba ella* and his well is known as *confi* and is a sort of trusteeship. The *confi* is matrilineal inherited and cannot be lost, even if the well collapses through disuse and someone else re-excavates it.

Daily routines at the well such as cleaning ramps, repairing small cave-ins and lifting water are supervised by an officer known as an *abba hirega* or father of the watering order, who is appointed by the well council. The watering order (or rotation) usually lasts three or four days. On day one the holder of the *confi* usually functions as *abba hirega*. Overall authority over use of the well is vested in the well council. Watering rights in any well must be gained and maintained through participation in the well council, and watering rights indirectly confer grazing access rights. Setting the watering rotation is the most important task of the well council, because this implies allocating watering privileges when water volume is a constraint.

There are also limits on the number of cattle that can be watered for a given herdowner. Owners with more than 200 head can be turned away, particularly if they have not recruited enough labour and/or local forage resources are in short supply.

Participation in well excavation can also be important to gain future access to water. The wells influence one level of land use referred to as *madda*. Most Boran lives and herd milking animals in one *madda*. There are about 35 *madda* on the central plateau with an average size of 500km^2. A500-km^2 madda can contain around 100 *olla*, 4000 people, and 10,000 cattle.

People have the right to use wells in other *madda* with permission. This is more common for *loni forra* (satellite dry) herds, which can roam outside their home *madda* to avoid resource competition with *loni warra* (resident milking) herds.

II) Awash Valley of Ethiopia

Awash Valley of Ethiopia is the home of one of the world's oldest civilization whose historical continuity was not disrupted by any significant interregnum of colonialism. The Ethiopian State has evolved through its own indigenous political process said to have been taking over a period exceeding fifteen hundred years. The modern Ethiopia was created during the last decade of the 19th century. The era of Emperors, and the Derg regime that overthrew the last Emperor Haileselase in 1974 was characterized by strong power of central government. This centralizing tendency was reversed in the 1990's by the current regime. It provided for a decentralized federal system of government with fairly homogenous regions in the ethnically diverse country constituting the federating units. Parallel to the political transition drastic ideological revisions (e.g. from socialism to "marketism") and devolution of control over diverse common pool resources to local user groups have profound implications for the management of common pool resources.

The basin of Awash valley is located in the Northern Great Rift Valley. It extends from the central to the Eastern Ethiopia with an estimated area of 70000 square kilometers that is effectively drained by Awash river that dissipated in alkali Lake Abbe on the borders of Djibouti and Ethiopia. The Valley is characterized by high temperature; the hottest months being May, June, July and August. The minimum and maximum temperatures during the hottest months are 20^o C and above at higher elevations, and 35^0 C and above at lower elevations, respectively. Moreover, the Danakil depression lying more than 116 meter below sea level with temperature in excess of 120o F is located in the valley. Usually the mean annual precipitation is less than 600mm and its distribution is bi-modal. Hadar, one of the most important paleoanthropological sites, providing the best fossil evidence of human evolution, has been recovered in the valley.

The Research Area

This study was carried out in the Afar region of Ethiopia in Amibara and Gewane woredas of The Middle Awash. The Middle Awash Valley (MAV) lies along the Awash River Basin, between the Upper and the Lower Valleys of Awash, where sugarcane and cotton plantation have been established by the central government of Ethiopia. The sample areas, i.e., Amibara and Gewane woredas are located in the Middle Awash Valley; Zone III of the Afar National Regional state. Amibara woreda covers the flood-fed pastures and wet-season lands located between the Awash station and Gewane. The woreda's boundaries in the west are the Addis Ababa- Assab/Djibouti Highways and the Alleideghe plain, bordering the Awash River in the East. Gewane Woreda is situated in Zone III of the Afar region extending from the Awash River in the west, to the Dire-Dawa –Djibouti railroad running in the east. The woreda's boundary in the southeast is the administration boundary, of Afar National Regional state bordering Somali and Oromiya Regions.

From the total area of Zone III 1,680,057 hectares, Gewane woreda covers 826,573 hectares and Amibara woreda covers 294,106 hectares. The two woredas constitutes 49.20% and 17.5% of the total land area in Zone III of Afar region, respectively.

The area is characterized by high temperature; it ranges from 25^0c to 35^0c. Usually the mean annual precipitation is less than 600 mm. May/June is the driest season of the year, *hagay*. It is said to be unsuitable for browsing since bushes dry up. The main rainy season *(Karima)*, which accounts for above 60% of the annual total rainfall are from July to September. This is followed by the best grazing season of *Kayra* that occurs form September to November. Another minor rainy season is *Sugum* and appears during March and April. The *Sugum* accounts for 20% of the total rain fall. *Gilal* is less severe dry season with relatively cool temperatures (November to March). *Occasional rainfalls called dada may interrupt Gilal.*

Table 1. Land Use Development Potential of Zone III in ANRS

Description	Extent of unit (ha)	% of zone
Potential for grazing and browsing	770,999	45.58
Potential for grazing	27383	16.28
Potential for irrigated pastoral	2352	1.42
Potential for seasonal grazing	9743	4.96
Potential for crop production	43194	5.79
Un utilizable land	826386	25.67
Total	**1680057**	**100.00**

Source: - Afar National Regional State

Present land use and land cover in the two sample woredas are presented as follows:

Table 2. Land Use/Cover by Sample Woredas

Description	Gewane		Ambibara	
	Extent hectare	**% of woreda**	**Extent hectare**	**% of woreda**
State farm	2,652	0.32	7956	2.71
Riparian	63,771	7.72	-	-
Open bushland	24,033	2.91	40,054	13.62
Dense shrubland	139,501	16.88	53,576	18.22
Open shrubland	5,054	0.61	98,055	33.33
Open grassland	66,514	9.05	23,179	7.88
Bushed/shrubbedgrass	-	-	25,195	8.57
Wooded grassland	81,631	9.88	-	-
Seasonal swamps	13,101	1.58	-	-
Seasonal marsh	31,497	3.81	19,686	6.69
Bareland	398,819	18.24	26,405	8.98
Total	**826,573**	**100.00**	**294,106**	**100.00**

Source: - Afar National Regional State

Cultivated land-state farms

From the total land cover by the state farms in ANRS i.e., 58,674 hectare or 0.64% of the total regional area, the two sample woredas (Gewane and Amibara) constitute 10, 608 hectares of land; which is about 18% of the total state farms in the region.

Vegetation types

Vegetation type composed of woods or bushes found along the major perennial rivers, mainly the Awash River cover a total area of 145,000 hectares, which is about 1.58% of the total regional area. Gewane woreda constitutes 63,771 hectares, which is about 43% of the total reverine woodland or bushland cover. The vegetation in this woreda is evergreen due to continuous water supply from the Awash River and is browsed by the livestock (camels and goats) during the dry season.

Riverine woodland or bushland

Grazing and browsing of livestock in Amibara woredas of Zone III is, relatively easily possible because of the availability of open bushland and there is free movement of livestock from place to place. The total area of open bushland in the ANRS is 93,892 hectares, which is about 1.02% of the total regional area. Gewane and Amibara woredas cover a total of 64,087 hectares, which is about 68% of total open bushland cover in the region.

Dense shrubland

Gewane and Amibara woredas constitute a total area of 193,077 hectares of dense shrubland, which is 67% of the total dense shrubland coverage in ANRS i.e., 288,100 hectares. The tree sizes are smaller than the bushlands. Its coverage is dense and does not allow the free movement of livestock and, therefore browsing in areas covered by this shrubland is low.

Open shrubland

In addition to, land coverage of Gewane and Amibara Woredas includes open shrubland, which comprised of both shrubs and herbs (grassess) with low density.

From the total area of 969,503 hectares, which is about 10.54% of open shrubland coverage of the regional area, the two sample woredas (Gewane and Amibara) constitutes 103,109 hectares, which is about 10.63% of the total open shrubland coverage in ANRS.

Open Grassland

The open Grassland is found scattered in the southern part of the regional along the Awash River Valley with area coverage of about 524,446 hectares, which is about 5-7% of the total area of the region. Gewane and Amibara woreda constitute total of 89,693 hectares, which is about 17% of the total open Grassland coverage in the region.

Bush/shrub Grassland

The total area of bush /shrub grassland coverage in ANRS is 251,195 hectares, which is about 0.27% of the total area. One of the samples areas, Amibara woreda, alone comprises the total grassland coverage in ANRS. Though the grass composition is the dominant vegetation in the area, bushes or shrubs are found scattered rendering both grazing and browsing provisions.

Wooded grassland

This type of grassland coverage is found in the side of the Awash Valley. The area coverage in ANRS is 175421 hectares, among these Gewane worked a constitute 81,631 hectares which is about 46.5% of the total Grassland coverage in ANRS.

The wetlands

The wetlands, which are found along the path of the Awash Valley River, are the seasonal swamps and marshy areas. In the swamps, few scattered trees grow, while the marshes are predominantly grasses and sedges. The two sub-units are described in detail as follows.

- **Seasonal Swamps**

  A seasonal swamp, which is mainly found in depressions along the rivers and their courses, is a good dry season graze for the surrounding livestock. The total area covered by seasonal swamps is 50,390 hectares, which is about 0.56% of the total regional area where Gewane woreda

constitutes 13,101 hectares, which is about 25% of the total swamps coverage in ANRS.

- **Seasonal Marshes**
  Seasonal marshes are mainly found along the Awash River banks, with total area of 182,499 hectares, which is about 1.98% of the total regional area. Gewane and Amibara woredas together constitute 51,183 hectares, which is about 28% of the total Marshes coverage in ANRS.
- **Bareland**
  Seventy percent of the total regional area (6,444,559 hectares) is bareland. Total of 425,224 hectares, which is 6.6% of the total bareland coverage in ANRS, is found in the two sample areas.

Population characteristics

According to the population and housing census carried out in Afar in July 1996, the population of the region was 1, 106, 383 of which 625, 839 were males and 479, 544 were females the total population, 92.2% live in rural areas and the remaining in urban centers.

Based on the Central Statistical Authority (CSA), Amibara woreda has a total 40,175 people of which 19,338 are settled in urban areas and the remaining 20,837 live in rural areas. Similarly, Gewane Woreda with a total number of population 28, 144, of which 8,580 live in urban centers while the remaining 19,564 people settle in rural areas. *(See Table 3.*

Population Dynamics

Changes in population size (or population dynamics) are determined by birth rates and death rates, among others. According to 1996 census, the crude birth rate for the Afar region is 18.8 births per 1000 population. The total fertility rate (i.e. the number of children a women loved have during her reproductive life if she experienced the age specific fertility rates) for the Afar region is 3.3 children per women.

The infant mortality rate (i.e. the probability of death in the first year of life) for the Afar region was 118 per 1000 live births. The child mortality rate (i.e., the probability of death for children in the age of 0-4 years) for the Afar region is 174 per 1000 children. Life expectancy at birth (i.e., the average length of life that would be observed in a population) for the region is 50.3 years, i.e. 53.1 and 47.0 years for males and females respectively.

Based on the 1996 census result, the population of the region and the two sample woredas (Amibara and Gewane) has been projected for the years 1998, 2000, 2002 and 2010. The population projections were made by woredas using the exponential growth model by applying the national estimated average growth rates of 2.23% for rural and 4.11% for urban. Assumptions are also based on growth rates applied by CSA to project the regional population up to year

2000.The population of the region for the years 2002 and 2010 has been projected, using the average national growth rate, which is 2.9 percent.
According to the 1996 census, the population of the region is project to reach 1,274,246 by the year 2002 and 1,624,669 by the year 2010. The project population of the two sampled woredas (Amibara and Gewane) up to the year 2010 is also indicated in table 4.

Accordingly, the populations of the two woredas are projected to reach 102,146 by the year 2010 correspondingly the rural population is projected to reach 59502. This will create tremendous challenges interms of natural resource-use and provision of social services.

Table 4. Projected Population of the Two Woredas in the Study Area

Woreda	1998			2000			2002			2010		
	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total
Amibara	20960	21777	42737	22718	22759	45477	24625	23785	48410	29538	30689	60227
Gewane	9300	20446	29746	10080	21368	31448	10926	22332	33258	13106	28813	41919
Total	30260	42223	72483	32798	44127	76925	35550	46117	81668	42644	59502	102146

Source: 1994 Census

Population Density
The Afar region is among the areas of the country with low population density (13 persons per km^2) with population size of 1,106,383 and land area of 85, 410 km^2. /According to the 1996 census/, the region has a population density of 13 persons per $km^{2.}$ The population density of Zone III, where the two sampled woredas are located is 9.4 persons per sq.km.

Particularly, one of the sample areas Gewane woreda is the least densely populated Woreda in the region, which are 3.5 persons per $km^{2.}$ However, it is important to put in mind that the population density among woredas might vary from time to time as the result of seasonal movement pattern of the pastoralists depending upon the availability of grazing land and water points.

Mobility and settlement pattern in the study area.
The pastoralists, in Amibara Woreda spend most of the winter season in Allaideghe plain, and the summer season along Awash River banks. However, during *Karima* the flood hazard resulted from Awash River and floods diverted from the private farms displaced a number of families and obliged them to shift their camp sites away from the Awash River. The flood has also aggravated malaria infestation in the area and a good number of people suffer from the daily disease.

Before the introduction of irrigation schemes in the middle Awash, the pastoralists in Amibara Woreda used to graze their animals in and around Melka Sedi and Melka Werer areas as a dry period grazing site. In the advents of commercial farms in Melka Sedi and Melka Werer the dry season grazing areas of the Afar pastoralists have been highly affected and their grazing pattern also changed.

The Afar in Amibara district often evacuate to Allaideghe plain, which has a vast grazing land used by all clans with less marked boundary. Although Allaideghe plain is the most common destination because of its rich resources, it has always been an area of contention among the Afar, Issa (Somali), and Ittu Oromos.

The pastoralist in Gewane woreda spend most of the winter season (*Karima*) in the vast grass plain area namely Yangudi Rasa in the North and a flood plain along the Awash River in the west. Allaidgehe grassland plain, which covers 200,000 hectares, is also 40km south of the woreda. After the resource centralization by the state since 1960's, Gewane woreda has lost 2,170 hectare of dry season grazing reserve for irrigation. The government displaced the community to the hillsides and issued their land for some investors and AVA. Similarly, the Yangudi Rasa plain was enclosed during the Imperial Regime for wild animal conservation. Nowadays the remaining portion of the Ynagudi Rasa grassland plain is encompassed by the Issa (Somali). Hence, as the result of conflicts in the area, about 471, 000 hectares of grassland is under utilized and given away for fire and nature even in times of drought.

Household size and composition

While the average family size of the surveyed households in the study area is 6.6 persons, the figure for the entire region of Afar as per the 1996 census is 5.7 persons and 6.0 persons for rural areas. Compared to other zonal administration in ANRS, Zone III, where the two sample woreda are located have an average family size of 4.6 persons of which 5.0 persons for rural areas is the lowest in Afar region. (CSA 1996).

The distribution of households and persons by household size in the surveyed areas showed that 20 % of the household (the largest proportion) has family size of 6 persons. About 70 % of the surveyed households have family size of 5 to 9 persons *(See Table 5)*

Table 5 Distribution of Households and Persons by Household Size and Average Number of Persons per Household in the Surveyed Households.

Household size person	Households		Persons	
	No	%	No	%
1	1	1.1	1	0.2
2	4	4.4	8	1.3
3	3	3.3	9	1.5
4	6	6.8	24	4.0
5	11	12.2	55	9.3
6	20	22.2	120	20.0
7	16	17.8	112	18.8
8	12	13.3	96	16.1
9	5	5.6	45	7.4
10	7	7.8	70	11.8
11	3	3.3	33	5.6
12	2	2.2	24	4.0
Total	90	100.00	597	100.00
Average household size	-	-	6.6	

Source: Field Survey

A household often consists of head, spouse, their children, and some other persons residing in the household. About 3 percent of the surveyed households are female headed. The largest proportion of the population in the surveyed households is Son/Daughter, which constitutes 49.4 percent of the total *(See Table 6)*.

Table 6. Percentage distribution of the surveyed Population by spouse

Relation to head of household or spouse	Male	Female	Total
Head	96.7	3.3	15.1
Spouse	_	100.0	15.9
Son/Daughter	68.1	31.9	49.4
Brother/sister	63.6	36.4	11.1
Father/Mother	45.4	54.6	5.6
Other relating	58.8	41.2	2.8
Non-relatives	0.5	0.5	0.1
Total	**59.8**	**40.2**	**100.0**

Source: Field survey

Age/Sex composition

The pattern of age obtained by the survey is shown in table 7. As can be seen from the table, the area has 41% of its population less than 15-year age, 55% between ages 15-64 years, and 4% at the age of 65 years and above. The age composition of the surveyed population indicated that the population is

dominated by the young age 0-19 years 51 %, almost half of the surveyed population being below 15 years of age. Sex composition of surveyed households indicates that there is the excess of males over females. *(See Table 7).*

Table 7. Distribution of the Surveyed Population by Age Group and Sex

Age-group	Male		Female		Total	
	No	%	No	%	No	%
0-4	49	13.7	35	14.6	84	14.1
5-9	57	16.0	36	15.0	93	15.6
10-14	40	11.2	28	11.7	68	11.3
15-19	34	9.5	25	10.4	59	9.9
20-24	41	11.5	16	6.7	57	9.5
25-29	27	7.6	25	10.4	52	8.7
30-34	29	8.1	26	10.8	55	9.2
35-39	12	3.4	10	4.2	22	3.7
40-44	19	5.3	9	3.8	28	4.7
45-49	7	2.0	5	2.1	12	2.0
50-54	11	3.1	7	2.9	18	3.0
55-59	6	1.7	3	1.2	9	1.5
60-64	11	3.1	7	2.9	18	3.0
65 +	14	3.8	8	3.3	22	3.8
Total	357	100.0	240	100.0	597	100.0

Source: 1994 Census

Literacy

According to the 1996 population and housing census, about 93% of the population of Afar region was estimated to be illiterate. Compared to the entire region the literacy level for the study area is relatively higher due to better school facilities in the state farm areas.

As per the survey result, out of the total population in the age range of 7 years and above, the majority or 81.4 % are illiterate, 4.3% can read and write, and 12.7% have primary education *(See Table 8)*

Table 8. Percentage Distribution of the Surveyed Population Aged 7 Years and above by Education and Sex

Education	Male	Female	Total
Illiterate	76.2	94.4	81.4
Read/write	6.1	4.3	4.3
Primary education	14.3	4.1	12.7
Above primary	2.0	0.5	1.2
Others	1.4	-	0.4
Total	100.00	100.00	100.00

Source: Field Survey

Socio- economic Infrastructure Development

Education

The education facilities in the region are generally inadequate and the existing few facilities is also unevenly distributed among Zones. The majority (more than 60%) of the elementary schools and all of the senior secondary schools were located in zone 1 and 3. Almost all (except one located in zone 2) junior secondary schools were located in zones 1 and 3.There are 24 primary and secondary schools in the two sampled woredas. However the participation level of the Afar people is very minimal. For instance, as the data from the regional Education Bureau indicates, the enrollment ratio of the Afar is only 26% and 5% of the total students enrolled in the primary and secondary schools respectively.

Number of Schools in Sample Woredas

Woreda	Primary	Secondary	Total
Gewane	6	1	7
Amibara	6	3	9
Total	12	4	16

Source: **Field Survey**

Water Supply

Safe water availability, especially in dry seasons, is an acute problem throughout the region. The rural area housing units that have access total water comprises only 5,353 or 3.2 %. The main sources of water in the study area are rivers and wells. Other sources such as boreholes, ponds and irrigation canals are also used to a lesser extent.

Main Sources of Potable Water

No.	Source	No.of respondents		% of respondents	
		Gewane	Amibara	Gewane	Amibara
1.	River	13	20	43.3	45.0
2.	Well	2	2	6.7	3.3
3.	Spring	-	2	-	3.3
4.	Borehole	3	12	10.0	8.3
5.	Pond	2	4	6.7	6.7
6.	Pipe	4	8	13.3	13.4
7.	Irrigation canal	6	12	20.0	20.0
8.	Total	30	60	100.0	100.0

Source: Field Survey

Health Services

A health service present in the region is one of the lowest in the country. There are 4 health stations, clinics, 8 health centers, 49 health posts, and 2 hospitals with 65 beds in the region.

The distribution of health facility in the region is not equitable. All of the hospitals and the health centers, and 32 of the 50 health stations (64 %) were found in zone 1 and 3 that are along the main road and where there are cotton plantations.

Distribution of Health Facilities in Sample Woredas

Health Facilities	Gewane	Amibara	Total
Health Station	-	6	6
Health Center	1	-	1
Health Posts	1	1	2
Hospitals	-	1	1
Total	2	8	10

Source: - field survey

Traditional Institutions of Afar

The Afars have their own indigenous (traditional self-help) institutions to look for assistance from one another in order to tackle their harsh environment and to keep up with their homogenous cultural linkages. The major idea behind these traditional institutions is to keep each other in socio-economic and political problems such as in herding of animals, cultivation of crops, managing offensive ethnic or tribal conflicts, local administration and many other socio-economic, cultural and political affairs. From the field survey and discussion with clan leaders, the information obtained on the role of clan leaders is that each and every Afar is organized in any one of the clan organization (traditional institutions) that exists in the study area. Age is an important factor in the Afar socio-cultural tradition. The population is also divided according to a system of age groups associated with cluster of rights, duties privileges and status.

Mablo

It is a general council of clan leaders and elders with in a tribe. It is the highest decision makers with regard to major changes in social organization, resources, re-allocation, and arrangements of self-defense and peacekeeping. The council is called and chaired by the chief of the tribe *(Makaban).*

Elders' council (Edola)

It is a clan level office comprising the clan leader, sub-clan leaders and elders of the respective sub-clans. It is the highest-level decision maker with regard to participation, resource management and social controls within a clan territory.

Fiema

Fiema is a formally organized group of men or women whose 'recruitment' is based on their age or / and the localities they come from. A *fiema* is usually a peer

group, made up of young people of equal age. The leader of the group *(Fiema-aba*) is responsible for coordinating the duties of the *fiema* such as prevention of conflict, executing fines and sanctions implementing elders' council decision etc.

Division of Labor

This assessment has been done following visits and a series of discussions with Afar women living in sampled woredas. In the Afar society elders, adult men, women, children have different but some times also over lapping roles in making their ways of life work.

Mobility

Due to the aridity of the physical environment and widely dispersed nature of the natural resources, the Afar are likely to increase their movement from one place to the other in search of pasture and water. Mostly it is the responsibility of the young people to take out animals for grazing. The rest remain near water sources caring for small stocks. By the help of their traditional information communication system, *Dagu,* men patrolling scouts (*gibba)* are responsible for mapping out the places where animals along with the human population will migrate.

Even if the last decision on where and when to move, is decided by men, women are also responsible and actively participate in the process of moving and locating humans and also animal herds and their makeshift house, *"Ari"* into a new settlement area. They pack all household and other movable items and load them on a camels or donkey's back. In situations where only big animals move young men will be responsible for the travel and women & young children both boys and girls, stay behind and look after small stocks (e.g., goats & sheep). Generally, movements from one to the other place need a co-coordinated work and hence the Afar pastoralists perform this task in a collective manner.

Domestic work

Apart from reproductive roles such as childcare, most of domestic work activities like acquiring and processing food, women undertake managing food rationing fetching water and firewood and too many other chores.

The men do not have any role in domestic activities. The Afar woman has the whole responsibility to ensure that her husband and children get enough food.

Marketing

Marketing is commonly done jointly while women take sheep and goats to the market, men sell cattle and camel. They often go to long distance markets.

Decision-making

Usually the men & women participate in making decisions at household level. Women participate and decide on routine domestic issues such as type of animals

they should sell, how to use their cash, what to buy from market and to whom, etc.
However men handle most matters that affect community when intra and inter ethnic conflicts arise due to resource use and other related manners .The men get together discuss and resolve the conflict. Women are largely left out from making decisions concerning community wide concerns.

Generally Afar men involved in selected activities while the women are tied up with a lot of activities from early dawn to the dusk. The role of women (both productive and reproductive) becomes much heavier during the dry season & whenever there is shortage of water in their vicinity. All in all, there exists no activity that is outside Afar women's domain. Despites these facts, the Afar women exclude from property right such as and ownership.

Economic Characteristics
As the majority of the Afar pastoralists depend on nomadic pastroralism, the data on occupation /type of activity/ of the surveyed population aged ten years and above, indicates that the major type of activity of the population is pastoralism 76.4%. This is followed by mixing farming 22.9% that is, both farming and livestock rearing (agro - pastoralism). The population who engage in farming alone and other non-farm and non –farm and non –livestock production is only 0.5% and 0.2% respectively. *(See Table12).*

Livestock Raising / pastoralism
The most important income generating activity for Afar in the study area is animal husbandry. Mainly, rearing of cattle, camel, sheep and goats for the daily subsistence need of milk and milk products, meat and hide is dominant. Veterinary services are hardly available in the study areas as well as the region as whole. Therefore, the off-take rate is directly related to good and bad years. During the bad years, livestock particularly cattle are highly stricken by drought and a good number of them die because loss of grazing land and water prints. The off-take rate, therefore marketable during the thought period is very low. In time of good years, the off-take rate is comparatively high and the number of livestock marketed is higher than the drought period. In addition, in time of good year, milk production would improve significantly, which covers significant portion of the household food requirement. In general, livestock are pastoralists' capital. They earn their living from their livestock. They can easily sell them to buy the household requirement from the market. Small ruminants (goats &sheep) are usually sold to meet basic requirements of the household such as food, grain, cloth, commercial goods, and others. Large stocks (cattle and camels) are soled in emergency situations like drought and for other social affairs /such as religious ceremonies, purchase of weapons, and resolutions of conflicts between individuals and /or clans/. In addition, the diversification of livestock production gives opportunity to cope with the harsh environment of the low land area. Live stockowners in the study area discussed the importance of live stock production as indicated bellow.

Cattle
They prioritize the products from cattle as milk for home consumption and cash income by mainly selling the milk, while butter is rarely sold. Cattle particularly are important during the rainy season when feed is very scars usually they sell the cattle. They prefer to sell the male calves for cash income than the female calves.

Camels
Camels are famous for their drought resistance to the harsh physical environment of the Afar region. They milk three times a day under normal condition. Camels are also important pack animals. The Afar pastoralists call them as the 'Vehicle of Afar'. They go through the dry season of the region without having enough water sometimes traveling for five days without water. The exchange rate of one camel is equivalent to about twelve cows. Unlike oxen camels are very important cash income source for the community.

Goats and sheep
Goats and sheep are another important livestock to the Afar community. Beyond their importance for food, goatskins are the only source of material for preparing water container and butter processing material.

The economic access of the pastoralists worsens due to the locations of market center. Livestock markets are located at distant places, which have significant impact on the body weight of the animals. The pastoralists of Amibara and Gewana woredas are forced to take their livestock to markets 2 to 4 days walks away.

Farming
The presence of the major river the Awash and the experience gained from the state farms established some four decades ago was supposed to bring a possibility of applying the wide use of irrigation farming to the region.

In the sampled Woredas, Amibara and Gewane, 1,956 and 2,652 hectares of land, have potential for crop production respectively. In addition a total area of 9000 hectares of land in the study areas has a potential for irrigated pasture. Several studies have confirmed that purely pastoral economy can no longer support the Afar. From the interview in the two sampled woredas, it's learned that, many Afar recognize the importance of integrating themselves in irrigation agriculture.

Crop production in these areas can provide sufficient food supply, subsequently, ensuring food security in the area. Moreover, abundant crop residues will reduce long distance travel in search of grazing land, which leads in turn to agro-pastoralism and subsequently to a sedentary life.

Nowadays, Afar pastoralists are recognizing the importance of mixing livestock raising with crop production for various reasons such as increasing resource-use

conflicts due to scarcity of grazing land and water points, past experience of drought which left many pastorals with no cattle remain on hand, large amount of profit generated by private cultivators on their land are some among many reasons. However, in the study area, there are insignificant number of households engaged in crop production for home consumption, sale in a nearby market and irrigate pastures to feed their animals.

The major constraints to integrate the Afar in irrigation activities are shortages of financial and human capital as well as contractual agreement with investors and clan leaders that set an obligation regarding access rights of other stakeholders. In the two sampled woredas, Amibara and Gewane, only 0.5 % of the surveyed activity on farming alone. *(See table 12)*

Farming and livestock /agro-pastoral/

As it is briefly discussed in the farming sub-topic above, nowadays the pastoralists are likely to be aware to increase their chance of survival by taking up non-pastoral activities. The rational behind this fact is the case their cattle wealth declined due to drought or shortage of grazing land and water points.

There are a few numbers of Afar pastoralists practicing crop production. From the data collected in the study area, the major type of the economic activity of the population in the two sampled woredas Amibara and Gewane is pastoralism (76.4%). About 22.9% of the surveyed households are mixing livestock and crop production. *(See table 12)*

Table 12. Percentage Distribution of the Economically Active Surveyed Population Aged Ten Years and above by Type of Activity /Occupation

Type of activity /occupation	Male	Female	Total
Pastoralism/livestock	67.3	84.0	76.4
Farming	0.4	-	0.5
Farming & livestock (agro-pastoralist)	32.3	16.0	22.9
Other	0.4	-	0.2
Total	100.00	100.00	100.00

Source: Field survey

III) Assessment of spatial information technology systems for the management of range lands

3.1 Borana Plateau

Monitoring and evaluating of rangeland change is an essential ingredient of rangeland planning and management. Advances in computer memory and speed, and new specialized software for the capture, manipulation and presentation of spatial information, have vastly increased the possibilities of spatial planning. Geographic Information Systems and the surge of theoretical work associated

with them, have vastly increased the range of possibilities of organizing spatial data. The aggregation error zones can now be overcome by new and efficient ways of spatial interpolation. Making use of reasonable assumptions about spatial distributions of attribute data between observation points.

A proper understanding of the ways in which rangelands have changed through time is important in rangeland management problems. The changes may occur due to social and environmental factors. The integration of satellite remote sensing with geographic information systems provides an excellent framework for data capture, storage, synthesis, measurement and alalysis, all of which are essential to rangeland change investigations. Planning strategies for sustainable land management require solid base line data on natural resources (soils, physiography, climate, vegetation, land use, etc) and on socio-economic aspects. GIS and remote sensing have an important role in linkage and analysis of such data, in particular for detection (direct or indirect), extrapolation and interpretation, area calculation, and monitoring. More specifically, GIS and remote sensing have been or could be used: a) to identify physiographic units; b) to serve as a common (physiographic) base map for assessments of different kinds of soils, degradation, and conservation; c) to overlay data layers for different map units; d) to make area calculations; e) to link spatial data with non-spatial but more detailed attribute data; f) to make geo-referenced information easily accessible to non-GIS users; g) to "bridge the scale gap", i.e. upgrade experimental results from small plots to larger areas; h) to present data in map and other graphic format; I) to map (temporal and spatial changes in) land cover and land use; and; j) to identify areas of degradation. In this study GIS and remote sensing will be used to map and temporal and spatial range land changes.

Useful sources of satellite data for rangeland change studies are images from Landsat (MSS and TM), SPOT, NOAA and many light weighted satellite systems. Although its spatial resolution is not as fine as that of SPOT HRV data. Landsat data are the sole multi-spectral digital data with synopric coverage extending back to1972. In addition these data are inexpensive and can be managed computationally even by a personal computer with a Pentium processor. Therefore, Landsat data have unique value and thus are extensively used for a variety of tasks, notably in natural resource surveys and environmental monitoring and therefore this study will be applying an application of Landsat imagery and GIS techniques to study the spatial and temporal rangeland changes in the southern part of the Borena administrative region. An integrated analytical method combining image analysis and GIS will be used to quantify rangeland changes. A geographically and temporally detailed assessment of rangeland changes during the period 1984 to 2002 will be made. The factors or processes contributing to the observed spatio-temporal trends will be further analysed. A quantitative analysis of trends is important to improve the success of controlling the natural ecology which is essential to the environmental management and sustainable development of the woreda rangeland changes.

ILCA has performed ecological site classification and mapping of the central Borana Plateau and aspects of environmental change induced by pastoral land use in 1980 to 1991 with a primary objective of reviewing and synthesizing results that pertain to the effects of the Boran pastoralists and their livestock on vegetation composition and trend and with a secondary objective of highlighting use of native vegetation by pastoral households and livestock. The study has showed that by the mid 1980s about 40% of the study area has experienced significant bush encroachment, while erosion attributable to grazing pressure affected 19% of the study area. The study used surveys of twelve 20 x 20 km regional blocks, Landsat imagery and other reconnaissance data collected during 1982 – 1985 to prepare an ecological map at a scale of 1:500,000 for a 26,600km^2 region. Issues relevant to resource use, range management and ecological sustainability were noted at ecological unit and subunit level with trends over time identified using previous maps, aerial photographs and satellite imagery. The justification for the new map was because previous maps of the region had insufficient detail for land-use planning.

The study doesn't seem to give emphasis to temporal changes but spatial changes between selected blocks. The produced map is a single map that shows the spatial variation in ecology and not the temporal variation in ecology. The present study will incorporate both spatial and temporal changes using available existing data, satellite images of two different time series, topomaps, aerial photographs accompanied with field surveys.

3.2) Awash Valley of Ethiopia

Successive Ethiopian Governments have undertaken many studies to evaluate the development potential of the valley. Information and communication technologies were applied as tools. A year before the establishment of the AVA the survey of the Awash River Basin was started under an agreement between the Ethiopian Government and the United Nations Development Program Special Fund (UNDPSF) with the UN Food and Agriculture Organization (FAO) as the Fund executing agency. The Basin valley survey was initially undertaken (in 1961) by SOGREAH (a French firm) as sub-contractor. The survey results including some 30,000 Km^2 of Land under aerial photography and some 7000 km^2 taken under soil survey together with steam flow and climatologic data (obtained through and established network stream gauging stations, climatologic and rainfall stations throughout the valley) were published in five volumes in 1965. The recipient of these publications and the party representing the Ethiopian government in the deal was the AVA(Mulat 1985).

A number feasibility study programs were initiated following the SOGREAH reports.

i. The AVA engaged the Italian firm ITALONSULT in a contract signed in 1968 to undertake a technical and economic feasibility studies for the Melka Sadi-Amibara irrigation are in the Middle valley. The surface area for the study included 20,000 km. A quarter of which was to be used for

a settlement program and was the rest for commercial irrigation agriculture. The study was completed and the reports were published in 1969. In 1978 (after AVA was dissolved). Final Design contract document was signed with Sir Willhiam Halcrows partners who also serve as supervising engineers to the construction Program also started late in 1978 with pulled funding from the Ethiopian Government, world Bank, African Development Fund and EEC sources.

ii. There was also another AVA contract signed with ITALCONSULT in May of 1968 for a "technical feasibility study of the Meky River Diversion Scheme" . The aim was to increase the volume of water in the valley through such diversions. The feasibility study was completed on time and was published in 1970.

iii. After international tender for bids the (Bureau Pour Le Development De La Production Agricole) won an AVA contract in 1972 to make a feasibility study of the Tibila Area. The objective of the study was to determine for sustained irrigated development, measure the extent of allocation of Awash water resources in the area, and to establish the relevant agriculture engineering, economic and social factors mix suitable for the development of the area. Several reports of the feasibility study were published in 1974.

iv. In July 1973 the Awash Valley Authority Commissioned Sir William Halcrow and partners to study the possible agricultural development of some 14,000 ha of land in the Angelel and Bolhamo area in the Middle Awash Valley. Because of an early identification of the suitability of adjoining land, the area under study was increased to 29,000 ha. And included Dijilu. The final report was produced in 1975 (after the dissolution of AVA, the report was updated in 11981/82 by a Dutch Consulting firm, NEDCO, and plan is now underway to engage other consultants in final design, construction and super-vision activities.

v. There was also the major feasibility study for the Lower plains by Sir Alexander Gibb and Partners (London) under a contract with the AVA. The fund for the project was received from a British Government Technical Assistance Program. The study had three aims.

The feasibility study took three years and in 1975 the findings were published in several reports. Outside these major feasibility studies, the UNDPSF/FAO supported researches had continued. Indeed, under a twining contract the Australia State Rivers and Water Supply Commission of Victoria was engaged in various types of studies programs for the Awash Valley Authority. In these programs as many as 30 manuals and reports are produced covering wide ranging subjects on valley Development.

Finally a draft of the Master Plan for the valley development was produced in 1970 under the FAO/UNDP program. The draft plan puts together into one the state of knowledge about the valley, analyses in great detail the economic and

social data made available by the feasibility studies and the Authority's own research, and evaluates the various developmental projects at their various stages of implementation. It also assesses the performance of the AVA in terms of meeting the objectives set forth in the Charter and identifies a string of institutional reforms necessary for purposes of attaining the valley development plan goals.

IV) Pastoral communities and ICT

Communication services - telephone connections, radio communications, postal service, telex and fax - are available in only a few towns of the region (see Table).

Table 13. Availability Of Communication Facilities And Banking Services In Afar Region, 1997

Zone	Town	Tele-phone	Radio Connection	Post Office	Telex	Fax	Banking Service
1	Aysaita	x	x	x	x	x	x
	Chifra		x				
	Dubti	x	x	x			x
	Elidar		x				
	Mille	x		x			
2.	Ab Ala		x				
	Berahle		x				
	Koneba		x				
	Megale		x				
3.	Awash	x	x	x			x
	Melka Sedi			x			x
	Gewane	x	x				
4.	Dibina		x				
5.	Simurobi Gele Alo		x				
	Telalak		x				
No of Towns		5	13	5	1	1	3

Source: Field Survey

As can be seen from Table 13 above, out of the 28 towns in the region, only five of them have telephone services, 13 have radio communications and 5 towns have postal services. Only Aysaita town has all the communication services listed above including telex and fax facilities. Out of the rest Awash and Dubti have telephone, Radio communication and postal services and Gewane town telephone and radio communications. As a whole most of the zonal towns and some weredas and sectoral government offices have radio communications.

This indicates that apart from the very low penetration of telecommunication service in the region their zonal distribution is very uneven. Thus, most of the communication services especially telephone lines and post offices and all of the telex and fax facilities are concentrated in zone one. On the other extreme zones 2, 4 and 5 have only radio communications and these too are limited to a few towns of the regions.

It is well known that any kind of business activity and industrial development requires availability of telecommunication and postal services. Their non-existence makes the region incur high costs because it forces civil servants and business men to travel by car from place to place to obtain information. On the other hand, it is crucial to recognize the fact that due to high technology and capital intensiveness of the sector and scarcity of these resources in the region, it is unlikely to have enough to provide the facilities uniformly throughout the region. It may therefore be necessary to have selected areas that will then be provided with adequate facilities on the basis of economic potential.

The problem of low density of postal facilities can be tackled more easily by increasing postal services both in the rural and urban areas of the region. This can be done by establishing permanent post offices in urban areas where the literacy rate is higher and exchange of information more frequent, and using postal and other government agencies and visiting post-men in the rural areas.

V) Institutional and policy variables that can affect the effective utilization of IT in the management of common pool resources.

Although the geo-spatial data application technology has been introduced in most of the natural resource data user organizations, there are dozens of problems which have been affecting its application. Most of the problems are related with data acquisition, financial problems, shortage of skilled personnel. Problems from the users, the dynamic nature of the technology itself and so on.

The following is summary of the problems which have been and are affecting application of geo-spatial data.

Problem in digital data acquisition

A decade ago, most of the geo-spatial data in Ethiopia were acquired from topographic maps and aerial photographs. However, such data are in analogue format that is not in digital format. Geo-spatial data in digital format is a very recent technology. Consequently, very few spatial data are in digital format.

Geo-spatial data processing facility which requires digital image processing, hardware, software, data/information, skilled man power, expendables (paper, film, ink chemicals and etc.), working environment are not usually complete in most geo-spatial processing institutions.

Data exchange, security and safety problems

There are no formal agreements among geo-spatial data acquisition and producing or distributing organizations, and also there is no guarantee to cross check the agreement before the illegal selling to a third party. When a processed data (with all raster, points, vectors, attribute and other relevant information) are prepared in soft copies, there should be an agreement and/or regulation at national or organizational level. As discussed above, most of the spatial data users agree on not transferring the raw data, practically it is not applicable. Even these days, copyright is not respected.

Price of data

In many cases users of geo-spatial data do not consider that it is value added commodity. It includes hardware, software, expendables and basic knowledge.

On the contrary even budget allocation for such data and information is tertiary stage. Some organizations understand the problem but highly consider the initial investment than its input/output value.

Most of the organizations are not ready to share what do they have other than propagating "information should be accessible". In fact information can be accessible freely or with price. Instead of sharing of available systems with reasonable price many prefer establishing their own system which needs significant amount of money

Problems of skilled manpower geo-information fields

This problem is twofold: The shortage of skilled manpower in geo-spatial data handling and problems of training centers. The two are inseparable.

Except EMA's 6-month "Geo-information and Mapping" training program, there is no spatial data management formal training program in the national level. Computer houses GIS training programs are not far from tutorial part of specific software "Clicking system" which lacks basics of geo-spatial data. Therefore, one can say that it is neither GIS Development nor its crises.

Problems of skilled manpower in geo-information fields

This problem is three fold: The shortage of skilled manpower in Remote Sensing and GIS; problems of training centers; and standardizing of the training program

Absence of distinction between data processors and users

(IT groups and application professionals)

Many users unnecessarily like not only to interpret and make integration geo-spatial data with processing and distributing organizations but also to process the data, which is already available, expensive and needs sophisticated equipment. It is common, therefore, to see different organizations importing expensive software, hardware and data in an uncoordinated manner. Therefore, different projects or departments under the same ministry import different software with

similar capacity of data processing for the same objective. This shows that there is no exchange of ideas among them.

Absence of Forum

As we can observe from different sources, surveying, cartography, remote sensing, photogrammetry, geo-information etc., specialists have got associations at national, regional, continental and global levels. In such forums, besides the exchange of ideas, they may discuss problems about the overall natural resources, environmental systems and the monitoring of them. They can discuss new techniques about geo-spatial data and publish the results in journals and newsletters. In Ethiopia there is no geo-information or related association.

Problems from the Users Part

Major users related problems are: dependency on foreign consultancy; undermining of local expertise, data sharing and exchange problems; absence of third party to cross check the data quality and standard; non-sustainable out look; and very much limited personnel

Local content

The capability to use, create and disseminate information in local languages is a prerequisite to the successful implementation of national ICT policies and strategies. Consequently, promoting African content and languages remains a challenge for the continent and represents a form of democratizing a ccess to the Information Society.

VI) ICT Policy in Ethiopia

Although Ethiopia has been active in developing a national ICT policy for sometime, it has remained one of the slowest in terms of translating policy efforts into concrete actions. The Government has recognized ICT as one of the key sectors of development. A national ICT policy task–force was set up by the Prime Minister to draft a policy document. The policy document has recently been adopted by the Council of Ministers.

Amid frustration with the slow progress, the British Council, in collaboration with ECA and UNDP, held a successful stakeholders conference in June 2001 with the aim of developing an ICT vision for Ethiopia, sharing examples of best practice and taking practical steps towards implementation of successful partnership projects. The recommendations emphasized the need for considering ICT as a key sector in development, access to information and knowledge for all as a national priority, and Ethiopia needs to use ICTs to develop its economy. The conference resolved that:

- An enabling legal and regulatory environment should be established to encourage innovation and use of ICTs;
- A universal access strategy should be established; • Incentives should be put in place to encourage applications development for and in the local market;

- The Government should initiate a programme to take advantage of opportunities for electronic government;
- All tertiary education institutions should be connected to the Internet by 2003;
- Schoolnet Ethiopia should be introduced in collaboration with the private sector and development agencies, and
- A national ICT human resources development fund should be established.
- The first cycle of implementation plan covering the period 2003-2008 was prepared and a national ICT Coordination Offi ce is being established to manage implementation, monitoring and evaluation process. The Government has recently embarked on a number of IT projects focusing on improving public administration, revitalizing education and enhancing the infrastructure. In July 2003, the House of Peoples' Representatives unanimously endorsed a bill providing for the establishment of the Ethiopian Information and Communication Technology Development Authority with a view to guiding the synergetic and systematic use of ICTs for accelerated political, social and economic development.

Ethiopia's draft national ICT policy considers the development of national information infrastructure (NII) as one of the strategic components to improve socio-economic performance and enhance transparency and efficiency in governance. This is even more urgent given the ongoing Agricultural Development Led Industrial Strategy and ongoing decentralisation in the country. The policy is articulated as follows:

Vision: To develop and exploit ICT as an accelerator for attaining national development and global competitiveness;
Focus areas: Local content development; infrastructure development; human resource development; introducing ICT applications for public services and business. The Government is in the process of identifying related projects and formulating the implementation plan. A National ICT Council chaired by the Minister of Capacity Building and the Ethiopian ICTs Authority has been proposed for coordinating and monitoring implementation.

Despite the recent liberalization and privatization measures initiated in the different sectors, telecommunication industry has remained under Government control. The Ethiopian Telecommunication Corporation (ETC) is the sole provider of fixed and mobile telephone, facsimile, Internet Services, telegraph and telex services.

- The number of telephone subscribers increased from 105,985 in 1987 and 1988 to 283,683 in 2000/2001. Facsimile subscribers grew by 24% per annum over the same period;
- Internet services that were introduced in 1996/1997 with a total of 1,042 subscribers increased to 6,487 in 2002. Although the coverage of Internet services expanded to 12 major towns around the country, 96% of the total subscribers were from Addis Ababa. The total number of locally hosted

websites increased from 68 in 2000/2001 to 88 in 2001/2002 and is expected to rise to 100 in 2002/2003;

- Mobile telephony became operational in 1998/1999 with an initial 6,740 subscribers. The number rose to 27,532 in the 2000/2001 . scal years;
- Teledensity was very low. The number of people per 1 main telephone line ranged from 15.4 in Ethiopia's Capital, Addis Ababa, to 1,935 in the Somali region. Overall, there are 224 people per telephone line or 4.5 telephone lines per 1000 inhabitants. This shows that the main lines serve only 65% of the expressed demand of the country's population, and the proportion of those on the waiting list (relative to the main lines) was 55% in 2000/2001; and
- Sectoral distribution of . xed lines shows that the private sector (residential and business) uses 86%, of telephony, while the Government and international organizations take up 12% and 2% of the lines respectively.
- According to estimates made by the International Telecommunication Union (ITU), the number of computers was 75,000 in 2001. There were 367,000 Television sets in 2000. Only 2.8% of the total households in the country had access to television sets and between 1999 and 2000 only about 18.4% of the population owned radios.

ICT usage in the selected sectors

ICT penetration and usage in schools, colleges and health facilities varies markedly by ownership between Government and Non-governmental.

- Government-owned health and educational institutions lag behind the private and nongovernmental Sectors. In relation to Addis Ababa, Regional towns are disadvantaged;
- Access to basic ICTs is lower among employees in Regional towns than in Addis Ababa. Diffusion beyond the capital city and the major regional smaller towns and rural areas where the bulk of the population resides, is extremely low;
- Penetration is generally higher in the public institutions that were sampled (e.g. federal ministries and regional bureaus), than the education or health facilities. For instance, all the public institutions have computers and direct telephone lines. Eighteen % and 67% of the schools and the health facilities, respectively, have no access to computers. Eleven per cent of the schools and 4% of the health facilities have no direct access to telephone lines;
- Internet connectivity is higher in public administration (69%), than in educational institutions (52%) and health establishments (13%);
- The high cost of computers, poor telecommunications infrastructure, lack of IT accessories and exorbitant Internet Service charges hamper access;
- Other notable problems include the shortage of a skilled workforce and the absence of an ICT plan; and
- All the respondents to the question of "identifying the major constraints for the expansion of ICT in Ethiopia" are consistent across the different sectors and regions.

Regulatory Framework

The high tax rates, weak legal systems and an inadequate capacity to enforce regulatory requirements. The telecommunications law that supports Government monopoly has adversely affected ICT infrastructure development. The long waiting-time for fixed lines and mobile telephones, coupled with the complaints of users about the quality of services suggest that closed market policies may be inconsistent with the desire to expand the use of the new technologies.