EASTERN NILE TECHNICAL REGIONAL OFFICE

NBI – Institutional Strengthening Project
PROJECT DELINEATION AND PRIORITIZATION

ANNEX 4.4
JITA DELINEATED WATERSHED PROJECT
(FINAL REPORT)

10th December, 2012

CONTENTS

ABBREVIATIONS

ADLI	Agricultural Development Led Industrialization
AHI	African Highlands Initiative
BoWRM	Bureau of Water Resources & Mines
CBPWD	Community Based Participatory Watershed Development
CGIAR	Consultative Group for International Agricultural research
COSAERT	Commission for Sustainable Agriculture and Environmental Rehabilitation
CRA	Cooperative Regional Assessment
CSE	Conservation Strategy of Ethiopia
EEFPE	Environmental Economic Policy Forum for Ethiopia
EPA	Environmental Protection Agency
ENSAP	Eastern Nile Subsidiary Action Programme
ENTRO	Eastern Nile Technical regional Office
FAO	Food and Agricultural Organization
FDRE	Federal Democratic Republic of Ethiopia
GIS	Geographical Information System
IDEN	Integrated Development of the Eastern Nile
IFPRI	International Food Policy Research Institute
ILRI	International Livestock Research Institute
IUC	Inter University Cooperation
JMP	Joint Multi-Purpose Programme
Km	Kilometre
Km2	Square kilometre
LLPPA	Local Level Participatory Planning Approach
MoARD	Ministry of Agriculture and Rural Development
MoWR	Ministry of water Resources
MERET	Managing Environmental Resources to Enable
N	Nitrogen
NTEAP	Nile Trans-boundary Environmental Action Programme
PASDEP	Poverty Alleviation & Sustainable Development Programme
SCRP	Soil Conservation Research Project
SDPRP	Sustainable Development & Poverty Reduction Programme
SLM	Sustainable Land Management
SWC	Soil and Water Conservation
t	ton

UNDP	United Nations development Programme
USAID	United States Agency for International Development
USLE	Universal Soil Loss Equation
WB	World Bank
WBISPP	Woody Biomass Inventory and Strategic Planning Project
WFP	World Food Programme
WM	Watershed Management Jita (Upper Beshlo) (Upper Beshlo)

DISCLAIMER

The maps in this Report are provided for the convenience of the reader. The designations employed and the presentation of the material in these maps do not imply the expression of any opinion whatsoever on the part of the Eastern Nile Technical Office (ENTRO) concerning the legal or constitutional status of any Administrative Region, State or Governorate, Country, Territory or Sea Area, or concerning the delimitation of any frontier.

1. BACKGROUND

1.1 Introduction

The results of the Trans-boundary, Distributive and Cooperative Mechanisms Analyses of Eastern Nile Watershed Management Cooperative Regional Assessment (CRA) provided a broad understanding of:

- the baseline conditions in each watershed, root causes of land degradation on national level and lessons from past experience in watershed management,
- each of the selected sub-basins as "*integrated"* watershed systems,
- the challenges and opportunities for cooperative watershed management,
- the cumulative costs and benefits of alternative watershed management interventions,
- the potential distribution of costs and benefits under alternative benefit sharing scenarios, and
- the nature and scope for generating regional public goods[1] through the watershed management project(s).

The Eastern Nile Watershed Management CRA identified a number of potential projects for subsequent implementation within the framework of the Eastern Nile Subsidiary Action Programme (ENSAP).

The Watershed Management CRA terms of reference called for the identification:

> *through analysis, the next round of watershed management projects, that are promising from a local livelihoods as well as a regional benefits point of view and are rational in view of anticipated multipurpose developments in the Eastern Nile region .*

The Distributive Analysis identified a comprehensive set of watershed management interventions to be implemented within Ethiopia, Sudan and Egypt. The majority of these had substantial in-country benefits in terms of reducing poverty, sustaining livelihoods and arresting the decline in the integrity of the natural resource and environmental base of the countries concerned. A number

[1] A regional public good here can be seen as the positive 'spill-over' effects of a country-level activity or asset in neighbouring countries.

of these had regional and global benefits. Many of the interventions identified were, or were likely to be in the future, integral parts of on-going development programmes.

The Cooperative Mechanisms Analysis examined a continuum of increasing levels of potential cooperation amongst the three riparian countries of the Eastern Nile Basin. These ranged from uni-lateral action with no cooperation through coordination (e.g. of information collection and sharing), collaboration (e.g. collaborative research or collaborative Watershed Management Planning) to Joint Activities (e.g. administration of Trans-boundary National Parks). With-in this framework many of the interventions outlined in the Distributive Analysis required a relatively low level of cooperation between the riparian countries, notwithstanding downstream (i.e. regional or Global benefits that could accrue to them.

A number of criteria were identified to enable a selection to be made of a first round set of potential projects from those identified in the Trans-boundary Analysis and outlined in the Distributive Analysis.

- Support and enhance cooperation among the three Riparian Countries in sustainable watershed management,
- Local, National, Regional and where possible Global benefits would accrue to the projects, and
- The projects would where possible support other IDEN Projects, the JMP and other NBI projects.
- The projects would address threats to Environmental and Natural Resource Hotspots

The "Benefits" criterion is broad in its interpretation. Benefits include positive impacts on (i) poverty reduction, (ii) support to sustainable livelihoods and reducing vulnerability, (iii) reducing or arresting natural resource degradation. Benefits accruing to these development goals are inextricably linked and are thus, considered together. Benefits were also assessed at the local/national, Regional/Eastern Nile Basin and the Global scales. All selected Projects have benefits at all three levels. All Projects selected also support to a greater or lesser extent on-going or proposed Projects within the NBI or ENSAP framework.

Two sets of follow-on projects were identified:

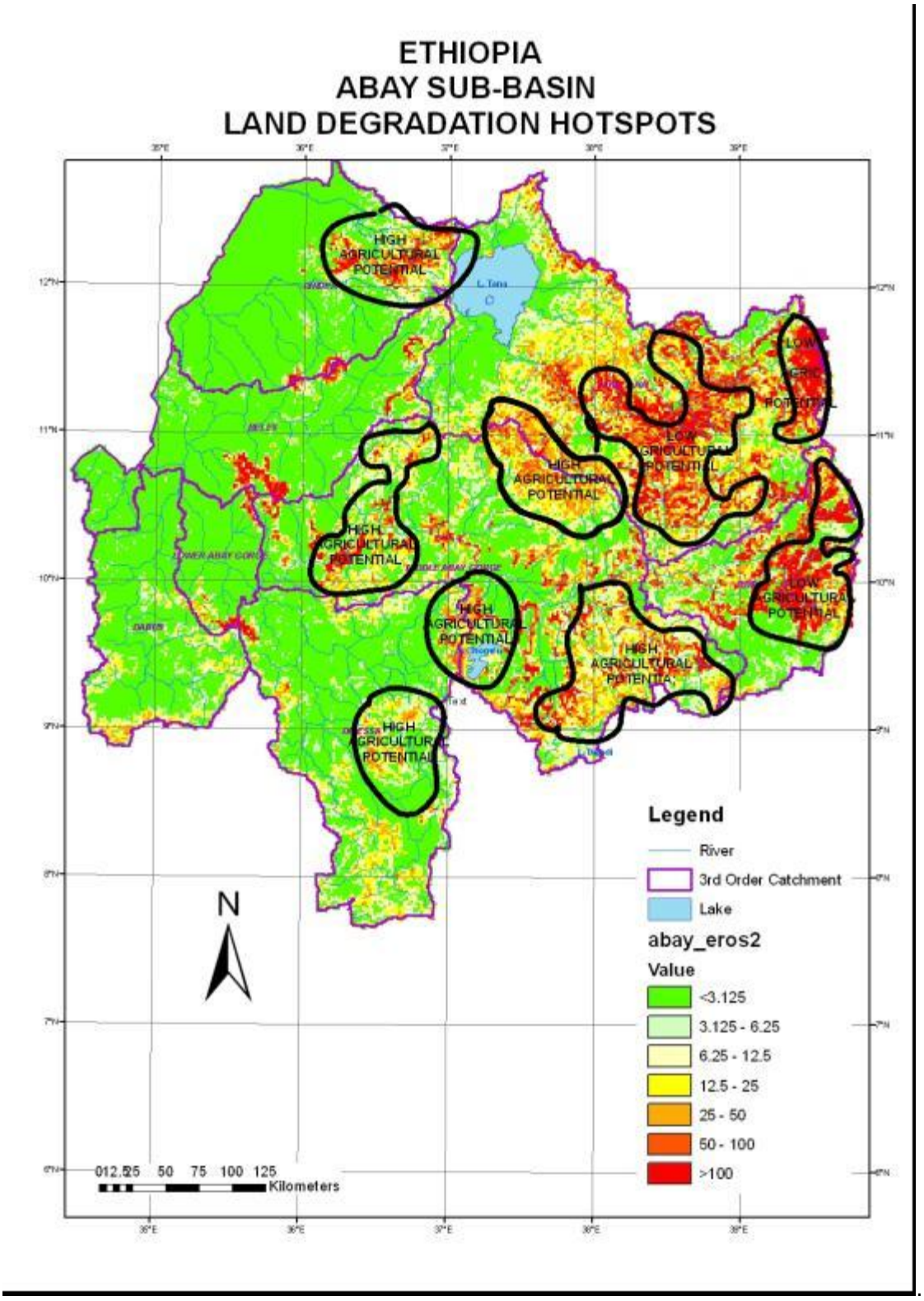
- National Investment Projects
- Cooperative Knowledge Development Projects.

The main criteria for the selection of the Investment Projects was that they addressed current threats to natural resource degradation in ways that negatively impacted on local household livelihoods and also negatively impacted on downstream river users.

This Report is concerned with four of the Investment Projects located within the Abbay Sub-basin within Ethiopia. This Project document is concerned with the Jita Delineated Watershed.

1.2 Primary Objectives of the Project

The Watershed Management CRA identified a number of land degradation hotspots in the Abbay Basin. These are areas of increasing population pressure on a degrading natural resource base, increasing food insecurity, with increasing household inability to invest in sustainable land management practices due to declining household and community natural, physical, social and human capital assets. The selected hotspots are located in areas of low agricultural potential where land degradation processes (erosion and soil nutrient depletion) are severe and of long standing.



Map 1. Abbay Basin: Land Degradation Hotspots

The objective of this Project is to provide support to the Regional Government to arrest severe land degradation hotspots within areas of low agricultural potential

in the Jita Delineated Watershed of the Abbay Basin, strengthen household and community livelihood strategies and contribute to the alleviation of poverty.

1.3 The Scope and Elements of Sustainable Sub-basin Management

River basins, Sub-basins, watersheds and sub watersheds and their hydrological processes operate in systemic way within a nested hierarchy but often in complex spatial and temporal patterns. For example, the linkages (or coupling) between vegetation cover, soil erosion (or soil conservation) and sediment yield at the micro-watershed level and the sediment load and sedimentation downstream at the macro-watershed level often do not have simple linear relationships. Terminology is generally based on area (although this is of necessity rather arbitrary).

Table 1. Watershed Management Units and Hydrological Characteristics

Management Unit	Typical area (km2)	Example	Degree of coupling
Micro-watershed	0.1 -5km^2	Typical watershed adopted by MERET interventions (Ethiopia)	Very strong
Sub-watershed	5 – 25km^2		Strong
Watershed	25 -2,500km^2	Zamra	Moderate
Sub-basin	2,500 – 10,000km2	Guder, Anger	Weak
Basin	10,000 – 250,000km2	Abay-Blue Nile	Very weak

After World Bank (2005)

In the present context the Basin level is the Abbay within Ethiopia; the Jita (Upper Beshlo) Sub-basin level comprises the two Watersheds of the Shodeb and Jita. The Sub-watershed is the next level and each Sub-watershed comprises a number of Micro-watersheds as used for Soil and water conservation planning.

In micro and sub-watersheds there is a strong coupling between the watershed area and the channel. Vegetation and land management practices closely control the runoff and the export of water, sediment and dissolved load into the stream channel. There is also a close coupling between groundwater and the river. In medium to large basins coupling between the watershed and the river is weak. The dominant process in basins of this size is transfer of material through the channel network and there is often temporary storage of sediment. Thus, the channel acts as a conveyor belt intermittently moving pulses of sediment during flood events. There is additional sediment from stream bank erosion and drifting sand.

Clearly, the approach to be adopted in developing a framework for watershed management for the Eastern Nile Basin needs to be very broad in order to

address a wide-range of objectives based on stakeholder perspectives across multiple levels and countries. The objectives to be addressed go beyond developing and conserving land, water and vegetation in the four sub-basins in the three countries. They include but are not limited to:

- Improving the management of land and water, their interactions and externalities;
- Linking upstream and downstream areas, and integrating environmental concerns with economic and social goals;
- supporting rural livelihoods by linking interventions in other "non-watershed" sectors (e.g. health in pond development, training in non-farm employment activities);
- addressing equity and gender concerns in the distribution of costs and benefits of watershed interventions (e.g. positive and negative externalities at various levels);
- identifying opportunities for incremental benefits accruing to cross-border coordinated interventions, including those being developed for the other IDEN CRA's and the Joint Multi-purpose programme (JMP);
- identifying global benefits (e.g. conservation of tropical forests, biodiversity and carbon sequestration) that accrue from national and regional level interventions.

At the same time it will be important to maintain a "Watershed Perspective". This is necessary to avoid losing focus on the unique upstream-downstream characteristics of watersheds and river basins. Maintaining such a perspective will avoid the danger of the analysis failing to develop a "system-wide" understanding of the issues and thus the identification of trans-boundary opportunities to improve livelihoods and achieve poverty reduction. Finally, a Watershed perspective will enable the identification of basin-wide synergies from cooperative trans-boundary interventions.

Strategic watershed planning needs to take into account different temporal and spatial scales and accept a degree of uncertainty. It can be implemented at scales ranging from small upland watershed to entire trans-boundary river basins. Whilst small-scale projects have the advantage of face-to-face interaction with stakeholders they have limited impact at the watershed or river basin level. The design and operation of local programmes must consider upstream-downstream linkages and a methodology for multi-level watershed, sub-watershed and micro-watershed planning needs to be developed. Scaling-up

of successful local experience is critical for the new generation of watershed management programmes.

2. NATIONAL SETTING - ETHIOPIA

2.1 Bio-physical and Socio-economic Setting

With a surface area of 1.1 million square kilometers, Ethiopia is located in the northeastern part of Sub-Saharan Africa between latitudes 3° and 15° north. The estimated population in 2010 was 79.8 million, the second highest in Sub-Saharan Africa. Some 84 percent of the population are rural (Population Census Commission, 2010). The estimated rural population growth rate (1995-2007) was 2.6 percent per annum and the urban rate was 4.5 percent. These growth rates are projected to decline between 2000 and 2030 (figure 1). Nevertheless the total population is projected to rise to 129 million by 2030 (see figure 2).

Figure 1. Changes in Rural, Urban and Total Population Growth Rates 1995- 2030 (Source CSA, 1999)

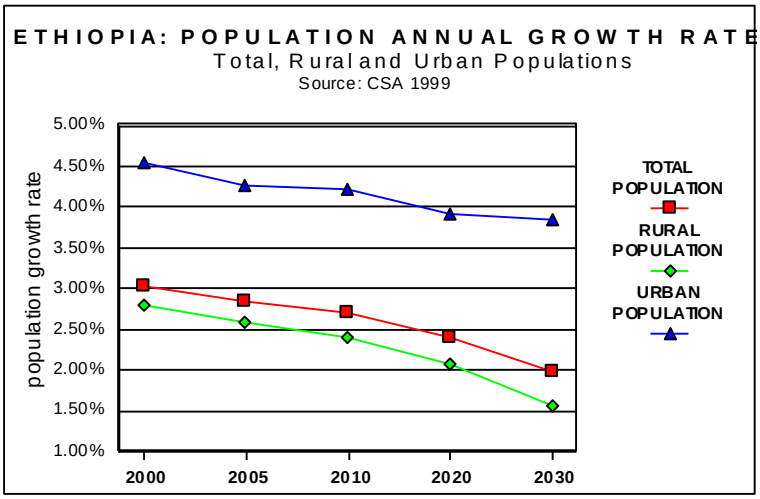
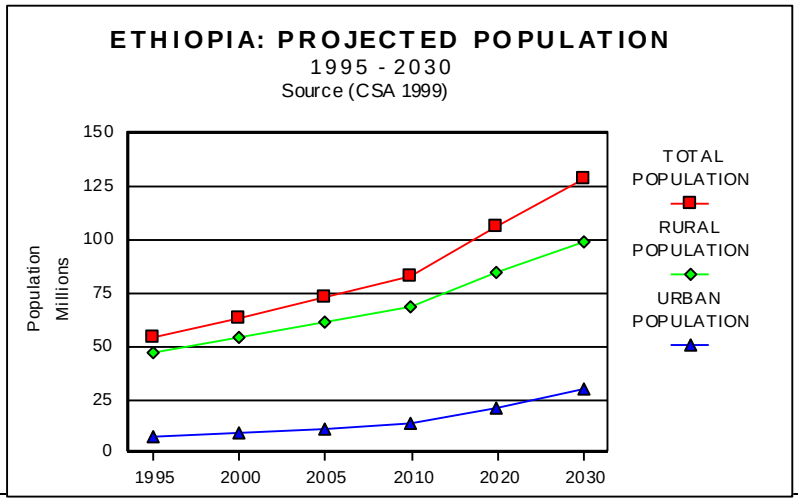
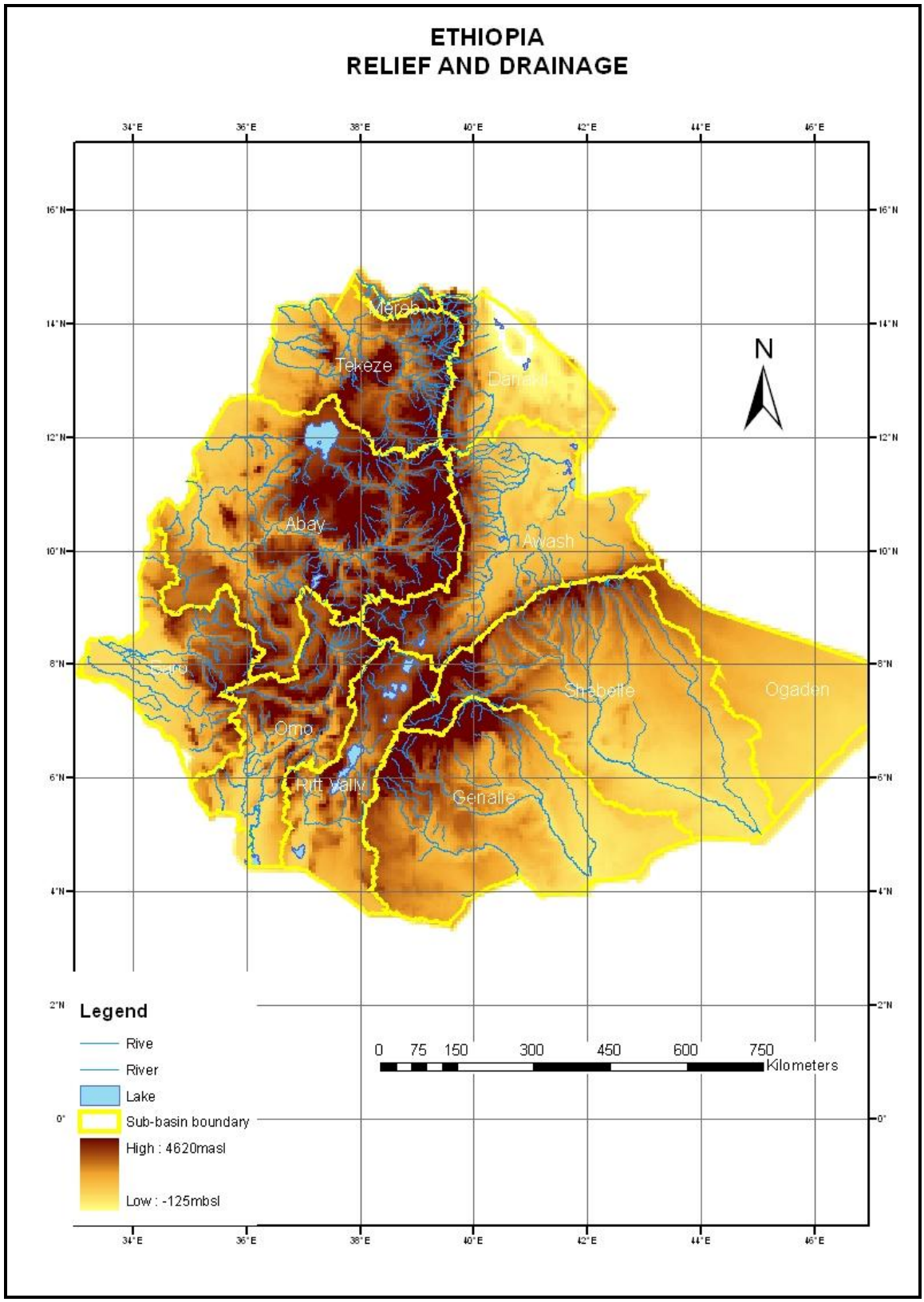


Figure 2. Rural, Urban and Total Population (1995 - 2030)





Map 2. Ethiopia: Relief and Drainage

The Highlands[2] form a broad plateau between 1,500 and 2,500 masl with isolated peaks rising as high as 4,600 masl. They cover 43 percent of the total area. The favorable climatic conditions of the Highlands sustain 88 percent of the population (Map 2). The Highlands account for 95 percent of the cultivated land, and also support 75 percent of the cattle population of 33 million. Most crop cultivation in the Highlands uses the plough and has a history stretching over many millennia. Ethiopia is one of the 12 Vavilov centres of crop genetic diversity, being a main genetic diversity center for crops such as aribica coffee, enset, niger seed, sorghum, finger millet, durum wheat, barley and many others. Given the erosion of genetic material elsewhere in the world, this diversity is assuming an increasing global importance.

Surrounding the highlands on all sides are the lowlands. To the east, southeast and south they are semi-arid to arid with an annual rainfall below 600 mm. These lowlands are inhabited by transhumant pastoralists who herd cattle and sheep (mainly grazers), and goats and camels (mainly browsers). In the Western Lowlands rainfall is much higher but the prevalence of trypanosomiasis precludes livestock production. This factor, together with the prevalence of human tropical diseases not found in the Highlands, has meant that until recently these areas were sparsely populated. However, under increasing population pressure in the Highlands these areas are now increasingly being settled.

In the high rainfall areas of the southwest and southeast highlands the original vegetation of the highlands was broad-leaved montane high forest. Further north with lower rainfall this changed to a mixed coniferous forest (Podocarpus spp. and Juniperus spp.) and woodland. In the driest parts of the north this in turn gave y to low Juniperus woodland. However, millennia of expanding settlement and clearing for agriculture has left only 3.6 percent of the Highlands covered with forest. The semi-arid lowlands of the east, southeast and south support a cover of Acacia-Commiphora woodland and shrubland. Increasingly these Lowlands are the source of fuelwood and charcoal for the highlands. In the wetter western lowlands this is replaced by Combretum-Terminalia woodland, with extensive areas of Lowland Bamboo (*Oxytenanthera abyssinica*).

In the Highlands severe population pressure, poor cultivation practices, steep lands and overgrazing by livestock has led to accelerated soil erosion that now affects more than 50 percent of the cultivated area. Some 95 percent of the cultivated area is farmed by smallholder farmers with average holdings of less than 2 hectares. In many areas an increasing proportion of the rural population have no land. With frequent droughts, each year more than 6 million people require food assistance.

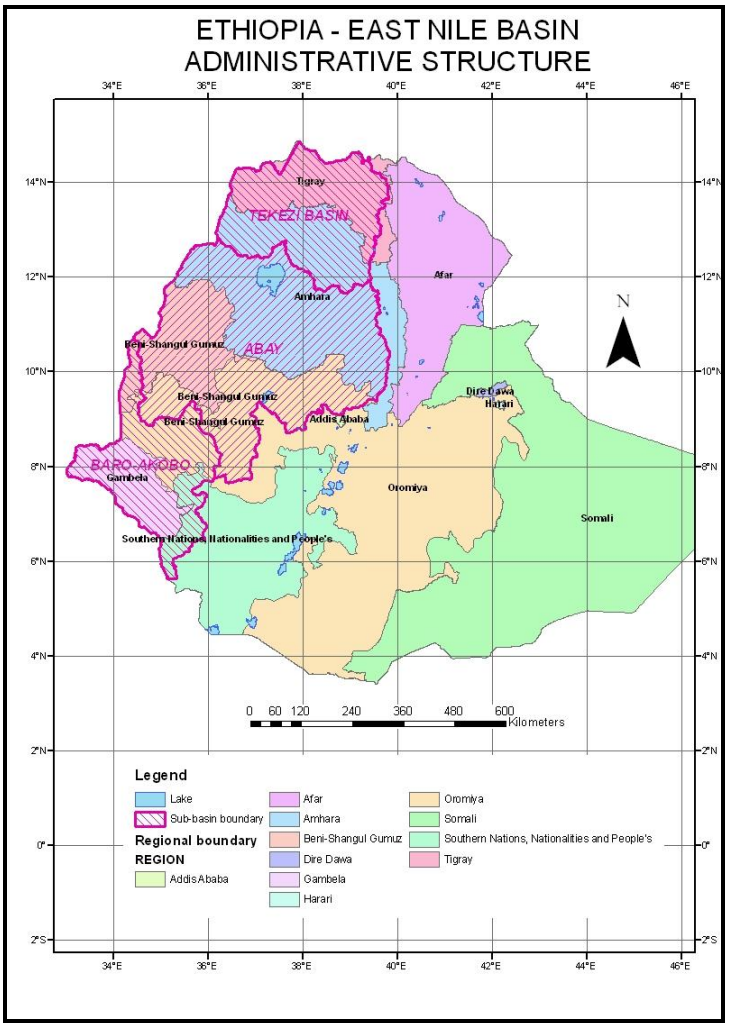
The household energy requirements of this large and fast growing population are supplied almost entirely from traditional energy sources. Biomass energy at the national level provides more than 96.9 percent of the total domestic energy

[2] "Highlands" in Ethiopia is land over 1,500 meters above sea level.

consumption: 78 percent from woody biomass, 8 percent from crop residues, and 11 percent from animal dung. Modern energy provides only 3.1 percent of energy consumption. This has serious implications for the natural resource base. Because of the scarcity of fuelwood many households burn dung and crop residues. The use of dung precludes its contribution of the soil nutrient pool, exacerbating declining crop yields due to soil erosion. The burning of crop residues precludes their use as livestock feed for a livestock population barely meeting its energy requirements for maintenance.

2.2 Administrative Structure

In 1991 Ethiopia adopted a federal structure of government with 9 Regional States, the City Administration of Addis Ababa and the Dire Dawa Administrative Council (see map 3).



Map 3. Ethiopia: Administrative Structure and East Nile Sub-basins

Many fiscal and administrative powers of the central government were devolved to the Regions. Within the Baro-Akobo, Abay and Tekezi River Basins there are six Regional States:

- Tigray
- Amhara
- Beneshangul-Gumuz
- Oromiya
- Southern Nations, Nationalities and Peoples (SNNP)
- Gambela

Within each Region there is a three tiered structure of Government:
- Region
- Wereda
- Rural Farmers Association (Kebele)

In Oromiya and SNNP Regions there is a fourth tier - the Zone. The area of the Farmers Association may be sub-divided into smaller areas for the administration of natural resources (e.g. Development Team).

The ministries at the federal level are generally mirrored at the Regional level and to a lesser extent at the woreda level. Ministries at Regional are referred to as "Bureaus" and Wereda levels to "Offices". The most relevant ministries/bureaus for watershed management include:

- Agriculture and Rural Development
- Water Resources
- Finance and Economic Planning
- Federal Environmental Protection Authority and Regional Environmental Protection, Land Administration and Use Authorities
- National Disaster Prevention and Preparedness Commission and Regional Food Security Programme Coordination and Disaster Prevention Offices

2.3 National and Regional Policy Framework

2.3.1 Introduction

A substantial body of policies and policy instruments are already in place with a direct or potential bearing on natural resource management and watershed management. In general, these have been adopted at the regional level.

The main policies and proclamations are:

- Conservation Strategy of Ethiopia (CSE) (1997)

- Agricultural Development Led Industrialisation (ADLI) (1992)
- Ethiopian Water Resources Management Policy (1999)
- Subscription to the Millennium Development Goals (2000)
- Sustainable Development and Poverty Reduction Programme (SDPRP) (2002)
- Food Security Strategy (2002)
- New Coalition for Food Security Programme (2004)
- Rural Development Policy and Strategies (2003)
- Productive Safety Net Programme – Programme Implementation Manual (2009)
- Plan for Accelerated and Sustainable Development to End Poverty (2005) more recently superseded by the National Growth and Transformation Programme (2009)
- Water resources policies and legislation
- Environmental Policy and legislation
- Rural Land Administration and Land Use Proclamations

2.3.2 Conservation Strategy of Ethiopia

The Conservation Strategy of Ethiopia (CSE), formulated in 1995, is at the basis of all environmental efforts and considerations in subsequent policies.

The CSE documentation consists of five volumes: Vol. I the Natural Resource Base; Vol. II Policy and Strategy; Vol. III Institutional Framework; Vol. IV the Action Plan and Vol. V Compilation of Investment Programmes.

The Environmental Policy of Ethiopia has emanated from Vol. II of the Conservation Strategy and was approved by the Council of Ministers of the Federal Democratic Republic of Ethiopia on April 2, 1997.

2.3.3 Agricultural Development Led Industrialisation (ADLI)

ADLI, i.e. using agricultural development as an engine for economic diversification and industrialization is still the government's core policy for rural development as well as overall economic development. Implementation of this policy has focussed on provision of agricultural inputs. Although agricultural production has increased in certain areas, increases in overall agricultural production at the national level are very limited. The modest expansion in the volume of real agricultural output over 1992-2002 was driven by policy measures – liberalization of input and output markets leading to increased use of inputs (fertilizer, and to a lesser extent improved seeds) and expansion of cultivated areas. As a result, yields have slightly improved on average although this masks diverging trends in favourable and less favourable areas. The increased

utilization of fertilizers and improved seeds has allowed turning some areas previously in food deficit into food exporters. This was achieved by activist policies in the context of the ambitious agricultural extension programme.

After initial success, the effect of ADLI seemed to stagnate, and has increasingly became the subject of debate. Questions raised are not only related to the way ADLI is implemented, but whether the theoretical basis of ADLI is correct. Central in the debate is the current strong focus on the supply side and the relative neglect of the demand side. It is now increasingly recognized in policy debates in the country that an efficient, low-cost, agricultural marketing system is required in order to close the national food security gap and increase per capita income. In addition, it is considered that there is need for structural change in the agricultural sector towards a more export market orientation that can only be achieved with reducing transport costs to world markets.

2.3.4 Millennium Development Goals (2000)

The document on a needs assessment related to the Millennium Development Goals (Millennium Development Goals Need Assessment: The Rural Development and Food Security Sector in Ethiopia – 2004), mentions important interventions for the period 2005-2015 to respond to the MDG, and focuses on:

- integration of environmental management in the implementation of Rural Development and Food Security programmes (environmental laws, EIA)

- watershed-based natural resource management for sustainable development and mitigation of resource degradation (proper land use, soil conservation, water/forest resource management, irrigation, biodiversity conservation).

2.3.5 Sustainable Development and Poverty Reduction Strategy (2002)

The Ethiopian Sustainable Development and Poverty Reduction Strategy (SDPRS) also focuses on agriculture centred rural development in order to achieve:

- rapid overall development
- liberation from dependency
- promotion of a market economy

It explicitly builds on ADLI by mentioning “an overriding and intentional focus on agriculture as a potential source to generate primary surplus to fuel the growth of other sectors of the economy (industry)” as one of its main thrusts.

Other broad thrusts are:

- Strengthening private sector growth and development especially in industry as means of achieving off-farm employment and output growth (including investment in necessary infrastructure),
- Rapid export growth through production of high value agricultural products,
- Undertake major investment in education and capacity building to overcome critical constraints to implementation of development programs,
- Deepen and strengthen the decentralization process to shift decision-making closer to the grass root population, to improve responsiveness and service delivery,
- Agricultural research, water harvesting and small scale irrigation,
- Focus on increased water resource utilization to ensure food security.

Some of the proposed measures in the agricultural sector are:

- Introduce menu based extension packages to enhance farmers choice of technologies,
- Expand borrowers' coverage of micro-financing institutions,
- Establish an institute for diploma-level training of extension agents and expand agricultural Technical Vocational Education Training (TVET),
- Measures for the improved functioning of markets for agricultural inputs (fertilizer, seed) and outputs,
- Organize, strengthen and diversify autonomous cooperatives to provide better marketing services and serve as bridges between small farmers (peasants) and the non-peasant private sector.

The number of farming households to be covered by the Extension Package Program is expected to increase from the current 4 million (2000/01) to 6 million by the end of the program period.

With regard to food security, the SDPRS takes into account a transition period where there will be continued reliance on food aid. The SDPRS is subscribing the concept of linking relief (*read: food aid*) with development as it has been applied since the late 1980s and is stating that "Various activities of environmental protection such as soil and water conservation, terracing and afforestation carried out over the years have shown positive results, and will be improved and continued in the future."

The latter statement has to be treated with care as it may have an important unwanted bearing on implementation modules in watershed management in which SWC and afforestation are key components. New initiatives of watershed management such those as within the framework of the ENSAP should be more critical with regard to the almost automatic connection between SLM, watershed

protection activities and food aid. It is particularly in the field of SWC where food aid has had some negative impacts on planning and effectiveness of implementation, and its disconnection need to be sought very seriously. A more detailed discussion on this subject is given in chapter 9.

2.3.6 Food security strategy (2002)

The Food security strategy equally underlines the importance of sustainable use and management of natural resources, mentioning more or less the same fields of attention as the SDPRS.

2.3.7 New Coalition for Food Security Programme (2003)

The New Coalition for Food Security Programme document outlines what it considers as the main causes of land degradation, which are actually symptoms of improper management of natural resources: a) cultivation of steep slopes, without conservation practices, poor, nutrient mining farming practices and b) using crop residues and dung for household energy instead of for ameliorating soil fertility c) biodiversity losses due to land degradation and deforestation.

The document suggests participatory watershed management planning as supportive of food security interventions.

2.3.8 Plan for Accelerated and Sustainable Development to End Poverty (2005)

The Plan for Accelerated and Sustainable Development to End Poverty (PASDEP) represents the second phase of the PRSP process (2005-2010) that began under SDPRP. PASDEP pursues initiatives under SDPRP and ADLI but with important enhancements to capture the private initiative of farmers and support the shift to diversification and commercialization of agriculture. It is realized in PASDEP that, “parallel to this shift to commercialized agriculture, improvement of pro-poor subsistence farming still needs to take place as the main welfare improvement for several million households still depends on achieving higher yields of basic food grains.

This second main orientation will be pursued through a combination of intensified extension support at the kebele level, establishment of a network of demonstration centres, increased low-level veterinary services, support for small-scale irrigation, better use of ground water, complemented by productive safety net and off-farm income generating initiatives supported under the Food Security Program. Both approaches need to be pursued with measures to manage the natural resource base and protect the environment.”

PASDEP distinguishes between the three main economic and agro-climatic zones: the traditionally settled semi-arid/sub-humid highlands, the potentially productive semi-tropical valley areas, and the hot semi-arid lowlands. This particularly applies to agriculture but also to the private sector development agenda. Instruments are infrastructural improvement (roads, telecommunication, electric power supply), strengthening of financial and administrative development capacity, and control of malaria and tsetse and special efforts for pastoral areas in the lowlands.

Watershed management related elements are mentioned under the sectors water management and irrigation (water harvesting) and crop production (water harvesting, soil and water conservation).

2.3.9 Federal Policy on Rural Development

The federal Rural Development Policy promotes, among others:

- intensification in high rainfall areas,
- livestock improvement and water resource development and marketing facilities in pastoral areas,
- irrigation and overall development of basic facilities/infrastructure in the western lowlands,
- water harvesting and land conversion in drought prone areas,
- livestock improvement through improved breeds and technology.

In its rural development policy it proposes voluntary resettlement programmes to alleviate land shortages as well as helping to develop hitherto uncultivated lands. The Strategic Policy Memorandum (SPM) of the Oromiya Bureau of Agricultural also assumes in the near future movement of people from degraded subsistence areas.

The Rural Development Policy promotes replacement, where possible, of food aid by financial support (Cash-for-work instead of food-for-work). In cases where food aid is to be preferred, food should be purchased from local sources.

Livestock improvement is to be sought through improved breeds and technology and technologies are to be disseminated through training centres for DA's.

Apart from the integrated rural development and agricultural development aspects, also covered in the SDPRS, the Rural Development Strategy also pays attention to the land tenure issue and the proper use of land. Important changes such as the moratorium on land re-distribution and the distribution of land

certificates are given a legal basis in a number of federal and regional proclamations.

Protecting user rights of the farmer definitely mitigates an important facet of the problem of tenure security, but does not solve the problem of non-availability of land for young farmers. This will be addressed by improving land use and productivity as well as employing technologies that use more labour resources and thus creating on farm job opportunities. Several measures are already successfully applied to this regard. Gully stabilization and plantation followed by allocation to landless youth is one example; rights of landless people to exploit rehabilitated hill slopes (after hillside closure and/or plantation) are another example. In the long-term, accelerated economic development should hold out the promise of increased job opportunities to the landless.

The more recent Main Report of the **National Livestock Development Project** – NLDP (1999-2003) confirms the pressure on land and forage resources by stating that, at a national scale, natural pastures in the mixed highland farming areas are taken over for cropping and crop residues (7-8 % at a national scale) and agro-industrial by-products are becoming major sources of feed although not adequately used. In these circumstances, the cultivation of fodder crops and forages becomes a serious option for increasing feed resources. Tremendous opportunities are reported for introducing forages into the cropping system through undersowing, intercropping and the use of leguminous shrubs as backyard hedges. The NLDP report further confirms that the need to intensify and integrate livestock production into more profitable farming systems is central to environmentally sustainable land use.

The NLDP project area touches parts of the ENB in ANRS, TNRS as well as in ORNS. It focuses on upgrading genetic resources, improved animal health and increased forage production. The latter is, among others, concerned with forage development in smallholder fattening and dairy production systems, development of local capacity for perennial legume seed production by small holder contract system. It is estimated that forage development may give a net benefit of ETB 6,000/ha (US$ 690/ha).

2.3.10 Productive Safety Net Programme – Programme Implementation Manual

The change from subsistence farming to a more diversified economy can only be made if the Government guarantees a safety net to farmers. Recently, a country-wide safety net programme has been prepared with the help of the World Bank. Distribution of food aid should be minimised as much as possible, and be replaced with cash aid, in order not to distort food cereal prices, which inhibits investments in agriculture and maintains low agricultural productivity. Many activities of natural resource management and watershed treatment (soil and water conservation, water harvesting, construction of feeder roads) are now

financed through the Safety Net Programme. Reportedly, the programme is more or less replacing the previous Employment Generation Schemes (EGS).

2.3.11 Rural Land Administration and Land Use Proclamations

Several federal and regional proclamations have been issued, among which:

- Federal Rural Land Administration Proclamation (No 89/1997)
- Federal Rural Land Administration and Land Use Proclamation (No 456/2005)
- Amharic Proclamation issued to determine the Administration and Use of the Rural Land (No. 46/2000)

The federal proclamation focuses on tasks of land management to be taken up by the regions. All proclamations (federal and regional) describe the rights and obligations of users of rural land, including traditional subsistence farmers, and in the more recent proclamations, also of private commercial farmers.

A breakthrough in land use rights has started in ANRS, where the proclamation stipulates that

- “a book of ownership shall be prepared by the relevant organ”,
- “peasants (individual or in communal holding) have the obligation to have a book of ownership”,
- “redistribution of land shall not be effective unless otherwise the land distribution does not affect the productive capacity, requested by the community, supported by the study and decided by law”.

The recent (2005) federal proclamation demonstrates the government’s concern about land degradation and its commitment to combating the problem. Most importantly in the current context, it defines obligations of rural land users, and land use restrictions. Thus, protection of land becomes an obligation and failure to protect can lead to loss of title. Free grazing in areas with SWC is prohibited and appropriate SWC measures are required for all lands of <30% slope. Cultivation on slopes of 31-60% slope requires bench terraces. Closure of degraded lands, and compensation for prior users is provided for. A minimum holding size is referred to, but is to be determined by the Regions.

In principle, the proclamation is a positive move; the possibility to enforce it in practice is yet to be seen. Some rules for proper use of land are defined in a simplified but yet rather rigid way. For example, the rule that “degraded lands of any slope shall be closed from human and animal interference” would preclude future exploitation on a more sustainable basis (cut and carry). Others are very general and need further specification, e.g. “users should protect and develop the productive capacity, biodiversity in rural wetlands shall be conserved”.

2.3.12 Ethiopian Water Resources Management Policy (1999)

The overall goals of the national water resources management policy of Ethiopia is to enhance and promote efforts towards an efficient, equitable, and optimum utilization of the available water resources and contribute to the country's socioeconomic development on sustainable basis.

The Water Resources Management Policy includes a Water Sector Strategy, which covers certain elements of watershed management under its different components:

- under Water Resources Development: water harvesting
- under Water Resource management: soil and water conservation measures to reduce soil erosion and reservoir siltation; local community participation in watershed management and water conservation measures and practices; a recognition of wetlands as a key feature in watershed management.

2.3.13 Water Resources Management Laws

(i) The National Proclamation on Water Resources Management (2002)

The basic thrust of this proclamation is that water resources management and administration in the country should be based on the National Water Policy, the Integrated River Basin Master Plan Studies (IRBMPs) and the Water Resources Laws of the country. MoWR is clearly identified as 'supervising body' in charge of enforcing the provisions of the proclamation. It is entrusted with broad powers of 'planning, management, utilisation administration and protection of water resources'.

Among MoWR's duties are inventory of water resources, allocation of water resources, establishing standards for design and construction of waterworks, issuing guidelines and directives for the prevention of pollution of water resources as well as for water quality and health standards, establishing water users' associations, and settlement of disputes. Details of most of the provisions of the Proclamation are expected to be provided in Regulations to be issued in the future. Issues that still need to be tackled are e.g. the integrated cross-sectoral approach to water resources management including environment, agriculture, economic activities at large, health, legal and planning considerations, as well as a specific participation of water users. This is a necessary step towards 'integration' in WRM.

(ii) Water Resources Management Regulations (2004)

The regulations contains a further elaboration of the Proclamation providing in detail the main requirements for the issuance of permits for different uses of water and the conditions for the issuance, as well as the level of water charge and procedure for licensing water operators.

(iii) Regional Water Resources Management Policies and Laws

In 2002, the Oromiya Regional State has issued a Regional water resources policy. A draft regulation for the management of water resources has also already been prepared by that Region. By and large, both the water resources policy and draft regulations for water resources management of the Oromiya Regional State are in line and similar in their content to those issued by the Federal Government.

2.3.14 Environmental laws

Environmental issues are given more and more emphasis in Ethiopia, with the recent development of a set of laws, following up on several new policies and strategies (such as the National Conservation Strategy and the SDPRP). The Ethiopian Environmental Protection Authority (EPA) has drafted three major laws regarding Environmental Pollution Control, Environmental Impact Assessment and Establishment of Environmental Protection Organs.

Although quite general, these laws, and particularly the “Environmental Pollution Control Proclamation” specifies clearly the function of law enforcement of the EPA and the Regional environmental agencies, in charge of taking administrative or legal measures against violations.

These laws are concerned mainly with pollution, and broader issues such as watershed management are not addressed yet. The need for a more integrated legal framework in line with IWRM or sustainable use of natural resources is noticeable.

According to the 2005 PASDEP document, EPA has now also developed EIA guidelines for agriculture, mining, industry, and road construction. It has assisted all regions to establish a regional EPA.

A key issue is how to get some action on the ground by agencies at the wereda level using a collaborative and not a "legal enforcement" approach.

2.5 Overview of Situation and Issues

The country’s population is currently approximately 64 million. The rate of population growth is expected to decline from 3 to close to 2 percent per annum

by 2030, when the country's population will reach between 120 to 130million people. Some 85 percent reside in the rural areas and most are dependent on agriculture or pastoralism for their livelihoods (Alemneh Dejene, 2003).

The high seasonality of rainfall over the Ethiopian Highlands, which is confined to a period of three to five months results in commensurate seasonality in river flows. The peak flows are able to transport very high sediment loads during these periods and lead to the high sedimentation rates in Sudan and Egypt.

The highlands of the Abbay River Basin contain many areas with structural food deficits which suffer frequent reductions in crop production due to low rainfall. The key issues are soil degradation, livestock feed deficits, fuelwood wood consumption rates in excess of sustainable yield, burning of dung and accelerated soil nutrient breaches and poor non-farm employment opportunities (Hagos, Pender and Gebreselassie, 1999). Nevertheless, in recent years the uptake of soil and water conservation measures has been impressive and in many areas of Tigray the rate of adoption exceeds 40 percent of farmers[3]. This has been mainly due to the visible impacts of the increase in soil-water conservation, risk reduction and significant crop yield increases. Communal grazing land management systems are in place in 80 percent of the villages. On-farm tree planting however lags behind that in the Amhara Region, possibly due to a ban on tree planting in croplands.

The proximate causes of infield soil erosion are reasonably well known although the science of the linkages between erosion and deposition in the landscape, sediment delivery to streams and total sediment yields with increasing basin size is less certain. An understanding of the underlying causes is still imperfectly understood, notwithstanding the impressive amount of research work undertaken over the past decade, particularly with the African Highlands Initiative (Pender, 2005). Underlying many of these is the almost total dependence on the natural resource base by the rural population. The results of research to-date may be briefly summarized as:

- The profitability of land management technologies is very important, though not the only factor influencing adoption or non-adoption.

- ++Risk is also a very important consideration. Profitability becomes more important for technologies that are risk increasing (e.g. chemical fertilizer) than those that are risk reducing (SWC investments in moisture stressed areas).

- In the context of imperfect markets and institutions the suitability and feasibility of land management interventions in different

[3] See figure 3 "Terracing in the Ethiopian Highlands", in Mahmud Yesuf & J. Pender "Determinants and Impacts of land management Technologies in the Ethiopian Highlands: A Literature Review - Draft", EEPFE and IFPRI.

locations and farmer circumstances are very context dependant making generalisations difficult. The numerous potential factors include: agro-ecological conditions; nature of the technology; land tenure relations; household endowments of natural, human, social and financial assets. Better market access appears to be associated with less SWC investment but more use of fertilizer.

- Land tenure insecurity and limited transfer rights appear to discourage land management investments, but the results are mixed. It appears to have less impact on the adoption of inputs (e.g. fertilizer) than long-term investments (e.g. SWC structures).

- The impact of the degree and type of household livelihood assets on investment decisions is mixed.

- The Malthusian argument of the negative impacts caused increasing population pressure, and Boserup argument for population induced agricultural intensification may both be correct in the Ethiopian situation. Farmers do respond to population pressure with intensified production, but this may not be sufficient to prevent resource degradation and increasing poverty. In this respect, Ethiopia compares poorly with the situation in Machakos, Kenya described by Tiffen et al (1994).

3. JITA (UPPER BESHLO) SUB-BASIN - BIOPHYSICAL AND SOCIO-ECONOMIC SITUATION

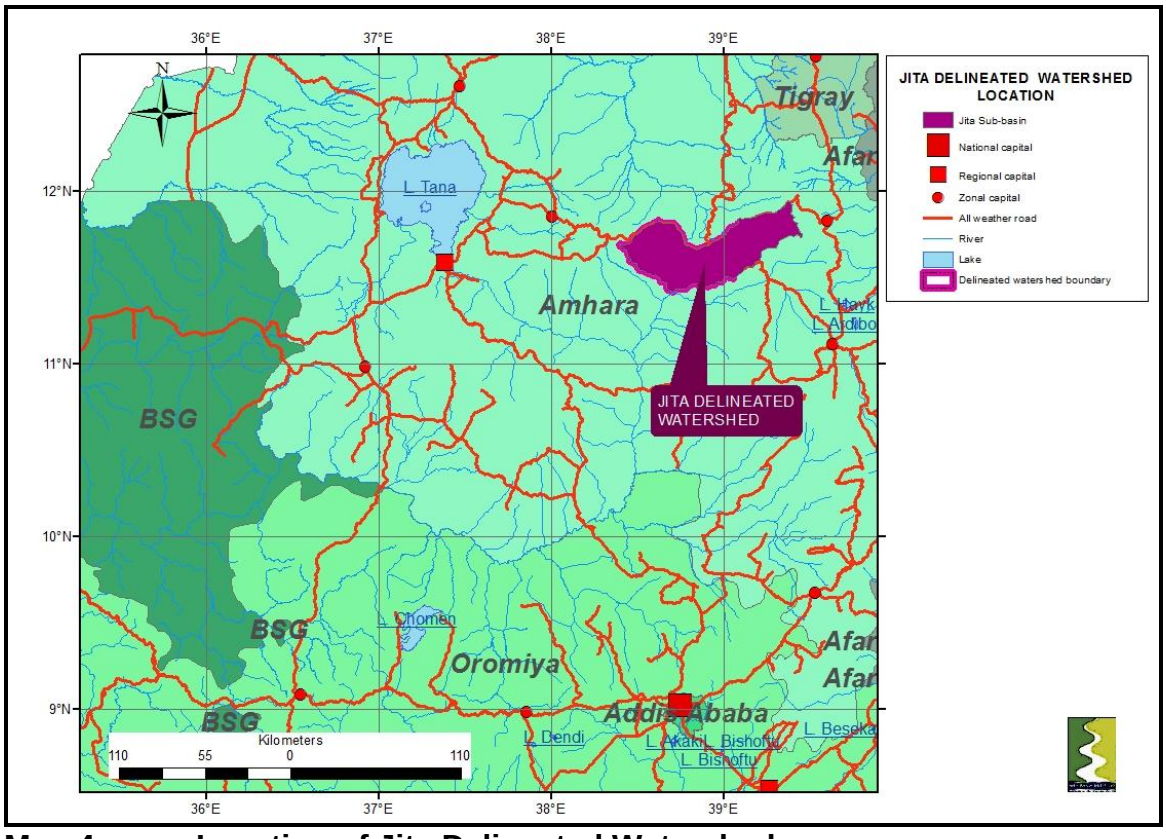
3.1 Delineation of the Sub-basin by Stakeholders

A Field Visit wa undertaken in November 2012 to delineated exactly the Watershed for Watershed Management activities under the Project (persons contacted are listed in Appendix 1). The delineated Watershed comprised the Watershed.

3.2 Biophysical Characteristics

3.2.1 Location and Extent

The Jita delineated Watershed is located in the southern part of the Abbay Sub-basin (See Map 5. The area of the Sub-basin is 2,915km2. It is sub-divided into two Watersheds: Shodeb and Jita.

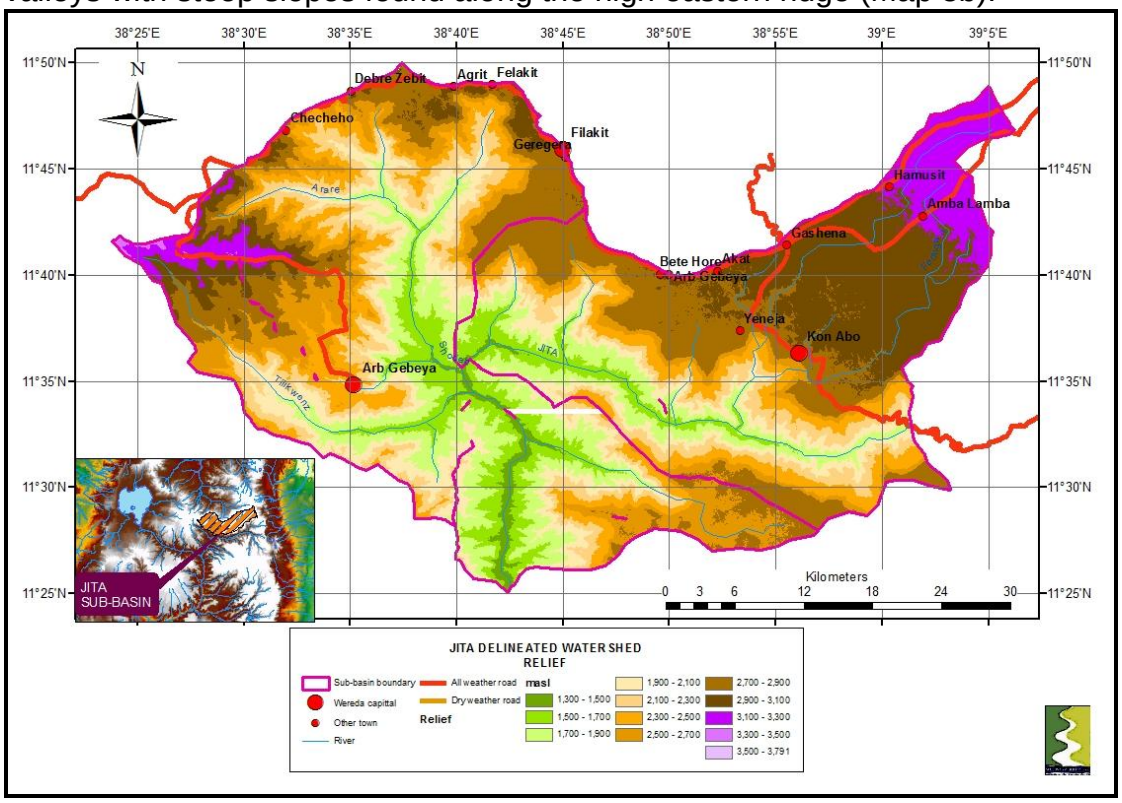


Map 4. Location of Jita Delineated Watershed

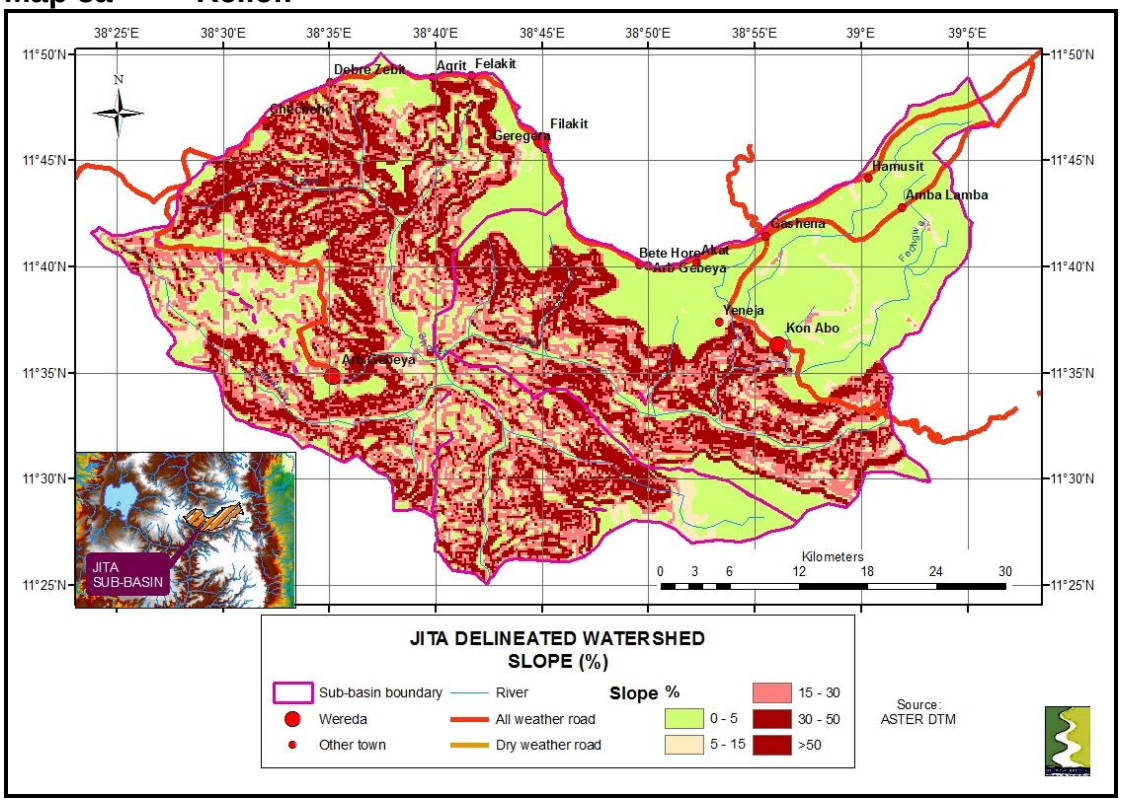
3.1.2 Relief and Drainage

The relief comprises a broad deeply dissected plateau with a ridge of high ground along the eastern and western borders of the sub-basin. The rivers are

deeply incised to 1,300masl (Map 5a). Steep slopes characterize the incised valleys with steep slopes found along the high eastern ridge (Map 5b).



Map 5a Relief.

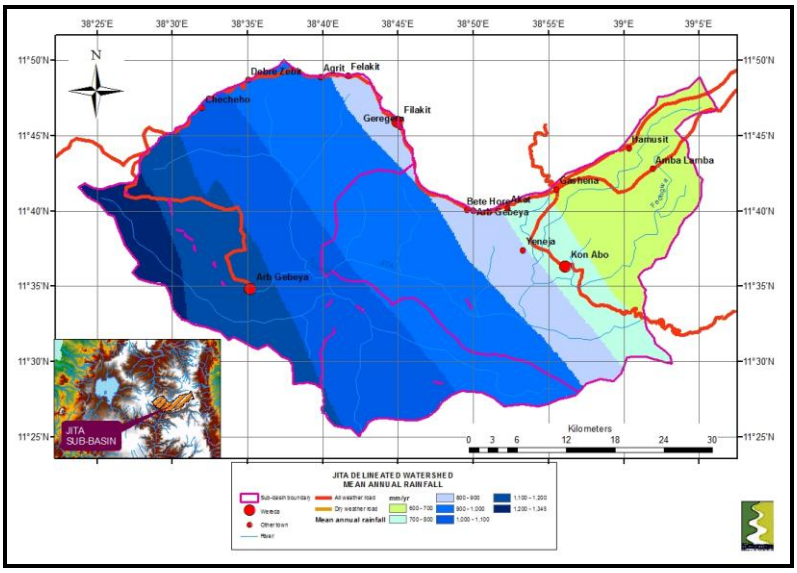


Map 5b. Slope (%)

3.1.2 Climate

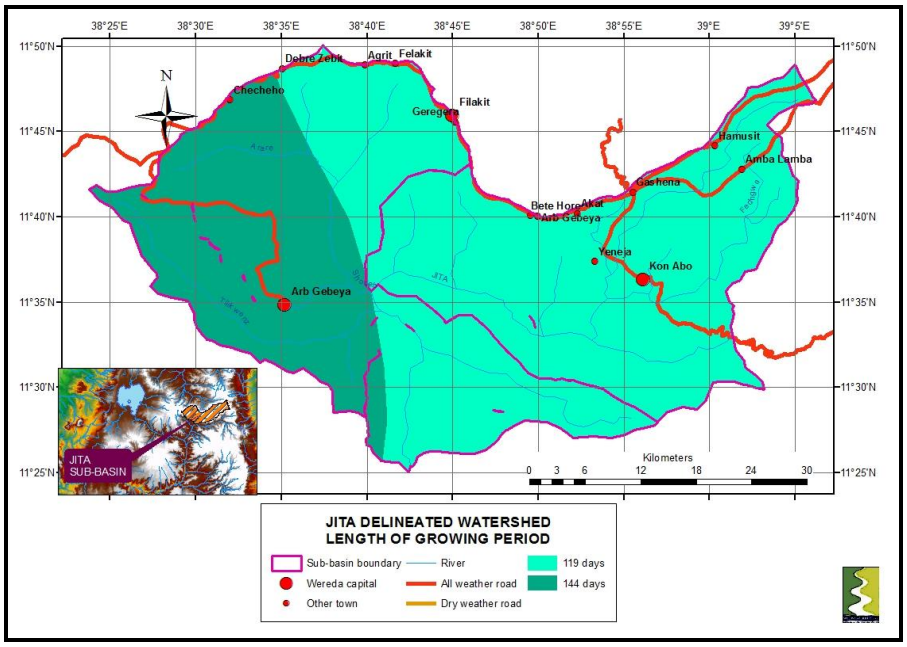
(I) Rainfall and Length of Growing Period

Mean annual rainfall over the Sub-basin (Map 6a) is closely related to altitude. The highest rainfall located on the western side of the Sub-basin (900 – 1,300 mm/yr) with the lowest rainfall located in the central part over the plateau (600 to 900mm/yr). This rises again towards the eastern boundary to 1,000mm/yr. The rainfall pattern is bi-modal along the eastern side of the sub-basin, with the short rains (belg) during March-April and the main rains (kerempt) from July to September. To the west over the plateau and in the gorges the rainfall is uni-modal with the peak falling between July and September.



Map 6 (a) Mean annual rainfall

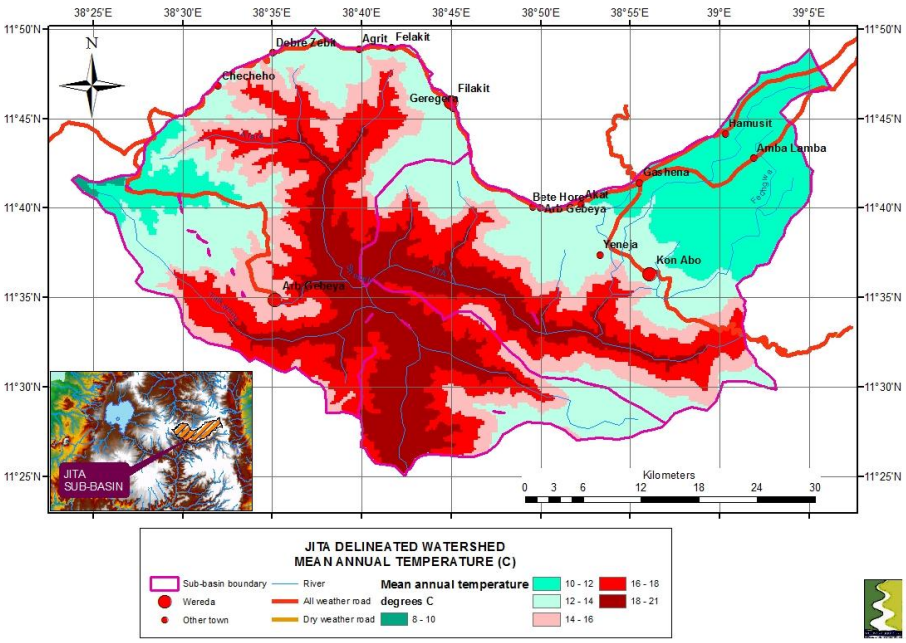
The dependable (4 years in 5) length of growing period is 119 along but increasing along the western boundary to 144 days (Map 6b).



Map 6(b) Length of Growing Period

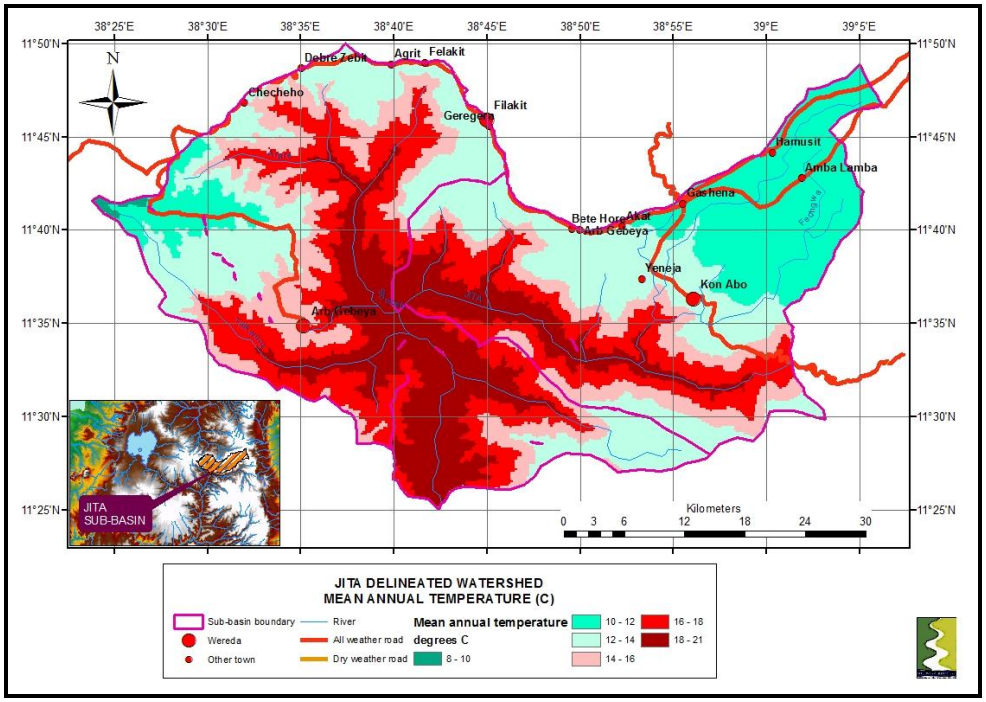
(ii) Mean annual temperature and Potential Evapo-transpiration

Mean annual temperature (Map 7(a)) is inversely related to altitude. Thus, the lowest temperatures (9 - 15°C) are found at highest altitudes on the watershed on the eastern ridge and the plateau. They rise to 22° C in the gorges.



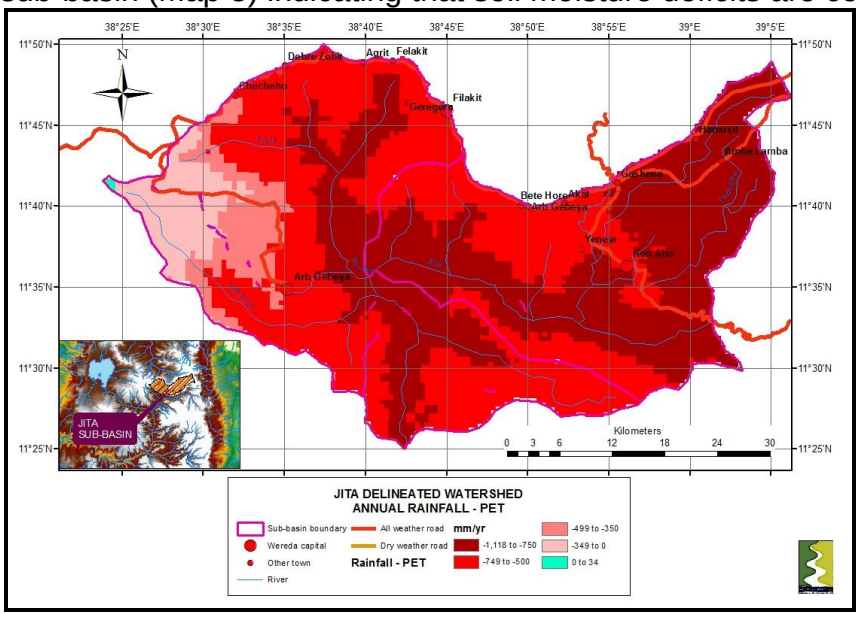
Map 7 (a) Mean annual temperature (C).

The pattern of mean annual evapotranspiration (Map 7 (b)) follows that of mean annual temperature and closely related to altitude with lowest rates on the watershed ridge and the plateau and the highest rates in the gorges.



Map 7 (b) Mean annual evapo-transpiration.

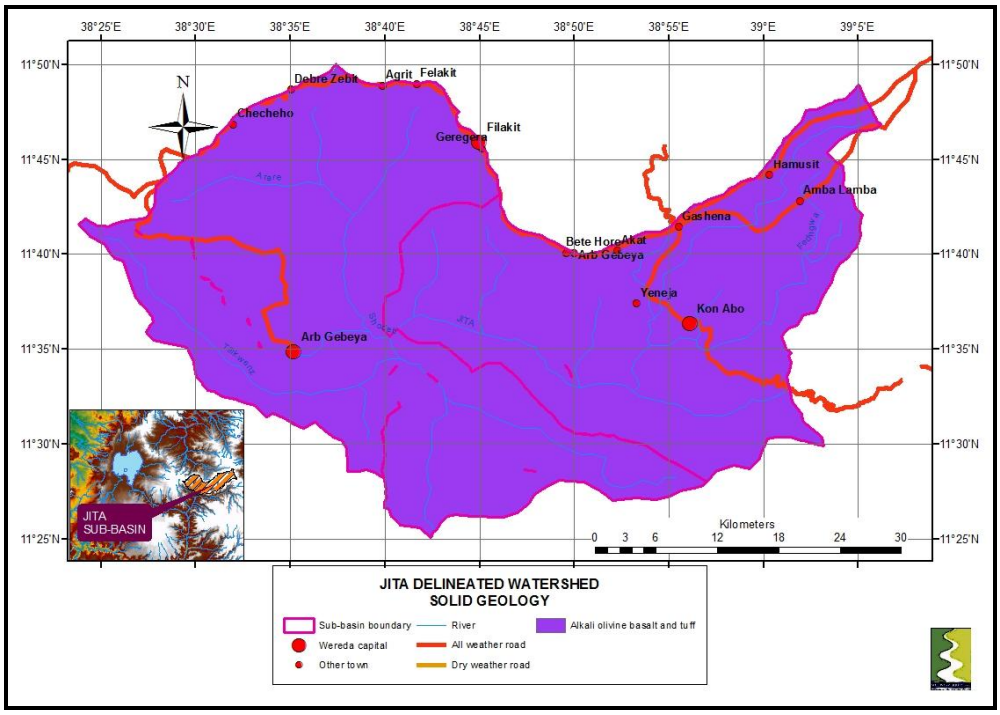
Whilst the annual rainfall levels are relatively low whilst the potential evapotranspiration (PET) rates are higher. Plotting mean annual rainfall minus annual PET indicates negative values over the plateau and in the gorges over the whole sub-basin (Map 8) indicating that soil moisture deficits are common.



Map 8. Mean annual rainfall minus Potential Evapo-transpiration

3.1.3 Geology

The watershed ridge is underlain everywhere by trap basalts (Map 9). The deepest gorges do not expose the underlying sandstones and limestones.



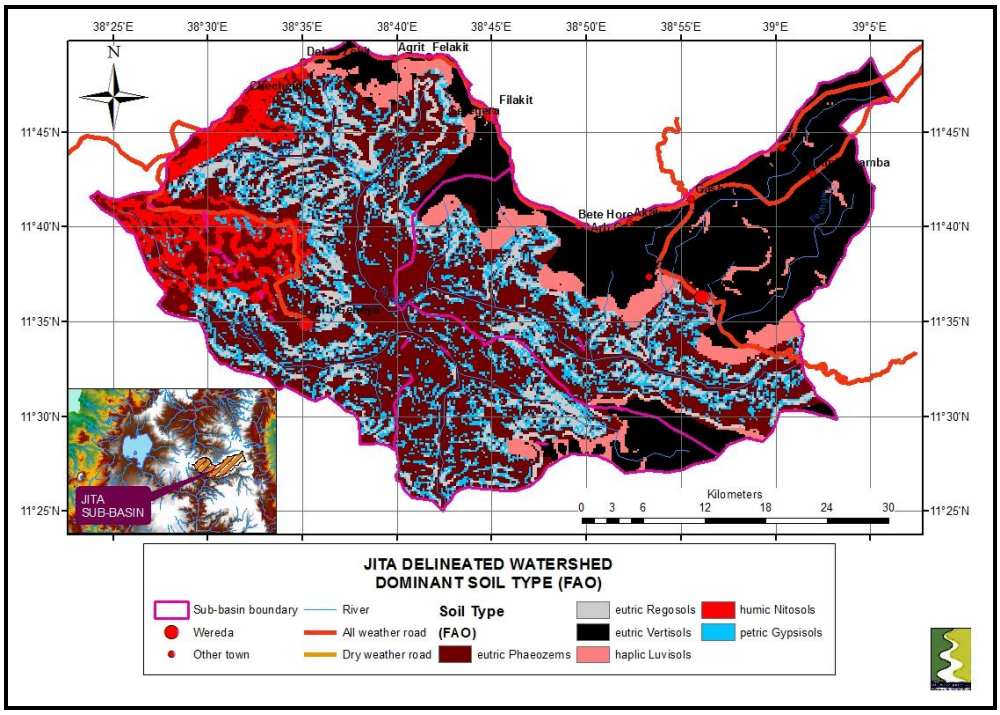
Map 9. Geology

3.1.4 Soils

Soils reflect the underlying geology and degree of slope (Map 8). On the plateau and the flatter areas in the gorge are extensive areas of Vertisols. Vertisols have a high clay content and thus the highest water holding capacity (150mm per meter), although they are difficult to work when dry. Their fertility is high although with a phosphorous deficiency.

On the eastern foothills and high ridge are Cambisols and Phaeozems, which are relatively deep moderately fertile soils.

Regosols (very stoney), lithosols (shallow and stony), Lixisols and petric Gypsisols are all found on the very steep slopes the scarp. On the less steep slopes of the lower gorge cambic Arenosols are found which are very sandy.



Map 10. Dominant Soils (FAO Classification)

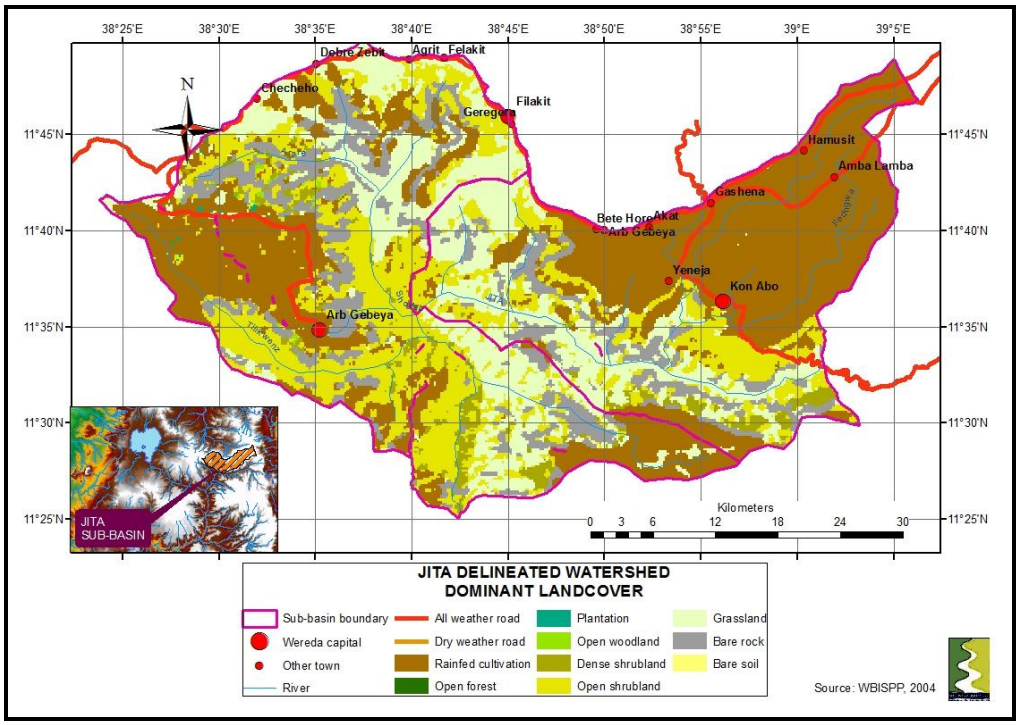
3.1.5 Land Cover / Land Use

The areas and percent of total area of the dominant landcover classes are shown in table 2 and their distribution in Map 11. The most widespread landcover is rainfed cultivation covering 53 percent of the Sub-basin with grassland, open shrubland and bare rock covering 18, 16 and 11 percent respectively.

Table 2. Jita Delineated Watershed: Dominant Landcover (km2)

Landcover	Area ()km2)	Area (%)
Rainfed cultivation	1,540	53%
Grassland	512	18%
Open shrubland	456	16%
Bare rock	328	11%
Dense shrubland	53	2%
TOTAL	**2,889**	

The rainfed cultivation is confined to the plateau areas with the grassland and woodland located in the gorges and on the high ridge along the eastern edge of the Sub-basin.



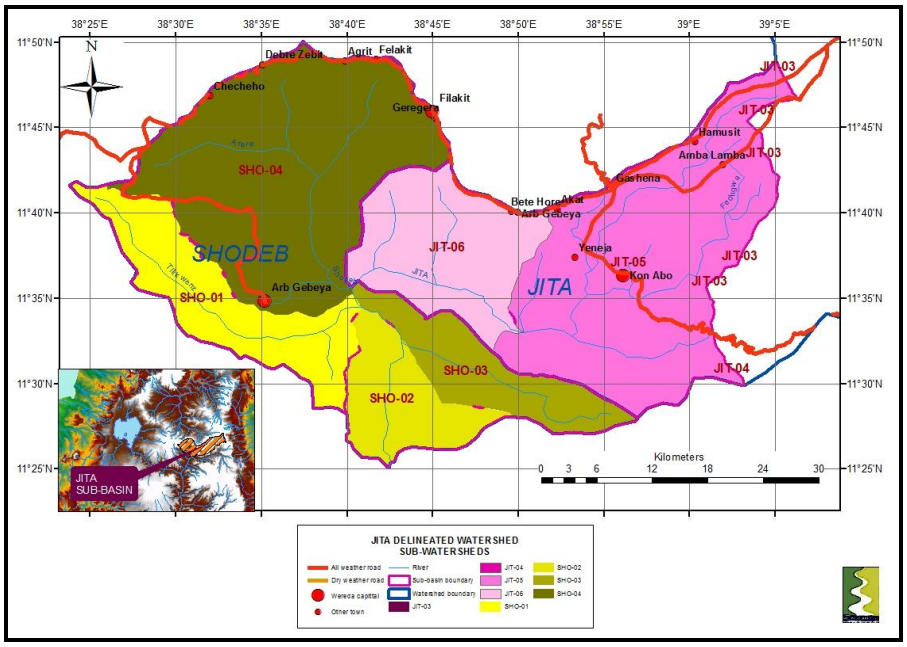
Map 9. Dominant Landcover

3.1.6 Water Resources

The watershed has been divided into two watersheds (Shodeb and Jita (Upper Beshlo)) and 10 Sub-watersheds (table 3, Map 10).

Watershed	Sub-watershed	Area (km2)
Shodeb	SHO-01	227
Shodeb	SHO-02	143
Shodeb	SHO-03	158
Shodeb	SHO-04	588
Sub-total		**1,116**
Jita	JIT-01	140
Jita	JIT-02	301
Jita	JIT-03	387
Jita	JIT-04	207
Jita	JIT-05	607
Jita	JIT-06	258
Sub-total		**1,900**
TOTAL		**3,016**

Table 3. Jita (Upper Beshlo) Sub-basin: Watersheds and Sub-watersheds



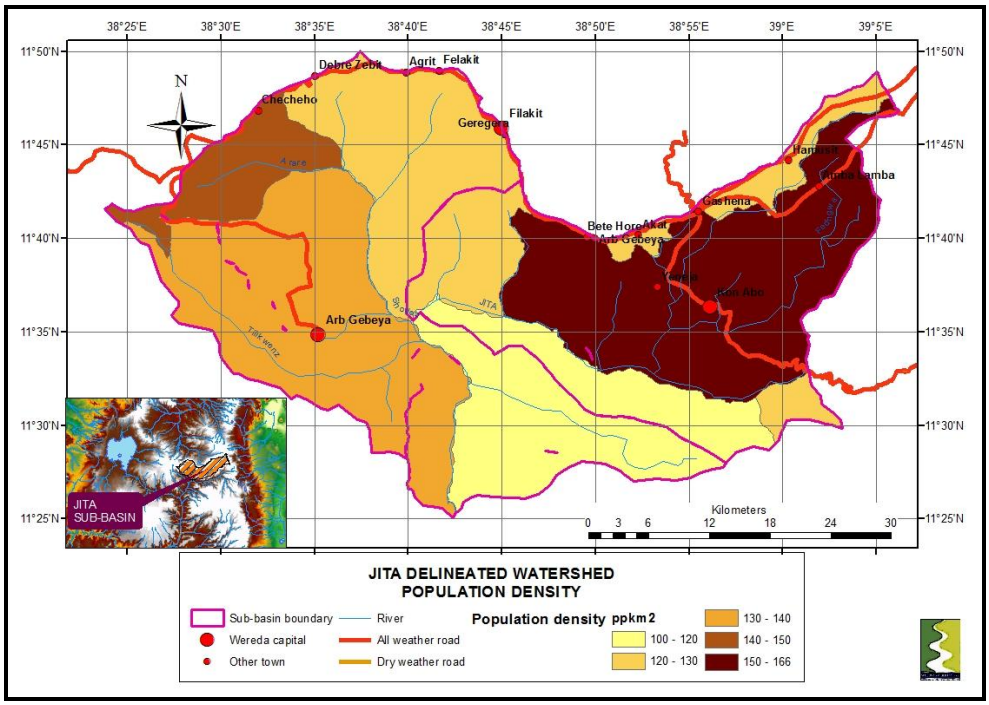
Map 10. Watersheds and Sub-watersheds

3.2 Population Distribution

The Sub-basin falls within (but not wholly within) 5 Woredas in the South Gonder and North Wollo Zones of Amhara Regional State. The 2007 rural populations (PCC, 2010) of these woredas are shown in table 3 and the spatial distribution in Map 11. The population and population densities refer to the complete woreda, whilst the area figure refers only to that part of the woreda within the Delineated Jita Watershed. Rural woreda densities range from 121 to 171 ppkm^2. Densities are highest on the plateau and watershed ridge.

Table 3. Total population, households, population density and household size within Jita (Upper Beshlo) Sub-basins.

Zone name	Woreda	Population (2007)	Density (ppkm2)	Area (km2)
South Gonder	Lay Gayint	236,265	155	1,522
South Gonder	Tach Gayint	116,646	141	825
North Wollo	Meket	260,159	136	1,909
North Wollo	Wadla	146,646	171	855
North Wollo	Delanta Wereda	146,950	139	1,057
North Wollo	Dawunt	74,499	121	618
TOTAL		**981,165**	**145**	**6,787**



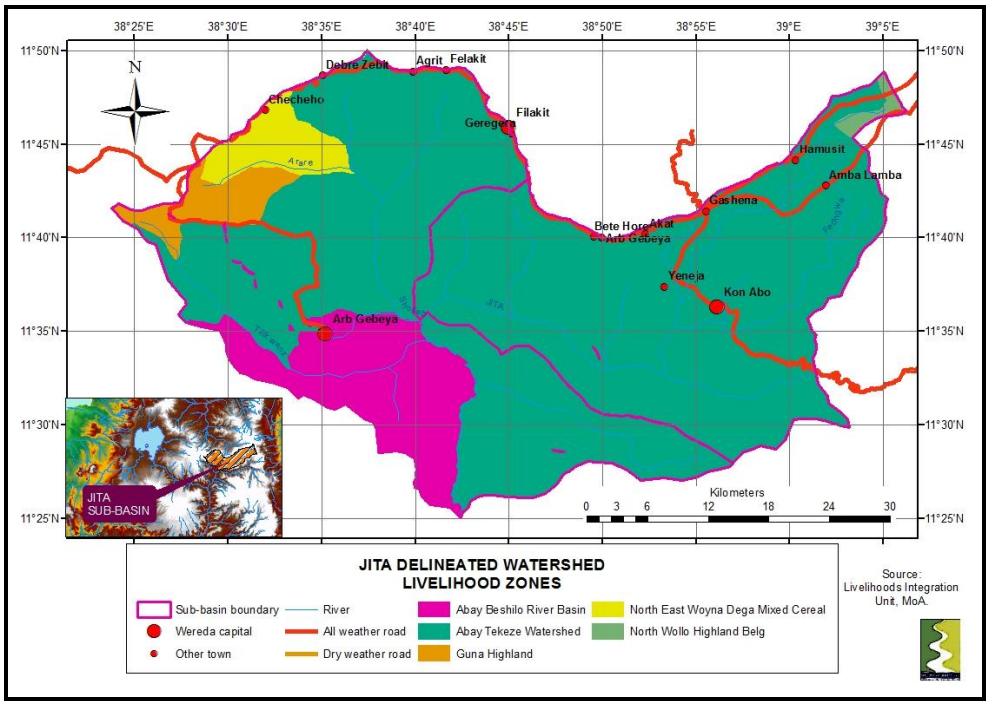
Map 11. Population Density and Distribution

3.3 Livelihood Zones (LZ)

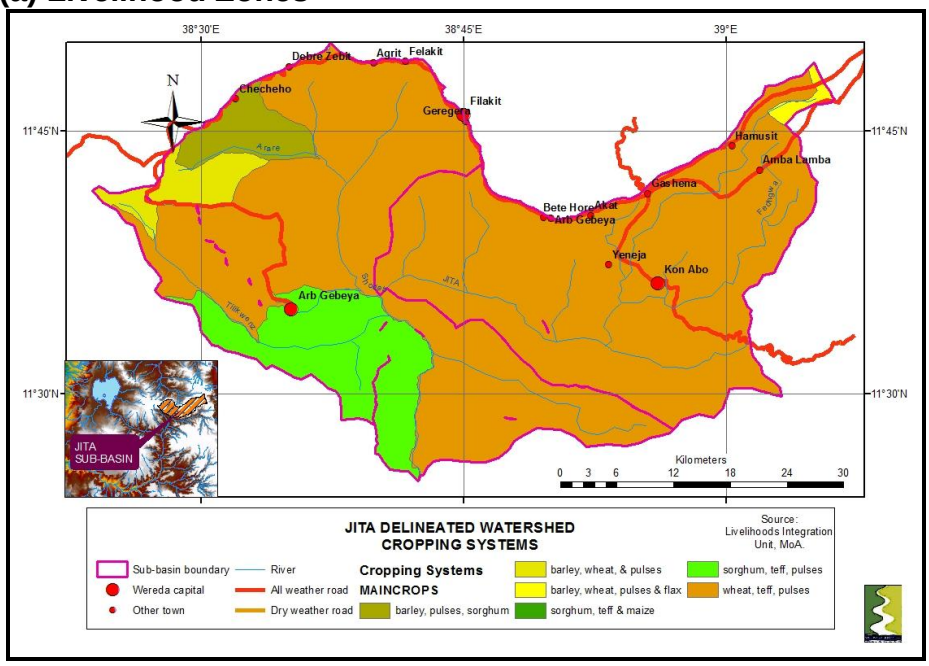
The Livelihoods Integration Unit (LIU) have identified five Livelihood Zones within the Jita (Upper Beshlo) Sub-basin. The Zones and major cropping systems are shown in Maps 12 (a) and 12 (b). The Zones are as follows:

- North Wollo Highland Belg Zone
- Abbay Tekeze Watershed Zone
- Abbay Beshilo River Basin Zone
- North East Woina Dega Zone
- Guna Highland Zone

They are detailed below.



Map 12(a) Livelihood Zones



Map 12 (b) Major Cropping Systems

3.3.1 North Wollo Highland Belg Livelihood Zone

The North Wollo Highland Belg Livelihood Zone covers the belg dependent highlands of Delanta, Dawint, Wadila and parts of Meket which share similar

agro-ecological setting, cultivation practices, cropping season and crops. The Livelihood Zone is an extensive high flat land traversed by River Jita forming two separate high flat lands-the Delanta Dawint plateau to the south of the River and the narrow and elongated high ground stretching from the highlands of Gubalafto in the east to the belg reliant areas of Meket woreda in the west.

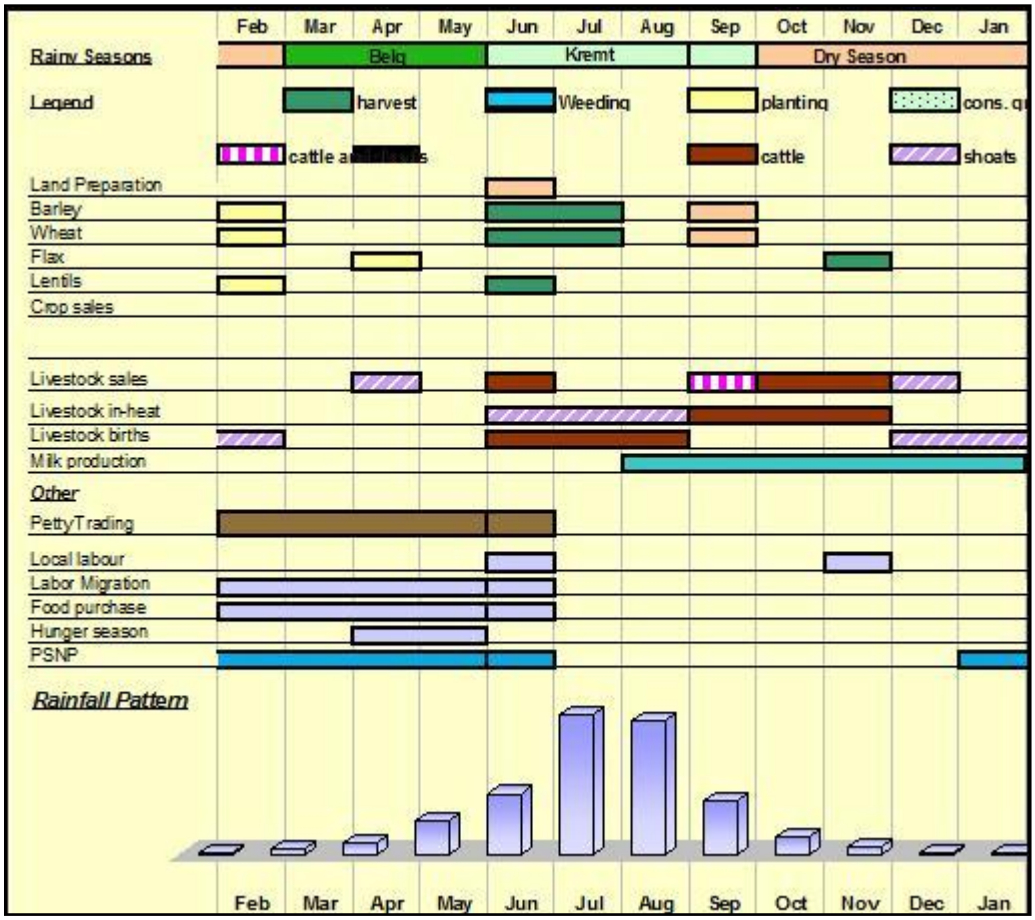
Crop production is entirely rainfed, except in small number of localities where the Ministry of Agriculture has recently introduced small scale water harvesting practices. There are two distinct rainy seasons-*belg* and *kremt*. However, the belg season is the most important one for the cultivation of both long and short cycle crops. Water logging in the kremt season and frost in October and November are the limiting factors for the cultivation of *meher* crops. In order of importance, the dominant crops of the Livelihood Zone are barley and wheat. Though in a slightly different environmental setting lentils and flax are cultivated in the Livelihood Zone. These crops are cultivated in the lower *dega* area, below the frost line, where the temperature is not as cold as the extreme dega areas.

Livestock in this zone include sheet, cattle and equines. These graze freely, better off households also purchase straw and hay from the poorer wealth groups, particularly in April and May. The middle and better-off wealth groups replace oxen from their herd, whilst the poor replace animals through purchase. Sheep are slaughtered during key holidays. Oxen are used for plowing; poorer households may also plough with horses. Safety net program exists in all the woredas in this zone

Agriculture is entirely dependent on belg rains that last from March to May. The main crops (barley and wheat) are harvested in June and July. Land preparation is done end of the kremt season (September) far ahead of the planting in February. The consumption year starts in July after the fresh harvest of the main crops (See figure 1).

Except in September when both cattle and sheep are sold, sheep are sold around the Christian festivals of Christmas and Easter when the maximum prices are anticipated, cattle are sold in June, October and November when there is no need for cattle for agricultural activities. Local labor is available only during the harvesting months of June: barley and wheat and November: flax.
Migratory labor, the exclusive income of the very poor and poor, is usually available from February to June. Although the period of food purchase extends from February to may, the maximum dependency on market for food coincides with the hunger season (April and May).

Figure 1. Seasonal Calendar: North Wollo Highland Belg



Wealth in this livelihood zone is determined by the ownership of livestock in general and the ownership of plough oxen in particular (see Figure 2). There is no big difference in the ownership of land between different wealth groups. Land holding ranges from 3 *timad* (very poor) to 4 *timad* (middle and better-off). The difference in crop production between the different wealth groups is the result of renting-out and renting-in of land by very poor and better of households respectively. The most common contractual agreement between the very poor and better-off households is share cropping (*yekul*-equal*)* in which all agricultural inputs (labor, oxen, and seed) are provided by the better-off households and half of the production is kept by both contracting parties.

The ownership of a pair of oxen and other draught power allows better-off households to plough their own land on time and rent-in the land of very poor households on the basis of share cropping contractual agreement. The ownership of higher number of other animals also enables them to gain multiple benefits such as consumption of more livestock products and generate more cash income through the sale of livestock and livestock products.

Middle households own a single plough ox and pair it up (*mekenajo)* with another household of the same wealth group and retain all the production from their own land.

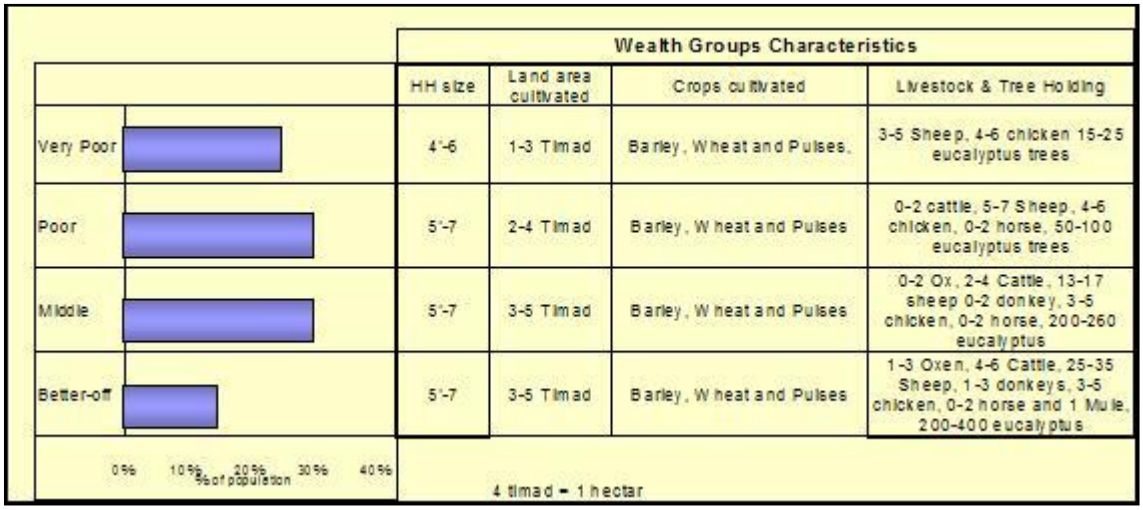


Figure 2. Wealth Groups: North Wollo Highland Belg

3.3.2 Abbay Tekeze Watershed Livelihood Zone

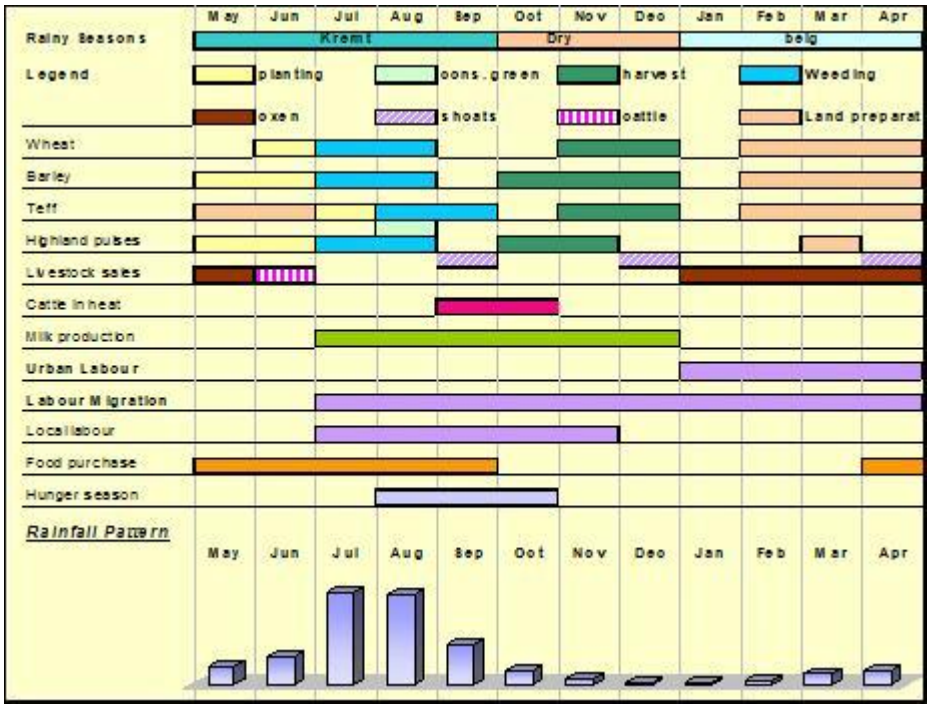
The livelihood zone stretches from the meher dependent woina dega area of north Wollo (Meket, Wadla, Delanta and Dawnt woredas) to the South-eastern part of the South Gonder Administrative Zone (Lay Gayint, and Tach Gayint woredas). The landscape has diverse characteristics: undulating, flat and hilly surfaces and valleys dissecting the livelihood zone. Safety net program is implemented in all the woreda both public work and direct support.

Crop production is entirely rain fed, except in very specific sites where small-scale cultivation of vegetables is cultivated through traditional irrigation. There is only one rainy season-*kremt* and it is important for the cultivation of both long and short cycle crops. In order of importance, the dominant crops of the Livelihood Zone are sorghum, teff and haricot bean. The methods of land preparation in the livelihood zone are major by ox plowing and digging by hand in the hilly and sloppy topography.

Livestock in this zone are sheep, cattle and goats – these are usually grazed but the middle and better off will purchase animal feed like hay and crop residues from October – January from the very poor and poor. Livestock access water from the major rivers in the livelihood zone in the rainy season. In the dry season, shallow hand dug wells provide water for livestock in addition to many small streams and spring water which has been developed for both animal and human

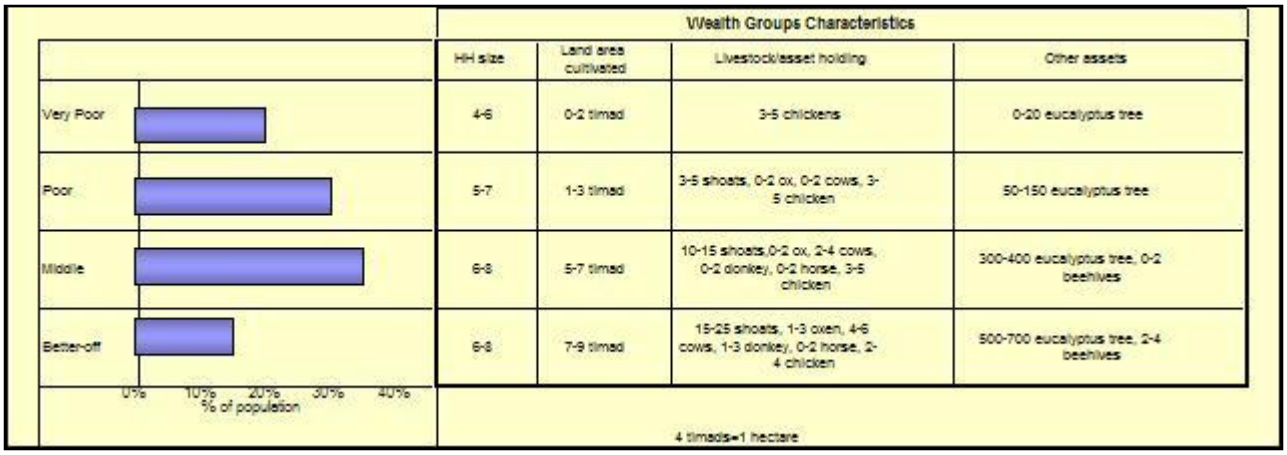
consumption. The main diseases and parasites affecting livestock are Anthrax, Blackleg (cattle and equines), Sheep pox, pasteurellosis (all livestock), African horse fever, lumpy skin and parasites (tick, mange, helimentosis, fasciolla).

Figure 5. Seasonal Calendar: Wuchale-Abichu-Kembebit: Livestock, Oats, Barley and Wheat



There are 3 main seasons: Bega/dry season (January-May), Kiremet/rain season (June–September) and the Meher/harvesting time (October -December). There is a Belg/small rain season (January–March) for some parts of North Wollo. Land preparation is from (February-June) and weeding (July-September) are the most laborious and time-consuming activities. Agriculture is entirely dependent on kremt rains that last from June to September. Barley and Teff have short, intermediate and long cycle crop varieties. Short cycle barley is grown from June to September and the short cycle teff from July-October. Long cycle barley, teff and wheat are grown from May/June -November/December.

Migratory labor is available July – December (agricultural activity) in Raya, Metema, Pawi, Nazrate and Humera. From January- April/May people travel to Addis and Jimma for construction and coffee picking. Local employment opportunities start with weeding in July and continue through to harvesting in November. The hunger season and the period of the greatest dependence on the market for food is last for about two-three months in August to October.



Wealth Groups Characteristics

	HH size	Land area cultivated	Livestock/asset holding	Other assets
Very Poor	4-6	0-2 timad	3-5 chickens	0-20 eucalyptus tree
Poor	5-7	1-3 timad	3-5 shoats, 0-2 ox, 0-2 cows, 3-5 chicken	50-150 eucalyptus tree
Middle	6-8	5-7 timad	10-15 shoats,0-2 ox, 2-4 cows, 0-2 donkey, 0-2 horse, 3-5 chicken	300-400 eucalyptus tree, 0-2 beehives
Better-off	6-8	7-9 timad	15-25 shoats, 1-3 oxen, 4-6 cows, 1-3 donkey, 0-2 horse, 2-4 chicken	500-700 eucalyptus tree, 2-4 beehives

4 timads=1 hectare

Figure 6. Wealth groups

The most important determinants of wealth are the size of land owned by households and the ownership of livestock in general and ownership of plough oxen in particular. Ownership of a pair of oxen allows better-off households to prepare their land on time and rent-in the land of poor and very poor households on a contractual basis. The most common contractual agreement between the better-off`/middle and poor/very poor is '*yekul*' (equal) in which 50% of the production is kept by each contracting party after threshing.

Land holding ranges from 2-3 timad for the very poor to 5-7 timads for the better-off. The difference in volume of crop production among the different socio-economic groups is partially attributed to the differences in land holdings and to the fact that the middle and better-off can rent in land from the poor.

Poorer households exchange labor for ox plowing. 1 day of ox plowing is paid for with for two days labor and crop residue . Constraints to crop production for the better-off include shortage of land and the poor fertility of the land, the limited supply of and high price of inputs (eg improved seeds and fertilizers), lack of labor. Local solutions include using compost and local seeds.

3.3.3 Abbay Beshilo River Basin Livelihood Zone

The Abay Beshilo Livelihood Zone is a food insecure area with a very long history of relief assistance. The woredas with kebeles within the Livelihood Zone are located inTach Gayint woreda at the lower end of the Sub-basin in the bottom of the gorges.

Poor physical infrastructure and complete obstruction of transportation during the rainy seasons also exasperate the problem of accessing food and cash income.

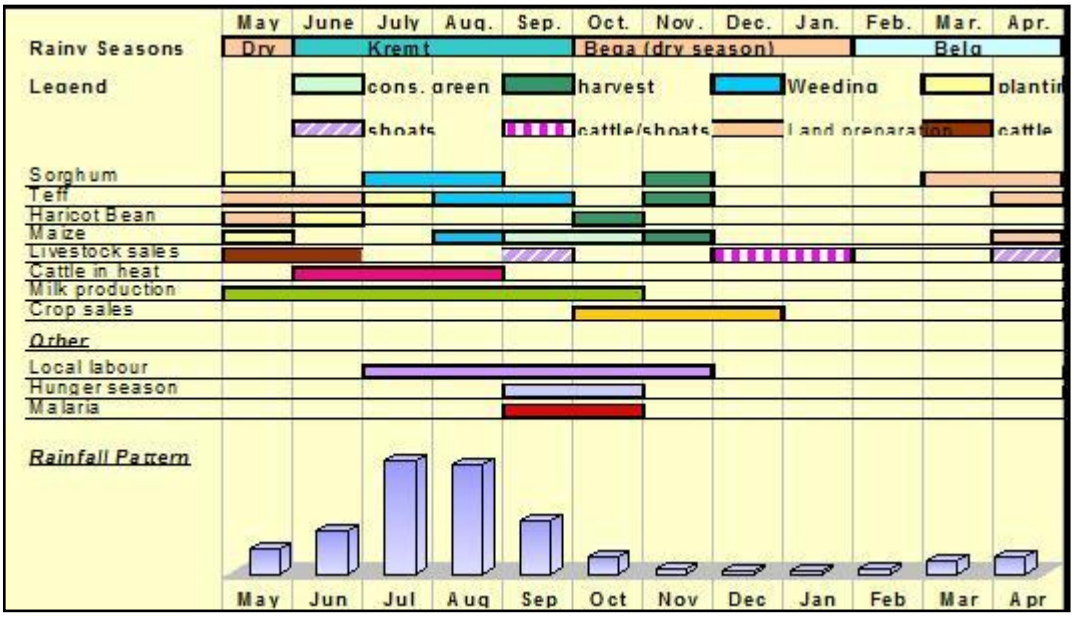
Substantial part of the Livelihood Zone, particularly areas along the riverbank, is completely inaccessible even during the dry season.

In a typical year, better-off and middle households have high reliance upon livestock and crop sales as a means of generating cash income. For the poor and the very poor safety net is the major source of cash income even in a typical year. Safety net program is implemented in all woredas for six months in a year and beneficiaries are paid mainly cash.

The population is relatively scattered. The vegetation is bush and shrubs. It is a mixed production system with crop and livestock production. The dominant crops of the Livelihood Zone include sorghum, teff, maize and haricot bean. Crop production is entirely rain fed, except in small number of localities where small-scale water harvesting practices are recently. There is only one rainy season-*kremt* and it is important for the cultivation of both long and short cycle crops.

The area is characterized by high temperature, erratic rainfall and sandy soil. These factors contribute to the high rate of evapo-transpiration and poor water holding capacity. The combination of moisture stress and poor soil fertility is the limiting factor for agricultural production. There is high prevalence of pest and disease, no utilization of input and yield per hectare is very low.

Figure 7. Seasonal calendar: Abbay Beshilo River Basin

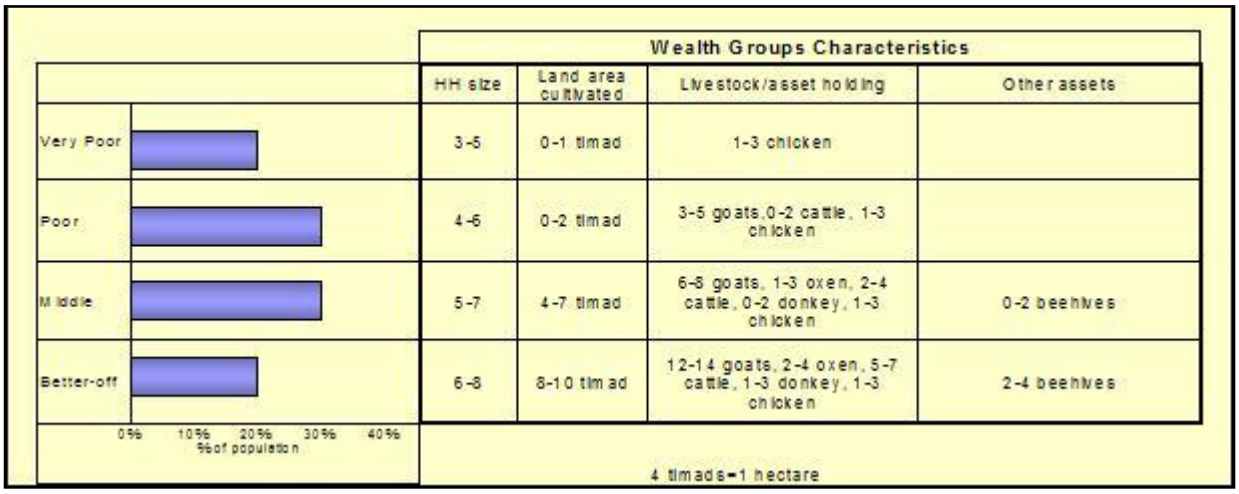


Of all agricultural activities, land preparation (March-June) and weeding (July-September) are the most laborious and time-consuming activities. Agriculture is entirely dependent on kremt rains that last from June to September. Maize is harvested green from September to October and the main food crops: sorghum and teff are harvested in November.

Except in December and January when both cattle and shoats are sold, different types of livestock are sold at different times of the year. Shoats are sold around the major Christian Festivals (New Year, Christmas and Easter). Cattle are sold in the months when there is no need for cattle for agricultural activities.

Whilst migratory labor is not common, some people travel to Tapi, Metema, Wollega, Nazareth, Bale Goba and Humera for work in December and January. Local employment opportunities are available for a relatively longer period of time starting with weeding in July to harvesting in November.

The hunger season and the period for the highest dependence on market for food last for about two months in September and October.



	Wealth Groups Characteristics			
	HH size	Land area cultivated	Livestock/asset holding	Other assets
Very Poor	3-5	0-1 timad	1-3 chicken	
Poor	4-6	0-2 timad	3-5 goats,0-2 cattle, 1-3 chicken	
Middle	5-7	4-7 timad	6-8 goats, 1-3 oxen, 2-4 cattle, 0-2 donkey, 1-3 chicken	0-2 beehives
Better-off	6-8	8-10 timad	12-14 goats, 2-4 oxen, 5-7 cattle, 1-3 donkey, 1-3 chicken	2-4 beehives

4 timads=1 hectare

Figure 8. Wealth groups: Abbay Beshilo River Basin

Wealth is determined by land owned and cultivated, livestock possession (plough oxen, cattle and goats) There is a big difference in the ownership of land with the better-off owning three times more land than the very poor. Differences in land cultivated are even greater ranging from 0-1 timad for the very poor to 8-10 timads for the better-off. This reflects the fact that the poor and very poor do not have oxen and so are unable to cultivate all their own land and so rent out part of their land to the middle and better off with an equal (half) crop sharing arrangement.

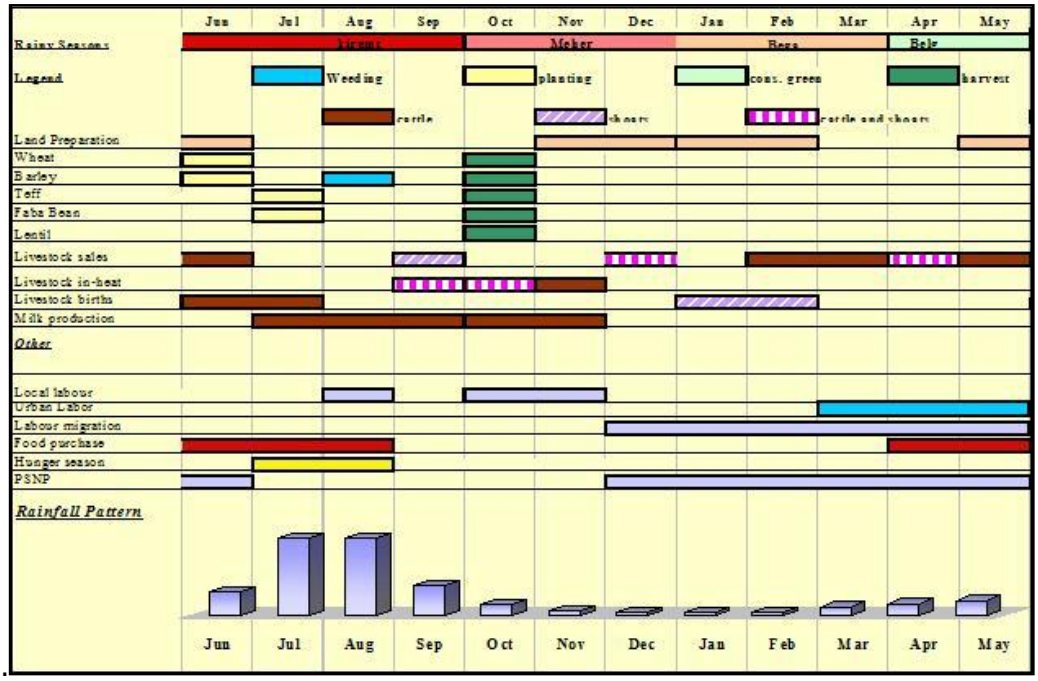
3.3.4 North East Woina Dega Mixed Cereal Livelihood Zone

This Zone is an area characterized by dry woyna dega agro ecology with undulating mountains, hills and gorges. The vegetation is mainly scattered bushes and scrubs particularly Acacia. It encompasses Gidan woreda in North Wollo zone and Lay Gayint woreda in South Gondar. The Productive Safety net program (PSNP) is available in the area.

The long rain/*Kiremt* is the main rainy season used for crop production. This is a food deficit area in which poor agricultural performance is attributed to high environmental degradation and weather-induced drought. Barley, wheat, sorghum and teff are the main crops cultivated for consumption while faba bean, lentils and oil seeds are grown in the area for sale. Oxen are used to plow, but in some areas where ox plowing is not possible and the digging is done manually. Teff production is the most laborious requiring high labor input from land preparation to harvesting. Land for teff has to be ploughed until the soil becomes fine. Farmer in the Zone uses compost and manure as an input to boost production. Wollo bush crickets, aphids, are some of the crop production threats affecting barley, teff, and wheat; while pea weevil affects pulses.

Cattle, shoat and equines are the main livestock reared in the Zone. Oxen are used for plowing, while shoat and cattle sales are the main source of cash income. Grazing is on communal land but insufficient, so most livestock are sold at the immature stage, as fodder is scarce. The better-off will exchange ox traction on a daily basis for straw/crop residue as a way of accessing additional animal feed. Livestock products like honey, butter, skin, and eggs are also sold to generate cash. Shoats are rarely slaughtered during holidays by better off households. The better off households mostly replace cows from within the herd, while the middle replace through purchase. Shoat pox and mange are the main livestock diseases affecting shoat and anthrax is a disease affecting both cattle and shoat. The other main economic activities in the LZ are sale of honey (from traditional beehives), firewood and migration labour.

Figure 9. Seasonal Calendar: North East Woina Dega Mixed Cereal

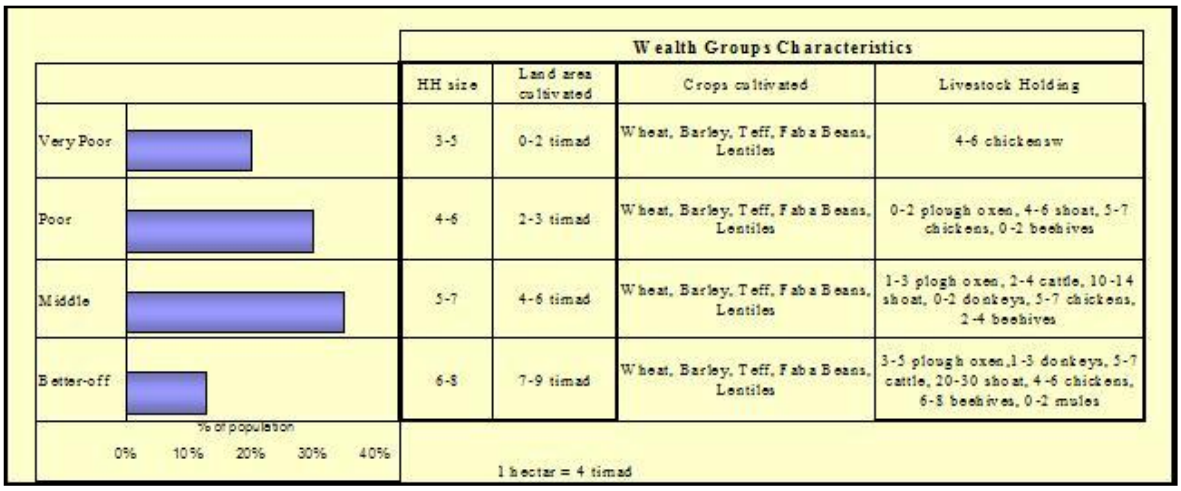


There are four main seasons in the zone, namely the long rains/*Kiremt* which extends from mid-June to September, harvest/*Meher* from October to December (harvest), dry Season/*Bega* from January to March and short rains/*Belg* from April to May.

The consumption period runs from the harvest of the main season (*Meher*), October up to the end of the peak hungry time September. The LZ is predominantly unimodal (ie depends on the *Meher* season harvest). The agriculture activities begin with land preparation in November through to February for barley and wheat. Land preparation for teff starts in January/February and continues again in May and June. The planting for all crops takes place in June/July and harvesting in October.

The main hunger months are the two months prior to the start of the harvest, July and August. Households engage in PSNP public works from January to June.

Figure 10. Wealth Groups: North East Woina Dega Mixed Cereal



Wealth Groups Characteristics			
HH size	Land area cultivated	Crops cultivated	Livestock Holding
3-5	0-2 timad	Wheat, Barley, Teff, Faba Beans, Lentiles	4-6 chickensw
4-6	2-3 timad	Wheat, Barley, Teff, Faba Beans, Lentiles	0-2 plough oxen, 4-6 shoat, 5-7 chickens, 0-2 beehives
5-7	4-6 timad	Wheat, Barley, Teff, Faba Beans, Lentiles	1-3 plogh oxen, 2-4 cattle, 10-14 shoat, 0-2 donkeys, 5-7 chickens, 2-4 beehives
6-8	7-9 timad	Wheat, Barley, Teff, Faba Beans, Lentiles	3-5 plough oxen,1-3 donkeys, 5-7 cattle, 20-30 shoat, 4-6 chickens, 6-8 beehives, 0-2 mules

1 hectar = 4 timad

Cultivated land and livestock ownership particularly oxen are the main determinants of wealth in the LZ. The land cultivated increases from very poor to better off wealth group. Land owned is similar across wealth groups, but lack of oxen among the very poor and some poor households means that these households rent out land to the middle and better-off on a crop sharing arrangement in which the harvest is shared equally. The poor and very poor, in some cases exchange labor for draft power (ie the very poor provide 2 days labor in return for one day's oxen labor).

Middle and better off possess all kinds of livestock while the very poor possess only chickens. Beehive ownership is also another criterion to determine the wealth status. The very poor groups have none of it while the better off group owns 6-8 beehives.

3.3.6 Guna Highland Barley and Potato Livelihood Zone

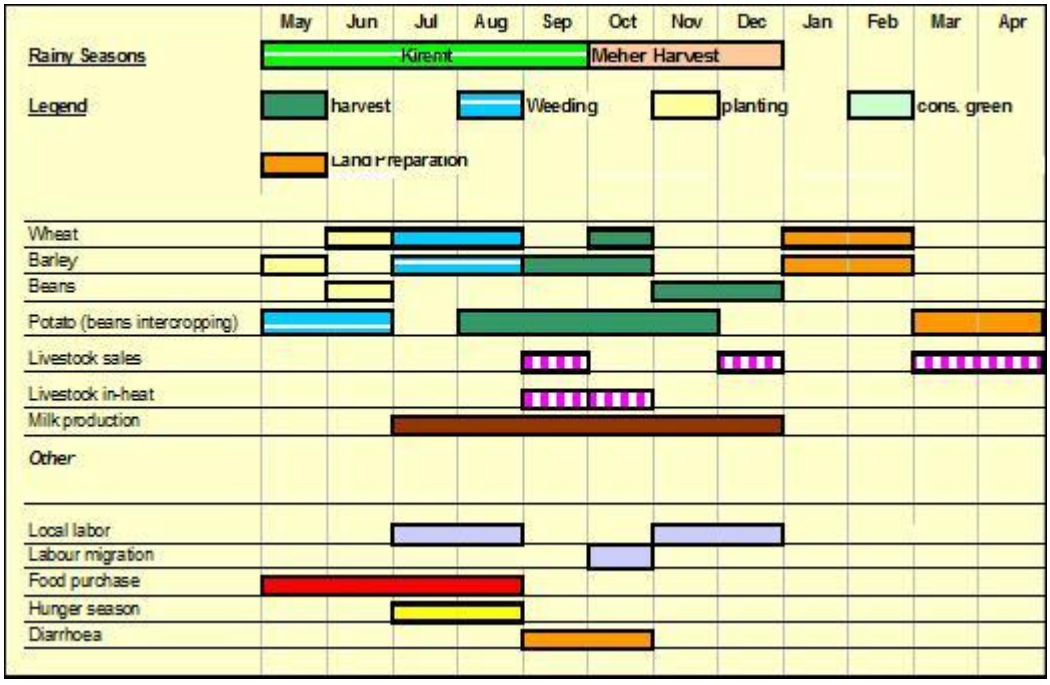
This livelihood zone is found in Lay Gayint woreda in South Gondor. It lies in the *dega* agro-ecology on a densely populated highland plateau. It is heavily deforested and existing vegetation is mainly comprised of pockets of natural forest and eucalyptus trees. This is a food surplus zone.

Agriculture activities are dependent on the *kiremti* rains that fall from mid-May to mid-September. Barley and wheat are cultivated mainly for household consumption, and potatoes and field beans mainly for cash income. Oxen provide draught power during the labor-intensive land preparation period. Weeding and harvesting are equally laborious, particularly for potatoes, and provide seasonal work for local men and women. Favorable climatic conditions and fertile soils provide a suitable environment for sufficient food production in the zone. The main hazards to crop production are leaf blight, rust, and aphids. Leaf blight mainly affects the cash crops- potatoes and field beans, and rust affects the food crops- barley and wheat.

The main livestock types reared are sheep, cattle, horses and donkeys. These free graze on grass (and crop residues in the case of cattle); there is limited grass purchase for livestock during the harvest season Livestock are key productive assets. The sale of sheep and cattle is the main sources of income, while donkeys are used to provide labor. Sheep are the most commonly sold livestock, in peak demand for slaughter during the festival season in April (Fasika), September (Meskerem), and December (Christmas). Sheep are owned across the wealth groups, and are sold to provide income for recurring household expenses.

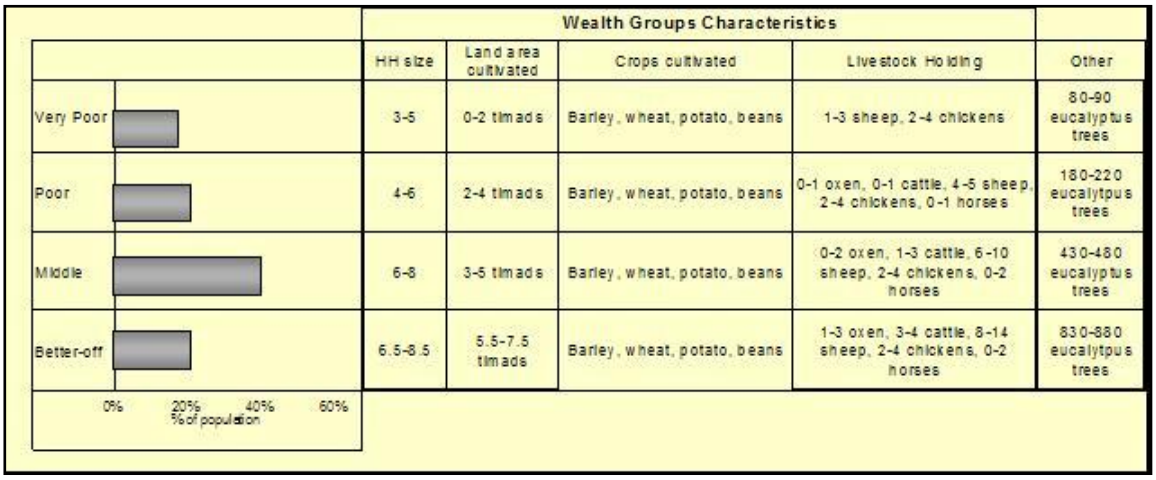
People in this zone earn additional income from the sale of eucalyptus trees, and from local and migratory wage labor opportunities. Men cut down trees with axes, whilst men and women from among the poor and very poor seek wage labor. Labor opportunities mainly involve weeding and harvesting during the farming season. Men typically migrate to Metema and Humera every year during the sesame cultivation season.

Figure 11. Seasonal Calendar: Guna Highland



The Meher harvest from September to December follows the Kiremt rains Agricultural activities are planned around the rains which start slowly in May and intensify between June and September. The farming season begins with land preparation in January, and gathers pace in March and April as the rains approach

Figure 12. Wealth Groups: Guna Highland



The chief determinants of wealth are the amount of land owned and livestock owned. The amount of land allocated to each household during the 1991 land redistribution exercise was based on the household size. Household size, along

with land owned, increases with wealth. A more important factor of productivity, however, is the number of plough oxen owned. Plough oxen ownership is a measure of household capacity for land utilization. The very poor have no oxen, and the poor households have between 0 and 1oxen, and they both lack the capacity to cultivate their entire land holding. The better-off have between 1 and 3 plough oxen and have enough draught power to cultivate more land than they own.

Sharecropping allows the better-off access to more land, while permitting the very poor and poor to benefit from their initial land holding, receiving 50% of the harvest from the land they rent out. There are also local arrangements allowing poorer households access to oxen in exchange for labor. Access to more land allows the better-off to commit more land to cash crops (pulses), as compared to the poor who, because of limited land holdings, produce fewer cash crops and prioritize food crop production. Poor households often cite shortage of farmland, plough oxen and money for agricultural inputs as their biggest barriers to productivity.

3.4 Social Infrastructure

The data of health infrastructure and health status for the whole of the Abbay Basin was taken from the data base of the World Bank's Country Economic memorandum. Details of health infrastructure and health workers are shown in table 3.

Table 3. Details of health Infrastructure and Workers in the Abbay River Basin.

BASIN/REGION	Health Professional/'000 pop.	No. Health Professionals	Health Infrastructure (hospitals, clinics, dispensaries/'000 pop.	No. of health infrastructures
ABAY BASIN				
Amhara	0.27	2,797	0.09	**913**
BSG	0.87	587	0.29	**192**
Oromiya	0.26	1,430	0.11	**619**
Total	**0.29**	**4,813**	**0.10**	**1,723**

The number of health professionals/'000 population is much higher in the Beneshangul-Gumuz Region. This figure is a reflection of the low population numbers. However, health infrastructure is much lower in that Region for the same reason.

Accessibility and the ratio of health workers to the population are key determinants in the number of people who are immunized. This is shown clearly

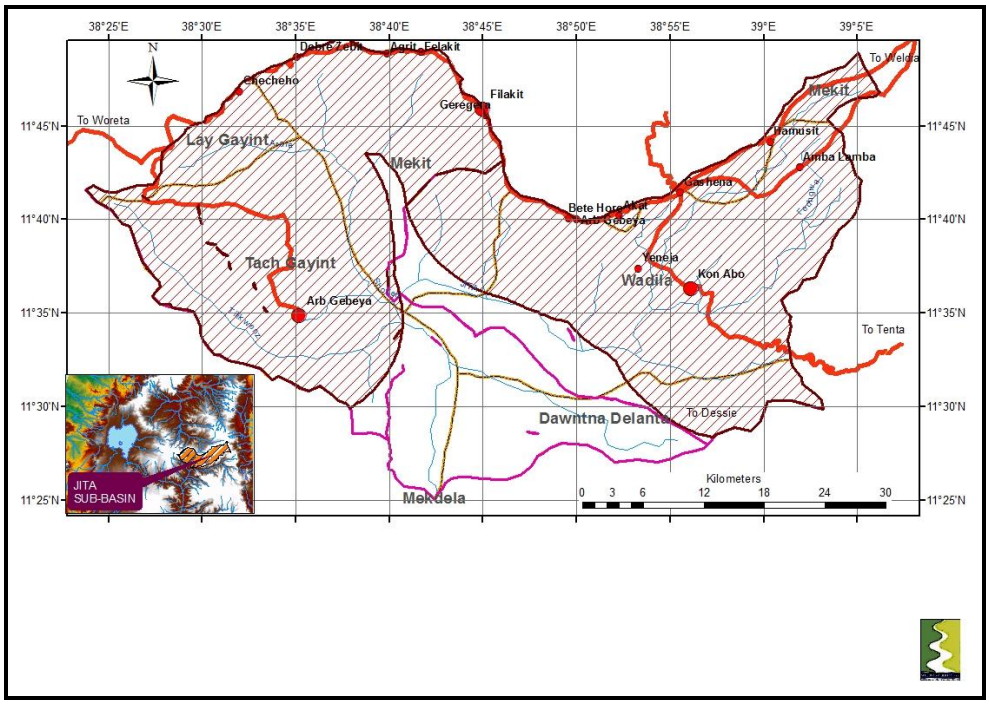
in table 15 where the very low rate of immunization in BSG Region stand out clearly. Malaria is prevalent below 1,500 masl and possibly in areas just above this altitude. The percent area exposed to and the percent of the population vulnerable to malaria are also indicated in table 4.

Table 4. Percent Population Immunized, Percent Population vulnerable to and Area Exposed to Malaria in the Abay River Basin.

BASIN/Region	% Pop. immunized	% Pop. vulnerable to malaria	% Area exposed to malaria
ABAY BASIN			
Amhara	62%	47%	**55%**
BSG	28%	73%	**74%**
Oromiya	40%	49%	**52%**
Total	53%	49%	**55%**

The BSG Region in the Abay Basin has the highest proportion of the population vulnerable to malaria. Just fewer than half the populations in Amhara and Oromiya Regions are so vulnerable.

3.5 Transport Infrastructure and Markets



Map 15. Road network.

The Woreta to Weldia road passes along the northern border of the Sub-basin. The Alem Ketema to Adua road passes from south to north through Wegel Tena reaching the Woreta-Weldia road at Gashena.

Only 21 percent of the sub-basin is more than 10km from a road.

4. KEY ISSUES, CHALLENGES AND POTENTIALS

4.1 The Underlying Causes of Land Degradation and Investment in Sustainable Land Management Technologies

Mahmud Yesuf and Pender (2005) have undertaken a comprehensive review of research undertaken into identifying the determinants of the adoption or non-adoption of land management technologies in the Ethiopian highlands. This report and a number of IFPRI/ILRI reports on research undertaken between 2000 and 2004 provide a comprehensive picture of many of the underlying causes of land degradation in Ethiopia. Other useful reviews include the NTEAP Study NTEAP, 2005), Alemayehu Tafesse (2005) and Herweg (1999).

4.1.1 Poverty and land Degradation

The poverty line in Ethiopia is set using a basket of food items sufficient to provide 2200kcals per adult per day. Together with a non-food component this represents Ebirr1,070 in 1995/96 prices. The proportion defined as poor in 1999/2000 was 45 percent in rural areas and 37 percent in urban areas. Per capita consumption expenditure of rural people in 1999/2000 was Ebirr 995 compared with 1,453Ebirr for urban people (FDR, 2002). However, income distribution is more evenly distributed than in other Sub-Saharan countries. The egalitarian land holding system may have contributed to this in rural Ethiopia. Between 1995/96 and 1999/2000 rural poverty declined by 4.2 percent, although it increased in urban areas (by 11.1 percent).

The dependency ratio is very important in determining poverty status in rural areas. Studies indicate that if the dependency ratio increases by one unit, a household's probability of falling below the poverty line increases by 31 percent. Households with more children under 15 years and those with people older than 65 years are particularly vulnerable to falling into poverty. This underscores the importance of adult labour in the welfare of rural households. Female headed rural households face a 9 percent higher probability of being poor than male-headed households although other factors such as age and education play an important role and need to be taken into consideration when targeting. Households cultivating exportable crops (chat, coffee) have a much lower probability of being poor. Living near towns and better access to markets has a poverty reducing effect. Farm assets such as oxen are important poverty

reducing factors: an extra ox reduces poverty probability by 7 percent. Households involved with off-farm activities are 11 percent more likely to be poor. This is because such activities are seen as a coping mechanism for poor people rather than a way of accumulating wealth.

Reardon and Vosti's (1995) typology of poverty is linked to natural resources. They use a household asset approach in terms of:

- natural resource assets (soils, water, vegetation)
- human resource assets (education, health, nutrition, household labour, skills)
- on-farm resources (farm land, livestock, trees, equipment)
- off-farm resources (non-farm employment, remittances)
- community owned resources (grazing land, dams, roads)
- social and political capital (family ties, networks)

They use a measure of "conservation-investment poverty", the cut-off point is situation and site specific being a function of labour and input costs and the type of conservation investment needed.

In Ethiopia, decisions to adopt sustainable land management technologies depend on households' asset endowments. Labour availability has been found to be a positive determinant of chemical fertilizer adoption, trees and terrace construction. However, simply using family size to measure labour availability was found to be misleading. The results of studies into the effect of farm size on land management technologies have been mixed. Both positive, negative and no relationships have been found between farm size and fertilizer adoption. However, with those technologies that take up space (terraces, bunds, trees) a positive relationships were found between farm size and adoption.

Livestock assets have been found to be positively related to adoption of fertilizer, planting of perennial crops, use of manure and contour ploughing. Gender (a human capital variable) does affect adoption of land management technologies. Male headed households use more labour and oxen draught power and apply manure, reflecting a cultural constraint on women ploughing in Ethiopia. The results for fertilizer adoption were mixed, with female headed households in northern Ethiopia likely to use more fertilizer and the reverse in southern Ethiopia. Positive relationships were found between education and adoption of soil conservation measures although the results for fertilizer adoption were mixed.

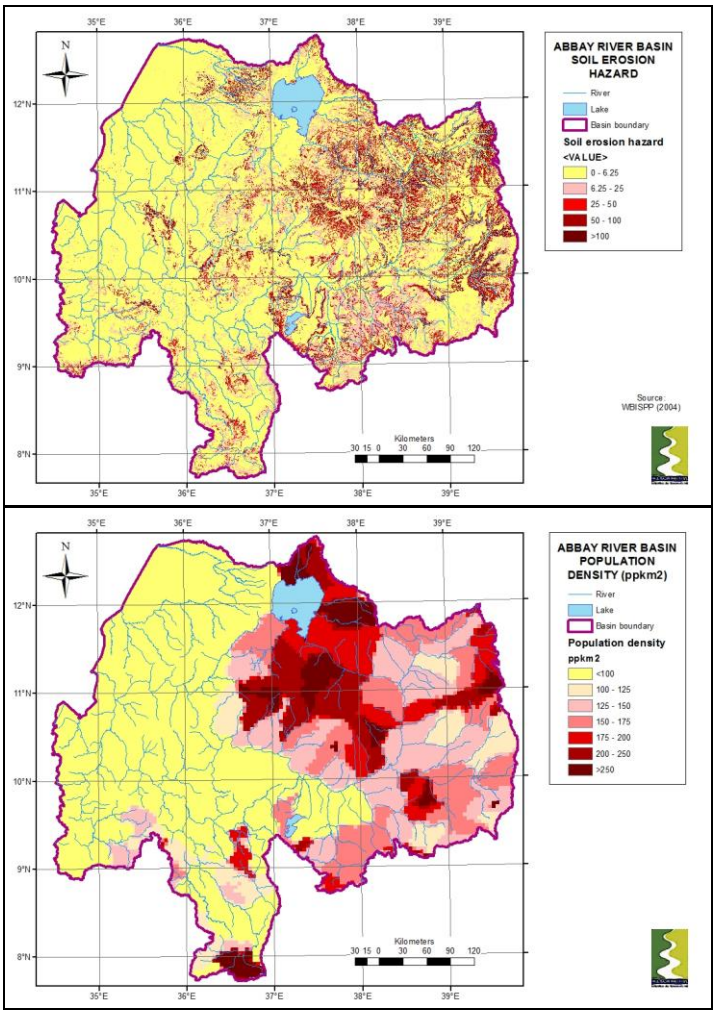
Related to poverty and household assets are the concepts of profitability of the improved land management technology, the farmers' perceptions of risk and farmers' private discount rates. Private discount rates are a measure of a person's time preference or time horizon. The shorter the time horizon the higher is the discount rate. Short time horizons are the result of a number of factors, tenure insecurity, poverty, and high risk environment. Many farmers have high private discount rates – as high as 70 percent even in the high potential farming area around Debre Zeit near Addis Ababa (Holden et al., 1998). A number of studies have found that adoption of soil and water conservation technologies is negatively related to high discount rates. However, where a technology is risk reducing (e.g. terraces that conserve soil moisture) adoption is much more likely.

4.1.2 Population Pressure and Land Degradation

Currently there are two basic hypotheses regarding the relationship between population growth and land degradation. The "neo-Malthusian" hypothesis predicts that agricultural production is unable to keep pace with population growth leading to falling agricultural production per capita, and increasing negative impacts on natural resources including land, water, forests and biodiversity. More recently, a more optimistic perspective has developed following from the work by Ester Boserup (1965) and others. This perspective emphasizes the responses of households and communities to population pressures that include a reduction in fallow periods, intensified use of labour and land, development of labour-intensive technologies and institutional changes. However, more recent evidence suggests that more specific conditions seem to be needed to get a Boserupian scenario to operate. These have been identified in the Machakos study as secure tenure, efficient markets, cash crops, supporting social organization and proven SWC measures. The evidence accrued so far in Ethiopia is mixed.

Grepperud (1996) tested the population pressure hypothesis for Ethiopia using econometric analysis, and found that when population and livestock pressures exceeded a specific threshold rapid degradation of land takes place. The threshold was the population and livestock carrying capacity of the land. Pender et al (2001) found in Amhara region of Ethiopia that high population densities were related to the decline in fallowing and manuring. They also found the high population densities were related to increasing land degradation and worsening household welfare conditions. In Tigray high population density was related to more intense use of resources (more fertilizer, manure and intercropping) at the household level but increased land degradation at the community level.

A comparison between population density and soil loss rates for the Abbay basin is shown in Map 16.



Map 16. Abbay Basin: A comparison between the pattern of population density with soil loss rates.

Whilst there is some similarity in pattern around the Mount Choke range and along the eastern edge of the Basin it is not everywhere exact. This suggests that the relationship between population density and erosion is not a simple one.

4.1.3 Poor Access to markets, roads and off-farm employment opportunities and Land Degradation

Better access to markets and roads mean lower transport costs for agricultural inputs and outputs and thus lower input costs and higher market prices. Thus better access is likely to lead to increased adoption of improved land management technologies, and poor access to lower adoption rates. However, better access may lead to better opportunities for off-farm employment. Here the potential impact on adopting or not adopting improved land management technologies is ambiguous as off-farm employment may reduce labour inputs but increase availability of financial capital for on-farm investment.

Howe and Garba (2005) found that reliance on traditional forms of transport pose considerable barriers to the development of an exchange economy and locks the farmers into subsistence form of livelihood. Pack animals offer a considerable advantage over human transport, with a cost reduction of approximately 50 percent. However, the average costs of mule transport of EBirr 16.7ton/km compare very unfavorably of EBirr 0.6-0.9 ton/km for local truck costs. With such high costs of transport for low value food crops such as maize ort sorghum makes a net return unlikely.

The evidence from Ethiopia of better access to markets and adoption of soil and water conservation technologies is mixed. In Tigray households with poor access were more likely to adopt labour intensive SWC structures than those with good access. Declining fallows and increasing use of manure closer to towns suggested increasing intensification of agriculture where access was better. The use of fertilizer was everywhere positively associated with increased accessibility. The relationship between off-farm employment and the adoption of SWC structures appears to be very context specific. In many areas adoption of fertilizer and SWC adoption was negatively associated with off-farm employment.

4.1.4 Issues of Land Tenure

Issues of land tenure here include insecurity of tenure, ability to use land as collateral and the transferability of property rights and the impacts these have on land investment or factor (land, labour or capital) allocation. This is a complex subject in Ethiopia.

The Federal Rural Land Administration proclamation (No. 89/1997) defines in broad terms individual land use and disposal rights. It delegates responsibility for land administration to the Regions. Oromiya has also enacted Proclamations for the Administration and Use of Rural land. The first round of land registration programme is complete in the region. However, land redistribution has not been ruled out in both federal and regional proclamations. A US-AID Study (ARD, 2005) indicated that reports from kebelle administrations that redistribution is possible even with Land Registration Certificates.

Land tenure issues and their impacts on land management and technology investment in Ethiopia have been well studied over the past decade, and Mahmud Joseph and Pender (2005) provide a very comprehensive summary of the empirical evidence that is now available. Much of the evidence relating to impacts of tenure issues on land management and potential investment in improved land management is also of relevance to the situation in Sudan even if the context is somewhat different.

Tenure insecurity in Ethiopia emanates from a number of causes. A major source was periodic land redistribution to reallocation land to land-poor households. In

northern Ethiopia the indications are that in areas where redistribution has occurred investment in terraces was lower, but that the use of fertilizer and tree planting was higher. This suggests that redistribution may favour short term investments in land management but hinder long term investments. The investment in tree planting (a short to medium term investment) may be due to a desire to increase tenure security or merely because trees are normally planted around the homestead.

A number of studies also found evidence that resource poverty had a much greater effect on farmer's decisions to adopt or maintain soil conservation structures.

In summary the effects of tenure insecurity on land investments appear to be mixed depending on whether the investments themselves affect security. Insecurity appears to hinder larger investments (e.g. terraces) than smaller and periodic investments (e.g. fertilizer, manuring). Redistribution is not the only source of insecurity, obligations to share land with younger family members is also an important source.

4.1.5 Impact of Agricultural Extension and Credit programmes on adoption of Land Management Technologies

The agricultural extension programme has strongly promoted fertilizer and improved seeds supported by credit. Studies indicate that greater access to credit increases farmers' likelihood of using fertilizer. However, risk is the crucial factor in the low rainfall areas in determining whether farmers will take credit for fertilizer even where it is readily available. The source can also determine the uptake of credit and specific use of the credit. This is probably a reflection of the technical advice that comes with the credit.

One study shows that credit uptake increased the adoption of fertilizer but reduced investments in soil and water conservation, contributing to increased soil erosion. The increase in fertilizer price since 2002 with the removal of the subsidy led farmers to increase the cultivation of crops requiring low fertilizer applications and reduce investment in soil conservation where the intervention was yield decreasing (e.g. soil bunds taking up cropland).

Studies indicate that the impact of extension on the uptake of improved land management is probably more positive in the high potential areas.

4.1.6 Economic Impacts of Land Management Technologies

Empirical studies on productivity and economic impacts of land management practices are few but consistent. Most studies show that short run returns from physical SWC structures are positive in moisture stressed areas but negative in

higher rainfall areas. Returns from fertilizer use show the opposite trend: with higher returns in high rainfall areas and lower in moisture stressed areas.

In moisture stressed areas internal rates of return to stone terraces varied between 20 and 50 percent. Again in moisture stressed areas other land management practices demonstrated increased productivity: contour ploughing (25% higher productivity), reduced tillage (57% higher productivity), and manure and compost (15% higher productivity). The impact of chemical fertilizer was insignificant and showed a high variability in productivity response indicating a higher risk.

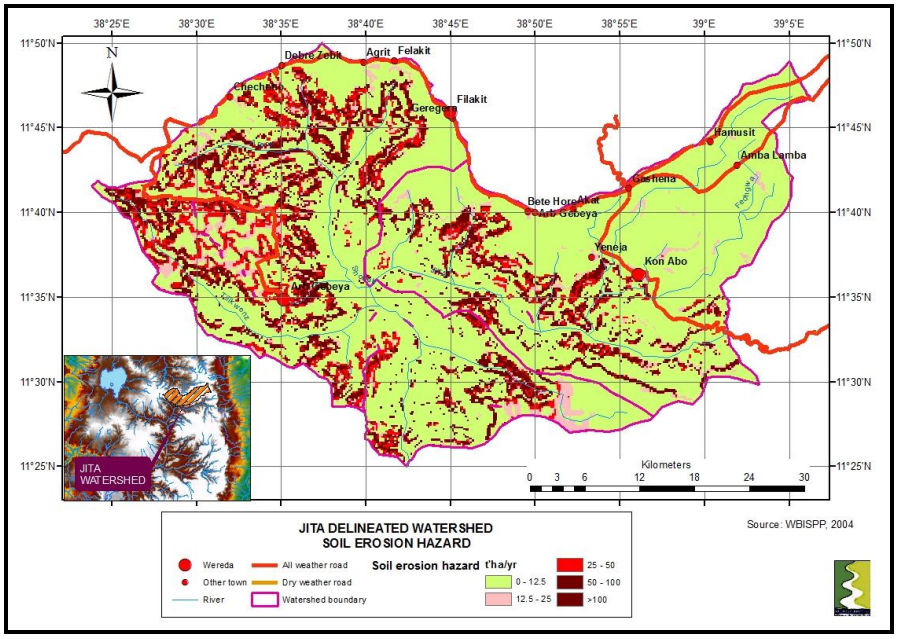
Benefits to physical structures were low where soils were deep (more than 1 meter) or very shallow where yields were already very low. This finding suggests targeting areas with rapidly degrading but still productive soils.

4.2 Jita (Upper Beshlo) Sub-basins

4.2.1 Assessment of the Extent Soil Degradation

(i) Sheet and Rill Erosion

The extent of the sheet erosion hazard using the USLE (as modified by Hurni, 1986) as a basis is shown in Map 17.



Map 17. Potential Soil Erosion (t/ha/yr)

The highest soil loss rates are found on the steep slopes of the river gorges. Locally, areas of high erosion are found on the ridges and foothills just above the plateau.

(ii) Biological Erosion

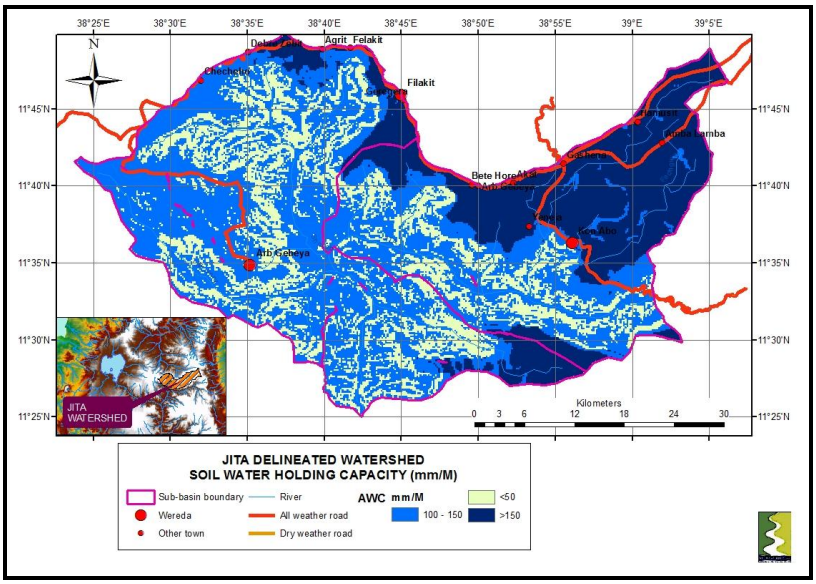
Biological erosion includes the loss of organic matter and soil nutrients. The former is caused by soil erosion and by the lack of replacement organic matter after cropping. Nutrient losses are caused by breaches in the nutrient cycle (particularly Nitrogen) caused by crop residue and grain removal from fields and the collection of dung from fields for fuel. Annual soil nitrogen losses caused by crop and dung removal from fields and grain losses using a nutrient:yield ratio of 6 were estimated (WBISPP, 2003) and are shown in table 4.

Table 4. Net Nitrogen losses and consequent grain losses due to lack of replacement from grain, residue and dung removal

Woreda	N loss (tons/yr)	Grain loss (tons/yr)
Lay Gayint	269	1,613
Tach Gayint	168	1,010
Dawntna Delanta	241	1,444
Mekit	342	2,051
Wadila	163	977
TOTAL	**1,182**	**7,094**

(iii) Soil water holding capacity

The soil water holding capacity (in mm of water per meter of soil) is largely a function of soil depth and soil texture. Deep soils with clay textures have a much higher water holding capacity than shallow and/or sandy soils. Shallow soils are found on the steep slopes of the river gorges, with deep clay soils (Vertisols) on the Plateau (Map 18).



Map 18. Soil water holding capacity (mm/m)

The high water holding capacities of the Vertisols found on the Plateau can be clearly seen with the shallow soils on the steep gorge slopes with very low soil water holding capacities..

4.2.2 Assessment of the Extent Deforestation and Degradation of Vegetation Cover in the Jita (Upper Beshlo) Watersheds

Open shrubland cover some 18 percent of the area of the Watershed. Most of this is confinbed to the gorges. Cultivation and grassland cover cover some 53 and 18 percent of the total area respectively. The remainder of the area is bare rock and bare soil.

(i) Changes in Tree Cover

Cultivation has expanded from the plateau down the steep valley sides removing open shrubland.

(ii) Degradation of Woody Biomass

Degradation of woody biomass is caused in the main by the removal of wood for household fuel. Removal of wood in excess of the sustainable yield (after accounting for removal of dead wood and fallen branches, leaves and twigs) leads to declining stocks, which in turn leads to declining yields and so to permanent degradation of woody biomass.

The WBISPP (2003) estimated for the five woredas in the Jita Watershed of Lay Gayint, Tach Gayint, Mekit, Dawna Delanta and Wadila fuelwood consumption

exceed sustainable supply by 165 percent, 135 percent, 133 percent, 151 and 171 percent respectively.. These figures suggest that degradation of woody biomass in the Jita Watershed is taking place.

(iii) Degradation of Herbaceous Biomass

Degradation of herbaceous biomass is caused mainly by overgrazing of livestock. An indicator of overgrazing can be determined by examining the livestock feed energy balance at the wereda level. Energy requirements of all livestock were computed by WBISPP (2003) using energy requirements for maintenance, draught power and lactation, and balanced against estimates of energy supply from natural pastures and crop residues.

The ratio of stocking rates to carrying capacity was estimated for the five woredas of Lay Gayint, Tach Gayint, Mekit, Dawna Delanta and Wadila to be 78 percent, 101 percent, 80 percent, 109 percent and 142 percent. Two woredas are exceeding the carrying capacity (Dawna Delanta and Wadila, one woreda (Tach Gayint) is at carrying capacity and two woredas (Lay Gayint and Mekit) are below.

4.2.3 Assessment of the Extent Reforestation and Increases of Vegetation Cover in the Jita (Upper Beshlo) WatershedS

(i) Communal and On-farm Tree Planting

Whilst there is evidence of the removal and degradation of natural vegetation cover, there is evidence that there has been an increase in on-farm tree planting and plantations, almost entirely of *Eucalyptus* species. Farm surveys of the numbers of trees owned and planted by farmers in Amhara Region has revealed that considerable planting of trees (mainly Eucalyptus) has taken place since 1991 (WBISPP, 2003).

Prior to 1991 there was very little on-farm tree planting. The reasons were firstly, that between 1975 and 1991 cutting of on-farm trees was prohibited, and secondly that between 1975 and 1989 there were frequent re-distributions of farmers plots. The net result was a strong feeling of insecurity of tree and land tenure that strongly discouraged farmers investing in tree planting. Following the change of Government in 1991 the prohibition on tree cutting was withdrawn and redistribution of holdings was much reduced and since 2000 had stopped. As a consequence perceptions of tree tenure security became stronger. This was coupled with a very large increase in the demand for construction poles following the surge in economic growth and the increase in building construction from 1992 onwards.

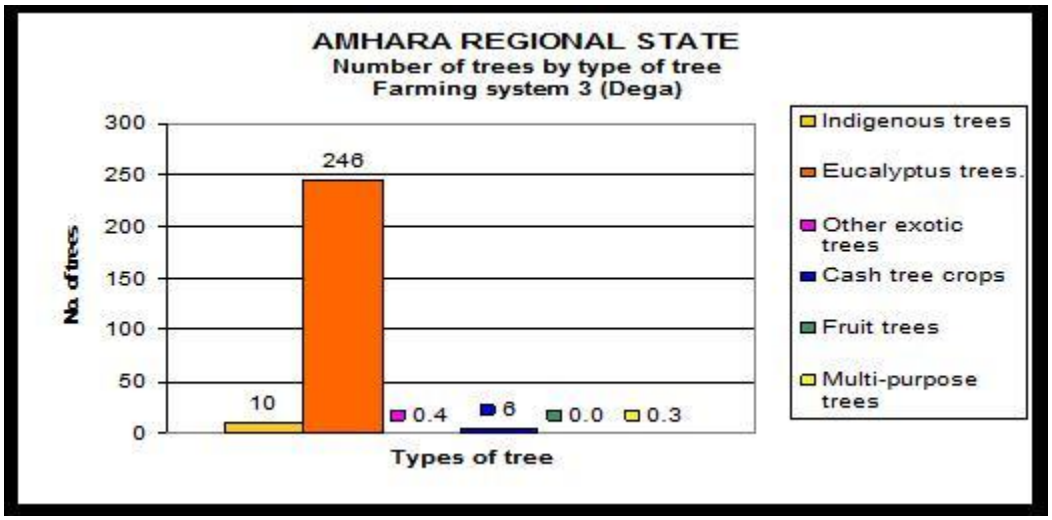
In 2002 the proportions of farmers having the six main types of trees on their farms is as follows:

Indigenous trees	Eucalyptus spp.	Other exotics	Cash crop trees	Fruit trees	Multipurpose trees	No trees on farm
39%	89%	3%	6%	1%	2%	6%

Source: WBISPP Socioeconomic Survey 2002

The average holdings of trees of tree owning farmers and across all farmers of the six types is shown in figure 1.

(ii) Figure 1. Jema Delineated Watershed - Average holdings of trees on farmland



In terms of woody biomass the contribution made by Eucalyptus trees is much greater than indigenous trees: some 92 percent of the 14.676tons total biomass stock and 2.05tons per annum yield.

Following the change in policy in 1999 regarding tree planting and cutting there was a surge in on-farm tree planting. The biggest incremental increase took place in the three years between 1999-2002. The average annual rate of planting by Eucalyptus tree owning farmers has increased from 7 trees per annum between 1988-1993, to 16 trees per annum between 1994-1997 to 34 trees per annum between 1998-2002. No subsequent data is available but it likely that rate of planting has slowed down as local demand for timber and fuelwood is met.

(iii) Enclosed or Livestock Exclusion Areas

Enclosed or livestock exclusion areas in Communal lands have clearly demonstrated that rapid natural regeneration of vegetation is possible. Research in Tigray on closed areas found they achieved trapping efficiencies approaching

100 percent. Closed areas were trapping sediment per unit area 3 to 4 times the rate of erosion (Descheemaeker et al., 2005). In most cases it was vegetation that controlled the rate of sedimentation rather than slope. Additional benefits include soil enrichment and increased infiltration of water.

Descheemaeker et al. (2005) found that soil organic matter in an enclosed area just the north of the Zamra-Areqa Watersheds, had increased from between 0.2 percent to 1.3 and 0.5 percent to 3.4 percent in areas that had been enclosed for 4 to 5 years. These would indicate increases from 17 to 45 tons/ha.

In a very detailed village study in the upper Zamra Watershed in Hintalo-Wejirat Woreda, Howard and Smith (2006) found that plants within the enclosed areas had considerable importance for traditional medicines (138 species), as wild food (30 species), as bee forage and for religious and cultural activities. Often there are gender differences in the value of these plants. The sale of some of these plants provides a vital source of livelihood for the most disadvantaged people in the community (e.g. female headed households). In the degraded areas many of these plants had disappeared. Clearly, these plants provide an important element in the broader livelihoods of rural (and urban) communities and their value has often not been recognized (Shackleton et al., 2000).

Financial analysis (ENTRO, 2008) indicated that for 1 hectare of closed area produced a financial rate of return of 68 percent and a B: C ratio of 13. The payback period is short – 3 years.

As an overall map of closed areas has not been completed it is not possible to say what proportion of the two Watersheds has been closed.

4.2.3 Trends in Soil and Vegetation Degradation

(i) Soil Degradation

In the absence of any widespread, consistent and long term monitoring it is difficult to estimate medium or long term trends of erosion or sedimentation. Any evidence must therefore be circumstantial.

In the absence of preventative measures, declining soil fertility and organic matter content are likely to increase soil erodibility. However, there have been impressive increases in the adoption of soil and water conservation and soil improvement measures over the past ten years. The WBISPP (2003) GIS assessment indicated that the proportion of cropland requiring SWC measures (i.e. cropland losing more than 0.1mm of topsoil per year) for the five woredas of Lay Gayint, Tach Gayint, Mekit, Dawna Delanta and Wadila was 16 percent, 38 percent, 10 percent, 9 percent and 9 percent respectively. The CSA Agricultural Census (2003) indicates that approximately 57 percent of farmers in the woredas

in the two Watersheds have adopted soil and water conservation measures on their farmland.

However, one of the main causes of soil nutrient depletion: burning of dung and residues and grain removal from fields without replenishment continue.

5. IDENTIFICATION OF WATERSHED MANAGEMENT INTERVENTIONS

5.1 Review of Current Interventions

5.1.1 Overview of current watershed management interventions

Watershed management for medium to large watersheds and sub-basins is a new activity currently being launched by MoWR. The ENSAP fast track watershed management projects are a first step towards implementation at this level.

Productive Safety Net Programme (PSNP): (FDRE, 2004) The objects of the PSNP are to provide transfers to the food insecure population in chronically food insecure woredas so as to prevent asset depletion at the household level and create assets at the community level. Through the programme block grants are provided to woredas for a range of activities including (i) soil and water conservation, (ii) water harvesting, (iii) irrigation, (iv) feeder roads, and (v) agricultural packages. The programme is complementary and has linkages to other programmes including the Food Security programme, Emergency Drought Recovery programme, Integrated Food Security projects. All five woredas in the Jita Delineated Watershed are included in this programme.

Watershed protection for some of the small dams has been undertaken by REST. "Watershed management" must be seen here as straight-forward watershed protection without provisions for future management or maintenance or utilization of resources created.

From the study reports, it appears that these studies are essentially technical and directional (top-down), with little or any participation of the concerned communities (although socio-economic studies were conducted). While it is assumed that the basic data are good, the designs do not appear to be implementable in their current form; they would need complete re-design based on the participation of the concerned communities. The target areas, although small, both cross Woreda boundaries, which is likely to complicate implementation.

Small-scale **watershed development in micro-watersheds** is practiced by the Regional bureaus and woreda offices of agriculture, with support from several donors, the main one being the WFP supported MERET (Managing Environmental Rehabilitation in Transition to Sustainable Livelihoods) project. This component is discussed in more detail in the following section.

5.1.2 Local Level Watershed Management

Watershed activities have long been centred on soil and water conservation (SWC) activities. More recently, a stronger link has been established with water harvesting, tree plantation and horticultural crop diversification.

Activities are always coordinated through the agricultural bureaus, implemented with help of the population and with donor support in various forms (budget support, financial support linked with technical support, food-aid) and from various parties. Contributions of the population are in the form of manual labour and are compensated in cash or in kind (food rations). Part of the work is still done on a voluntary basis, i.e. unpaid but in mass mobilization campaigns (20 days per year per able person).

The MoARD has designed and launched a **Community Based Participatory Watershed Development** Approach (CBPWD), intended to spearhead the process of rural transformation and the generation of multiple and mutually reinforcing assets. It is now general policy that interventions in soil conservation, water harvesting, afforestation and land rehabilitation should follow a watershed approach.

The principal actor in watershed management is the WFP supported MERET project within the Ministry of Agriculture and Rural development (MoARD). This project, started in 2002, follows on from previous projects supported by the WFP (Land Rehabilitation Project, Project ETH 2488). The project is concerned at farm level with conservation, intensification, expansion of cultivated land, and diversification of income opportunities (WFP, 2005). The Local Level Participatory Planning Approach (LLPPA) developed within this project has gained national acceptance and ownership. The Guidelines on Community Based Participatory Watershed Development (CBPWD) are commonly used, directly or in some modified version.

Vast areas have been ‘treated’ under this programme, usually supported by food-for-work, most particularly the Productive Safety Net programme. The area focus has been food insecure (and generally moisture deficit) Weredas; activities have been largely limited to soil and water conservation measures and area closures. The performance of the biological conservation measures (primarily forestry plantations) has generally not been satisfactory.

5.1.4 Observations and lessons learnt for Watershed Development

(i) Innovative approaches

The better linkage between SWC, water harvesting and agricultural diversification (based on micro-irrigation), introduced by the MERET project, was certainly innovative for the Ethiopian context.

Promising trials of genuine community participation have been practiced in a SNV supported project in Bugna woreda (N.Wolo in Tekeze basin), and in a project of SOS-Sahel in Meket wereda in the far north of the Abbay basin.

(ii) Technology innovation

Some important technology innovations have taken place in watershed treatment. Currently these are at a small scale. The former GTZ-supported Integrated Food Security Project in South Gondar, now coming under the SUN programme, had put the largest possible emphasis on biological measures, both for on-farm conservation and for gully stabilization. Introduction of Vetiver grass was strongly promoted there.

The most substantial change has been the greater emphasis on water resource development enabling the expansion of micro-irrigation, and thus agricultural/ horticultural diversification and commercialization. This change has been introduced by the MERET Project but has now been adopted by most actors. Water resource development (e.g. construction of shallow wells) is a logical step following improved water retention through SWC measures. It proves to be most productive in watersheds where SWC is widespread. An example is the case of Abraha Atsbaha Tabia, in the Northern Zone of Tigray, where long term activities in separate Kebeles have now resulted in an aggregated protection of almost the entire watershed (of some 3,000 hectares).

(iii) Water harvesting

Water-harvesting (e.g. ponds, small earth dams, river diversion) has become an essential ingredient of SWC programmes, although it has known limitations. The ENSAP Watershed management Study (ENTRO, 2003) reviewed water harvesting experiences in Ethiopia and concluded as follows:

- Pond and canal seepage are limiting factors, reflecting problems in design, construction and supervision.
- Inflows from harvesting areas have been less than expected due overly optimistic runoff coefficients.

- Excessive sedimentation is a problem, pointing to need to integrate water harvesting with the overall watershed management.

- Pond water is insufficient for dry season irrigation, and is often actually used for supplementary irrigation in the wet season.

- Water should be used on high value crops, but horticultural crops have high input costs and have limited storage capacity (where markets are thin).

- Water borne diseases (malaria and bilharzias) and safety need to be considered.

- Success was achieved where both technical and social aspects were adequately covered.

(iv) Impacts and implementation efficiency

Local level watershed protection has been undertaken for three decades, at enormous cost. Large areas have been treated now, particularly in Tigray. The NRM Department in Tigray admits that "impacts are not yet in relation to the efforts made through time", but that the achievements are considerable:

- about 25 % of cultivated land treated,
- 200,000 hectares under area closure,
- 300,000 hectares of natural forest being exploited in a proper way.

Improved crop transformation and improved livelihood conditions are also mentioned as main achievements.

Research activities (Mekele University, project's own evaluations, and in earlier days, the SCRP) have shown that SWC has a positive impact in terms of erosion control, moisture retention and land rehabilitation. The Inter-University Cooperation project (IUC) of Mekele University estimates that terracing on cropland produces an average net increase in crop production (including the loss of land) of 3%. Revival of natural springs is also mentioned as an important indicator.

However, the cost efficiency of all the work is rarely questioned. After many years of SWC practice, field observations still lead to similar conclusions:

- SWC implementation follows a blanket approach, structures are often over-designed; no flexibility or refinement in measures can be observed based on varying terrain conditions,

- maintenance is generally inadequate or lacking,

- there is a strong predominance of mechanical, loose rock structures which could be replaced in many places by cheaper, biological measures contributing in the same time to productivity,

- quality control is limited to target fulfilment and is not concerned with optimum impact of measures.

The type of data collected with regard to SWC implementation generally focuses on physical achievements (i.e. length of terracing, seedlings produced, etc). After three decades of massive soil conservation campaigns, it is possible to trace exactly how much food was spent, but it is not possible to say what the impact has been on agricultural production, farm incomes, which areas have been covered (and even covered how many times) and whether the work was carried out in an efficient way.

(v) Some selected cost figures

A few data on average overall costs of micro-watershed treatment are available:

- ENTRO (2006) estimate the average cost of micro-watershed treatment following the CBPWM approach, at about US$180,000 for a watershed of some 200-500 hectares, i.e. about US$ 360-900/ha or ETB 3,000-8,000/ha.

- GTZ has calculated an average cost of US$ 115,500 (ETB 1 million) per micro-watershed, which is in the same order of magnitude (two thirds) of the previous estimate by King and Kasahaye.

- The evaluation report of Irish Aid activities calculated a cost of ETB 3,000 /hectare (85 % of which is SWC and gully treatment) for investment cost only and excluding project overheads. The same document reports the possibility to recover the program investment costs of ETB 1.8 million within 3 years.

- The IUC project (Mekele University) gave as a rough estimate an average cost of about ETB 5,000/hectare, to be repeated every 10 years.

- The MDG needs assessment document estimated unit costs of watershed treatment to amount to an average of 2,500 – 3,000 ETB/ha (based on standard WFP work norms, including materials and equipment but excluding project overhead costs).

The above indicative figures all relate to activities compensated in food or in kind, and are probably based on the same standard work-norms developed by MoARD

and WFP. The variation is probably related to different average intensity of works assumed, and different proportions e.g. of hillside closure (relatively cheap) and gully treatment (expensive).

The dominant role of food aid is also expressed in WFP project budgets. In the overall budget for the 2003-2006 MERET programme, the combined cost of food commodity and of local transport/storage/handling amounts to US$ 40.7 million, which is 94 %, of the total WFP contribution plus 92 % of GOE contribution. Other direct operational costs (staff, training, capacity building, M&E, equipment and materials) take only 6 % of the WFP contribution, and 8 % of the GOE contribution.

(vi) Positive experiences but limited up-scaling

The recent document on a joint EEFPE/IFPRI stakeholder analysis (Gete Zeleke et al., January 2006) reports that “enormous efforts in massive land rehabilitation were undertaken since the 1980s, with the aim of arresting land degradation and improving rural livelihoods in the country. Despite these efforts, there has been limited success in controlling land degradation, in comparison to the efforts applied, the organizational structure and the resources mobilized. The problems with past conservation efforts were largely rooted in a lack of understanding of the important interface between resource conservation and agriculture, and of the factors that motivate farmers to invest in sustainable land management (SLM) over the long run.

(vii) Building on the Past

The MERET/WFP project has been operating some 25 years (under different names), and offers a wealth of experience. The approach to this project has changed considerably over the years, reflecting experience of what does and does not work, and paralleling changes within government, as outlined above.

Over the last 10 years, paralleling the decentralization process, the project has been re-designed to a ‘bottom-up’ project, owned and driven by communities. Target areas have been reduced to micro-watersheds – or community watersheds – on a scale of 200 to 500 ha. And the focus has shifted from protection – conserving the resource base – to production and improvement in rural livelihoods. This is in line with national policies and with international experiences. Most organisations working in watershed management now follow similar practices.

Overall, the various experiences provide guidance on what is implementable and at what rate. The 2005 guidelines Community-Based Participatory Watershed Development build on local experience and provide a reference to the projects.

The experiences in watershed management (including water harvesting) suggest a few key considerations for future projects:

- Community ownership and institutional structures are basic to project success
- The 'building blocks' for watershed management should be community watersheds in the 200-500 ha range
- Larger projects (e.g. the current project) should be seen as target areas for coverage by 'micro-projects' at the 200-500 ha level i.e. should be assemblages of micro-watersheds grouped and linked at a broader scale
- Conversely, larger projects can 'add value' by allowing physical integration of the micro-projects and by allowing a more holistic approach than possible at the micro scale
- Projects benefit from an 'integrated' approach. However, concepts on 'integrated' vary and rarely extend beyond agricultural production
- Due to the diversity of landscape and socio-economic conditions in Ethiopia, interventions need to be adapted to local conditions rather than following standard models.
- Implementation is easiest in areas offering most immediate benefits, i.e. in moisture-stressed areas. By extension, water conservation offers more immediate and visible benefits than soil conservation.
- Extensive support by Development Agents is required for project implementation. Optimum support levels are around 3 diploma level development agents per development centre. This has important implications for project implementation and management. The scale of the proposed projects will make major impositions on the capacity of the Regional Bureaux of Agriculture. Future projects may need to either provide support to these bureaux or to have a separate implementation management (albeit linked to the bureaux)
- Payment (food or cash for work) will most likely be required for a large part of project implementation.
- A key issue yet to be resolved is how to 'scale up' from the micro-watersheds to larger areas – a question to which upcoming watershed management projects should make an important contribution.
- It is difficult to sustain watershed management on increased productivity of food grains alone; diversification for cash crops adapted to local markets or other income generating activities is an essential part of the mix. This emphasizes the importance of markets and marketable products to offset the cost of investment in conservation.
- Key constraints are institutional capacity limitations at Regional, Wereda and Kebele/community levels; free grazing of livestock; the requirement of external support (generally food-for-work) to support community mobilisation; and lack of maintenance after completion of the project.

- There are no evaluation data available on post project benefits as compared to baseline situations. Most observers agree that, within the moisture deficit and food insecure Weredas, crop and forage production benefits are positive. MERET has undertaken an economic analysis which suggests that activities are economically viable.
- Despite the previous point, there is limited evidence of community driven watershed management and self-replication is limited. Efforts have been, and remain, primarily supply-driven by government and donor agencies, and supported by payment (food or cash for work).

(viii) Integrated watershed management

Considerable experience has been built up in the Region on the technological aspects of integrated watershed management. In particular there has been an increasing emphasis on biological measures using where possible locally available materials and away from physical structures. Biological measures include those under the headings of better “land husbandry”, “crop husbandry” and “livestock husbandry”.

At the small dam watershed level, technical interventions will need to be developed in an integrated manner that takes into account the nested nature of watersheds and the hydraulic system. Small dams need to be integrated into other components of the watershed management plan with watershed management interventions being implemented in the upper micro-watersheds and moving progressively downstream. Similarly, external water-harvesting measures will need to be similarly planned and executed. In-field water harvesting measures will need to be integrated with soil fertility enhancing measures if full benefits are to be achieved.

Proposed interventions will need to range beyond soil and water conservation technologies and include inter-linked technologies related to crop, animal and tree husbandry.

A thorough understanding of the land use systems and their inter-linking components will ensure that any potential technical interventions will not adversely impact on and where possible support the other components in the system.

5.2 Project Stakeholders

Primary Project Stakeholders: **These include the following:**

- Rural agricultural households residing within the Jita Watershed with land holdings for cropping and access to communal grazing and forested lands;

- Landless rural households residing within the Jita Watershed who have access to communal lands for collection of fuelwood, medicinal herbs and water;

- Staff of the Bureau of Agriculture and Rural Development who will receive technical and logistical support.

Secondary Project Stakeholders: include:

-

- Operators of the Millennium dam who will benefit from reduced rates of sedimentation in the reservoir.

5.3 Watershed Management Planning Framework

5.3.1 Strategic Considerations

The principle of integrated watershed-based development is the declared policy of Government and thus provides a suitable guidance for watershed management. Rehabilitation and protection of land and water resources are at the centre providing the basis for sustainable development.

It is known from lessons learned that watershed management planning can be undertaken at various levels, but **implementation has to take place at grass root level**. The conventional options for purely administrative and regulative solutions to land and water use problems appear to have reached their limits. It is becoming increasingly apparent that a more consensual approach to natural resource management is a more attractive solution for harmonizing interests of resource users, managers and regulators. Allowing and facilitating local communities to develop their own resource management systems is proving a more effective, economic and efficient approach than central or regional government control.

Sustainability of achievements requires ownership of its users and these are the local communities. A sense of ownership is created only through their **genuine participation** in planning and decision making. Decision making should not be the privilege of nominated leadership only. Motivation for genuine participation can only be based on **tangible benefits** and a sustained resource-base. Many benefits can be achieved through integrated watershed management for improvement of livelihoods.

The requirement of genuine participation sets preconditions to the organizational structure and approach of watershed management projects. Emerging lessons from watershed management projects in Ethiopia and elsewhere include the following:

- A participatory project cannot be target-driven right from its start. In its initial phase, the project design should focus on the process of establishing participation rather than on seeking to achieve physical targets. It also requires appropriate institutional development at community-level; appropriate in the sense that institutions are created (or strengthened if already existing) to respond to the emerging needs, and may therefore differ from place to place. Needs depend on priorities in watershed management activities, functionality of existing traditional institutions and prevailing group dynamics within a community. A standardized institution for all communities (such as a Kebele watershed committee) will be an imposed one and will undermine the feeling of project ownership in the community.

- It is important to strive for a simple organizational and coordination structure, based on existing structures and clearly stipulating linkages with higher levels (need for support.

- Institutional arrangements are required that allow for multi-disciplinary and multi-agency collaboration and across ministries, contributing to breaking through single sector approaches.

5.3.2 Technical Interventions: Levels and boundaries of analysis

It is often stated that a watershed approach to development conflicts with the administrative and political reality and that their boundaries rarely coincide. Implementation activities are initiated and carried out within an administrative jurisdiction. This argument is countered by pointing out that the physical world has no respect for administrative or political boundaries and activities in the upper part of a watershed can serious impact on people in the lower parts in another administrative or political jurisdiction. In practice the two approaches need to be complementary and an administrative/political realism should be superimposed on watershed planning to obtain administrative support and action.

Watershed management is a system-orientated concept with a holistic approach to problems and potentials. For this reason it will be necessary to identify “bundles” of interventions that complement each other where possible in a synergistic way. Given the cross-sectoral, sustainable livelihoods and poverty focus of the Watershed Management CRA with its stated objective of tackling the underlying problems of natural resource degradation in the East Nile Sub-basins, many of these “bundles” will comprise technological, institutional and policy components.

Most technological interventions are targeted at the agricultural[4]/pastoral household and rural community level although some are targeted at medium scale watersheds. The organizational, institutional and policy interventions/recommendations are targeted at the higher administrative and political levels.

In addition, strategic choices in development have to be made to achieve the following:

- balanced identification of priority areas for watershed protection, based on an agreed set of criteria;

- dual attention for both rehabilitation of degraded food-insecure areas and timely protection of strongly eroding high potential areas,

5.3.3 Technological Interventions: Basic Considerations

Considerable experience has been built up in Ethiopia, the Eastern Nile Region and elsewhere in the world on the technological aspects of integrated watershed management. In particular there has been an increasing emphasis on biological measures using where possible locally available materials and away from physical structures.

A thorough understanding of the land use systems and their inter-linking components will ensure that any potential technical interventions will not adversely impact on and where possible support the other components in the system.

At the micro/mini watershed level technical interventions will need to be developed in an integrated manner that takes into account the nested nature of watersheds and the hydraulic system. For example the development of small dams should be integrated into other components of the watershed management plan with watershed management interventions being implemented in the upper micro-watersheds and moving progressively downstream. Similarly, external water-harvesting measures will need to be similarly planned and executed. In-field water harvesting measures will need to be integrated with soil fertility enhancing measures if full benefits are to be achieved. Proposed interventions should range beyond soil and water conservation technologies and include inter-linked technologies related to crop, animal and tree husbandry.

[4] Included here are tenant farms on government irrigation schemes, farm workers on large-scale mechanized farms and as well as smallholder farmers.

5.3.4 Targeting Interventions

(i) Development Domains

In Ethiopia the MoARD Guidelines for Watershed Management provide details of many land management options. The suitability of these options depends on the bio-physical and socio-economic characteristics of a particular area. Given the large number of agricultural/pastoral household units and their extremely wide range of environmental, social and economic circumstances, it is necessary to stratify households and communities into some form of spatial unit. For this reason it has been necessary to sub-divide the three Sub-basins into spatial units of similar environmental, socio-economic (include market access) conditions and related problems and potentials. These form the basis of "**Development Domains**" (Pender et al. 1999). These have a common set of interventions, impacts, costs and benefits.

Three criteria have been used to define the Development Domain: (i) agricultural potential, (ii) accessibility to markets, and (iii) Highland or Lowland.

Agricultural potential is defined on length of growing period (LGP) and rainfall variability (CV). Thus high agricultural potential woredas have LGP >6 months or 4 months with rainfall CV <100 percent. Low agricultural potential woredas have an LGP <3 months or 4 months with rainfall CV >100 percent. Medium potential woredas lie between these values. With LGP of 150 to 179 days both watersheds lie within "Medium Potential" areas.

Access to markets is also a key factor in targeting interventions. Areas with good access to markets have advantages in terms of producing high value perishable crops, livestock intensification and greater possibilities for off-farm income. Conversely, areas remote from markets will need to focus more on higher value but easily transportable commodities such as small livestock and apiculture. Good market accessibility is defined as being within 4 hours vehicle travel time to a town of >50,000. In the Project Area this refers to Makelle. Enderta, Hintalo Wajirat and the higher parts of Seharte Samre Woredas are within this range. The lower parts of Seharte Samre and Tanqua Abergele woredas are outside this range.

Highland and Lowland are defined as >1500 masl or <1,500 masl respectively. Pender at al. (1999) used population density as their third criterion. However, in Ethiopia the Highland/Lowland distinct covers not only population density but a range of socio-cultural and environmental factors.

Within each Development Domain are a number of Farming Systems that have been described in para 3.3. The distribution of In terms of targeting specific land management technologies the available evidence suggests that there is a clear distinction between frequently moisture stressed and areas that are infrequently

stressed. The two Watersheds are located within “Frequently Moisture Stressed” areas.

The Project area lies within one Development Zone :

Highland: Medium Agricultural Potential: Low Market Access

- Wheat-Barley System above 2,500masl
- Teff-Maize-Sorghum-Finger Millet System between 1,500 and 2,500 masl

5.3.5 Technological Interventions by Development Domain

HIGHLAND: Medium Agricultural Potential (Medium moisture stress risk) Poor market Access: Located above 1,600masl

(a) Overall Strategies: High Market Access

The opportunities for marketable agricultural development in this Domain are good with their good access to the Makelle market. Use of external inputs is likely to be profitable to farmers (Pender et al., 1999). Marketable agricultural products can include low value, high volume and perishable products. These could include crops such as tomatoes, potatoes, cabbage, milk and dairy products and honey production. The strategy for own-consumption agricultural production should be to ensure food security.

(b) Overall Strategies: Low Market Access

The opportunities for marketable agricultural development in this Domain are good with their good access to the Makelle market. Use of external inputs may be privately unprofitable (to farmers) but may be economically cheaper than importing food into the area (Pender et al., 1999). Marketable agricultural products will be limited to high value, low volume and non-perishable products. These could include crops such as onions and peppers, small livestock such as sheep and goats, and honey production. In parts of Ethiopia improved goat production by women has proved very successful, particularly for women-headed households. The strategy for own-consumption agricultural production should be to ensure food security. The long-term Government strategy is to improve accessibility to markets through feeder road and farm to market road construction and market access will improve.

(b) On-farm Interventions

Improved Soil Husbandry: The use of manure and compost increases soil organic matter and nutrients and increases water holding capacity. This intervention requires sufficient quantities of manure and residues, and labour. These interventions need to integrate with improved animal husbandry interventions.

Chemical fertilizer: This will be confined to areas with good market access and to cash crops (teff, vegetables).

Improved tillage: Contour ploughing assists in reducing runoff and soil movement.

Stone terraces: These are more efficient in retain soil moisture that bunds or grass strips. In many parts of the two Development Domains surface stones are readily available. The high rate of adoption indicates that many farmers appreciate their use for soil and soil moisture conservation.

On-farm Forage Development: Backyard improved forage: forage grasses (e.g. including but not limited to *Pennisitum purpureum*, *Panicum maximum*), tree legumes (*Leucaena leucocephala*) and pigeon pea. The focus of the intervention is on improving small ruminant productivity.

On-farm Tree development: In areas with good market access trees for timber and fuelwood as well as fruit trees (citrus, avocado and mango) would be promoted. In areas with poor market access on-farm tree production for timber will be for own consumption only. However, there is the potential for fruit trees as citrus, avacados and mangos will bear transport costs.

On-farm Water Harvesting: Rainfall is variable and there is potential for water harvesting interventions to provide domestic and livestock water supplies as well as backyard irrigated vegetables.

(c) Interventions on Communal Lands

Cut-off Drains: A pre-requisite for in-farm soil conservation measures is a cut-off drain above cultivated areas. Even by themselves they can reduce in-field run-off and soil movement.

Road and track drains: run-off from roads needs to be controlled with small check dams and safe outlets to streams.

Gully Stabilization: This requires the integrated stabilization of both the gully and its watershed area. This will require a combination of livestock exclusion (in

both watershed area and gully), and vegetative and structural measures (check dams, etc) within the gully. This intervention can be integrated with a communal forage development programme.

Communal Forage Development: To be effective and sustainable this best undertaken at the sub-kebelle (tabia) level. This intervention usually requires some form of area closure with cut-and-carry, or controlled grazing or controlled hay production and harvesting. The site of the intervention can vary from steep and degraded hillsides, poorly drained valley bottoms, and stream edge buffers. A key object is to reduce livestock movement. The process of natural re-generation can be supplemented with over-sowing of herbaceous (*Pennisitum purpureum*, *Panicum maximum*) or tree legumes (*Leucaena leucocephala*) and pigeon pea but this increases costs. The intervention can also be integrated with communal tree production.

Small-scale Supplementary Irrigation: For high value non-perishable marketable crops (onions, garlic, peppers) using supplementary irrigation for maximum area (given good storability season price fluctuations are small).

(d) Other Strategies

Honey production: In densely populated areas where land is short honey production is not affected by land or cash constraints. Improved hive can substantially increase production.

5.4 Other Strategic Interventions

5.4.1 Improving Rural and Urban Domestic (traditional/biomass) Energy Systems.

The focus here is on domestic biomass (or “traditional”) energy sources. “Modern” energy sources are considered only in respect of their role as substitutions for biomass sources.

The reason for this focus on biomass energy is because of its very large contribution to household energy consumption, even where modern energy sources (electricity, LP gas, kerosene) are available. This is because a large proportion of household energy is used for cooking and the relative total costs of using biomass fuels for cooking is often lower than modern fuels, particularly when the capital costs of modern energy stoves are taken into account. The widespread and increasing total consumption (with rising population) of biomass fuels has obvious implications for vegetation cover and land degradation. The continued use of biomass fuels and emissions of smoke and corrosive gases in enclosed kitchen spaces also have very important implications for the health of women and children.

Many recent studies of rural (and to a much lesser extent urban) energy consumption have revealed an often complex spatial and seasonal patterns to the various biomass fuels consumed (wood, charcoal, crop residues and cattle dung). Generally there is a clear distinction between rural and urban household consumption patterns with the consumption of a higher proportion of modern energy, and within biomass fuels of charcoal. Except in some parts of Tigray Region, there is virtually no consumption of charcoal by rural households in Ethiopia.

WBISPP (2005) surveys indicate that women and girls are most involved in collecting biomass (mainly wood) fuels. They spend on average 6 and 3 hours per week respectively collecting biomass fuels, compared with one and half hours per week for men and boys. Women spend an additional 14 hours a week transporting biomass fuels. Boys and girls spend on average 6 hours and men 2 hours per week transporting biomass fuels. The burden of collecting and transporting biomass fuels involves considerable energy - most particularly on children and women. This has negative impacts on nutrition. The considerable time spent on collecting and transporting fuel means less time for other activities (child rearing) and rest. In addition, women and children are exposed to natural hazards and injury.

A number of strategies are proposed. In summary these are:

Improved Mitads: The annual reduction in wood use for mitad baking is 20%.

Lakech Charcoal Stove: publicity campaigns by Regional Bureaus of Rural Energy to maintain the momentum of stove adoption.

Improved ceramic '*gounziye'* Stove with an annual fuelwood saving of 30%.

5.4.2 Improving Rural-urban socio-economic linkages in the context alternative livelihoods.

The proportion of households dependant on agriculture in Ethiopia is 85 percent although the contribution of agriculture to the country's GDP is only 45 percent and declining, with the Service and Industrial sectors providing the remaining and increasing proportions. Much of the latter's activities are taking place in the major urban centres, but also in the small and intermediate centres.

Experience in Ethiopia and elsewhere suggest a number of possibilities for small and medium sized urban centres (Barret et al. 2001, World Bank, 2004). These include:

- Increasing rural agricultural income by acting as demand and market nodes for agricultural produce from rural hinterlands.

- Reducing costs and improving access to a range of public and private services and goods from within and outside the immediate region by acting as a centre for production, processing and distribution of goods and services to rural hinterlands.

- Becoming centres for growth and consolidation of non-farm economic activities and employment for rural residents through the development of small and medium size enterprises or the relocation of branches of large private or public enterprises.

- Attracting rural migrants through the demand for non-farm labour.

A study on employment and labour mobility in Ethiopia RESAL-Ethiopia, 1999) concluded that migratory labour is an important source of additional income for poor rural households and likely to play an increasing role as a coping mechanism for households facing food insecurity. It noted that little attention has been devoted to this topic than hitherto. Another study in Ethiopia (Berhanu Nega, 2004) also noted that the development of the non-agricultural sector in general and the issue of urbanization in particular should be taken very seriously. The study questioned whether development of the agricultural sector by itself could serve as the engine of growth for industrialization.

A number of key strategies have been identified:

- Develop and improve access to markets through improved road and other forms of communication (e.g. telecommunications);

- Improve access to capital and credit sources;

- Provide basic technical skills (e.g. bricklaying, carpentry, etc.) to improve employability;

- Provide support to traders through improved working capital and credit (they provide the link between farmers and non-farm activities and between local, national and international markets).

Together with accessible markets, access to credit and input supplies are main ingredients for rural development. Despite a number of efforts in the past, all three are poorly developed, let alone their appropriate linkage. The Millennium Development Goals Needs Assessment Report (Seme Debela et al., 2004) reports, that “consumption levels of fertilizers and pesticides are one of the lowest in the world, and that there is an enormous potential for agricultural development if inputs are made available timely and at affordable prices and acceptable quality and quantity, supported with favourable policy environment.”

As far as credit and inputs are concerned, it is very difficult to get out of the vicious circle of poor farmers, high interest rates of private credit providers, low reimbursement rates, limited government capacity to provide soft loans, and non-sustainability of incidental soft loan systems through projects/programmes with a limited duration. Bad experiences in the past (failures of blanket-wise input promotion not suited to all conditions) have made farmers even more reluctant to take credits for agricultural investments.

The importance of micro credit is emphasized by many. The evaluation report of Irish Aid activities in Tigray mentioned access to credit as the best secondary project benefit to farmers. The Report suggests using part of the compensation in cash for community work for the creation of revolving funds for credit supply services.

Ready-made solutions to the credit/supply issue do not exist but a number of preconditions need to be considered:

- more site-specific extension messages need to be developed as to replace previous blanket approaches,
- extension and input supply systems should become more problem-oriented and demand-driven,
- both the demand and supply side should develop in line with market-oriented agricultural development,
- supply systems should be developed by the private sector and not by government,
- institutional development at grassroots level should be promoted to better represent farmers' interests (appreciation of extension messages, knowledge of the market, negotiating interest rates).

Successful examples of credit supply (e.g. by Menschen für Menschen in Merhabete, Mida and Dera weredas in Abbay basin) are based on short term inputs, like providing a starting capital, with appropriate institutional arrangements for long term application. Institutional arrangements need to be based on existing (banking) structures. Revolving funds created and managed by some NGOs within the framework of their ongoing activities are likely to collapse after phasing out of the project.

A number of overall policy issues have been identified as of considerable importance in relation to local economic development in small and intermediate urban centres (Satterthwaite & Tacoli, 2003). These support and reinforce some of the issues previous identified. They include:

- Transport and communications infrastructure are very important although of themselves will not guarantee local economic development.

- Decentralization has great potential in terms of efficiency and accountability but there are a number of cost and other considerations. In particular there is a need to address: (i) access to adequate financial resources, (ii) a favourable climate for local institutions (e.g. land tenure systems, institutional structure of markets, a broader national development strategy that is export orientated).

- Better integration of local, regional and national planning.

- Capacity building of local institutions especially where decentralization is recent.

- Strengthening of local democracy and civil society to make it easier for poor groups to have their needs taken into consideration.

5.5 Monitoring and Evaluation

5.5.1 Data Gaps

During the preparation of this Report it has become apparent that there is a vast amount of data appropriate for watershed management planning available in Ethiopia. The work of the Soil Conservation Research Project laid the foundations of research into soil erosion. Work at the University of Makelle under the joint programme with the KU Leuven, Belgium is continuing this pioneering work. In the MWR the River Basin Master Plan Studies of the Abay, Tekezi and Baro-Akobo River Basins are a mine of data and information for watershed management. From the MARD the GIS and socio-economic database of the WBISSP also provide a substantial set of data.

However much of this data are quickly becoming out of date or the data which is available is fragmentary in time and place. Two main areas of data that require to be filled are (i) Aggregated maps of all Watershed Management Activities, (ii) detailed landcover mapping, and (ii) long-term and consistent sedimentation data at various scales. These are considered in more detail below.

A third area that requires more research (rather than monitoring) is in the field of poverty and livelihood strategies, and relationships between sustainable land management and determinants of farmers' investment decisions. The substantial work undertaken by Ethiopian Research organizations and the CGIAR group over the past decade is to be continued and will provide much relevant data that will effectively inform policy and strategy development in sustainable watershed management.

5.5.2 Aggregated Maps of Watershed Management Activities

A key element in the success of the Loess Plateau Watershed Management Project in China was a series of maps that recorded areas that had been covered by WSM activities, allowing the effective programming the remaining areas and effective monitoring of areas already covered (ITAD, 2006)).

A key element missing from the WSM Projects in Ethiopia has been the lack of an over map indicating areas that have been covered by the various WSM interventions. Thus, whilst there is considerable data on the thousands of kilometres of bunds and terraces constructed this is never translated into areas of cropland and grazing land conserved with details of their located. There is anecdotal evidence of some areas being covered two and more times with SWC measures.

WSM Maps are generally constructed at the micro watershed level as part of the over micro watershed planning. Existing maps need to be geo-referenced and all future maps routinely geo-referenced. These can then be delineated on an overall Watershed Management Map that can clearly indicate progress to-date and allow critical areas requiring treatment to be prioritized. These maps can be subsequently used in a cost-benefit analysis to determine economic benefits accruing. Using sediment research data from Makelle University (Nigussie Haregeweyne et al., 2005) estimated can made at the micro watershed level on sediment delivery to the drainage system.

5.5.3 Land Use and land Cover

The objective of establishing a land use /land cover monitoring system is to capture the dynamics of landcover and land use in terms of location. Knowledge of the rates of conversion of forest, woodland and shrubland to agriculture and on the specific locations and extents of these conversions would also be a great value in evaluating and reformulating policies and plans on watershed management. In addition the results could be used for monitoring:

- agricultural and rural development;
- domestic bio-energy supply;
- forestry and woodland management and conservation:
- resettlement planning, implementation and monitoring;
- disaster preparedness planning and monitoring;
- water development;

- many other facets of natural resources management and conservation.

A reduction in the resources required could be achieved if a more focused assessment was made of landcover changes in key thematic and geographical priority areas. These might include but be not limited to:

- Assessing landcover changes in key Sub-watersheds as an input to analyzing household energy supply changes, sedimentation rates and changes in flood frequency and the need for developing micro-watershed management plans and activities;

- Assessing changes in forest cover in the forest and woodland areas on the frontiers of agricultural expansion;

- Assessing landcover and woody biomass changes in reception areas where voluntary resettlement is being undertaken;

- Assessing woody biomass changes in areas of high-intensity agriculture to monitor on and off farm tree and shrub cover;

- Assessing landcover and woody biomass changes in areas of active expansion of Commercial agriculture.

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- Assessing landcover changes in valley bottoms and impacts on food security, woody biomass, biodiversity and hydrology.

5.5.4 Erosion and Sedimentation Control

The MWR has an extensive network of gauging stations a substantial proportion of which are capable of obtaining data on sediment load. A three years project "Assessment and monitoring of erosion and sedimentation problems in Ethiopia" came to an end in June 2002. The main activities of the project aimed at establishment of "an operational erosion/sediment monitoring network".
A number of recommendations were made which are of relevance to the present project:

- appropriate monitoring in micro-watersheds still requires substantial, and partly specialised, inputs,

- monitoring should preferably cover the period before, during and after watershed treatment and dam construction,

- substantial capacity building is still required to allow MoWR to become a leading agency in guiding watershed management activities, and

The objectives of such a long-term monitoring programme would be to:

- To develop and test a monitoring methodology for micro-watersheds to provide information on erosion and sedimentation

- To improve MoWR's capacity in monitoring and in guiding watershed management, and

- to elaborate guidelines for monitoring, sustainable watershed management, and impact assessment;

In order to achieve these objectives a number of activities were proposed.

1. Develop a long-term monitoring strategy including
   - consolidation of hydro-sedimentological network operation
   - rational extension of network of benchmark station in large basins
   - integration of project data into national hydrological database
2. Select, procure and supervise installation of equipment for modest network extension or intensification
3. Assist in preparation of Hydrological Yearbooks
4. Design monitoring devices, e.g. flumes, at the outlet of micro-watersheds/ inlet of reservoirs
5. Define related monitoring requirements such as basic meteorological stations, bathymetric surveys
6. Select and procure monitoring equipment for micro-watersheds
7. Supervise the installation of monitoring devices in pilot micro-watersheds
8. Identify qualified partners for monitoring activities in micro-watersheds
9. Develop and support the first phase of a monitoring programme using verifiable impact indicators
10. Assist in the formulation and execution of a balanced pilot implementation programme in pilot watershed(s), including
    . selection and training of an implementation partner
    . implementation of priority sites/areas for watershed treatment
    . formulation and initial implementation of a sustainable watershed management programme
11. Identify possibilities for linking up monitoring of large basins with smaller watersheds (this would be most relevant within the framework of river basin development, and not necessarily at the national level of river basin monitoring)
12. Train and coach staff at federal, regional and local level in network operation (tools and operation procedures), data collection and data dissemination
13. Propose/ carry out a training programme aiming at

- general WSM capacity building in MoWR (internal workshops, seminars with other agencies, formal training, on-the-job training, field work training)
- transfer of know-how in all activities carried out in micro-watersheds

14. Develop guidelines for national network operation, based on lessons learned
15. Develop procedures for dissemination of monitoring data
16. Assist in the development of guidelines for planning of WSM activities
17. Prepare guidelines for monitoring the impact of watershed protection activities

6. Distribution of Benefits

There are a number of local, regional and global benefits:

At the local level degradation of the natural resource base would be arrested, sustainable livelihood development would be supported and levels of poverty reduced.

At the regional level the soil and conservation measures would significantly reduce sediment loads in the river systems contributing to reduced sedimentation in dams and reservoirs downstream, reducing sedimentation in irrigation canals and reducing costs of water purification for domestic and industrial water supplies.

At the global level sequestration of carbon would be increased in wood and herbaceous biomass and also in increased levels of soil carbon. Plant genetic and plant species biodiversity would be enhanced.

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ANNEX 1. BASIC INFORMATION ON THE DELINEATED MICRO-WATERSHEDS

Jhita Watershed

1	**Region:**	Amhara
2	**Zone:**	North Wello
3	**Contact Location:**	North Wello Office of Agriculture
4	**Persons contacted:**	• Cherinet Demeke (NRM Coordinator); • Thsegaye Temesgen (Land Use Expert).
5	**Contact Address:**	Cherinet Demeke, Tel.: 0913 362734
6	**Micro-watersheds major land use/cover (estimate):**	• Cultivate land (50%); • Grass land (25%) • Forest (5%); • Shrub land (10%); • Settlement (10%).
7	**Noticed environmental trends since early 1980s:**	High rate of deforestation; cropland expansion, formation of gullies and bare land, depletion of surface water, erosion, sedimentation and siltation at downstream areas. etc
8	**Major challenges:**	• High rate of population growth; • Water resources depletion and decrease in Lake Fincha'a aquatic resources; • Land degradation due to soil erosion; • Food insecurity and widening poverty; • Shortage of livestock feed, decreasing livestock population; • Animal disease and pest, etc.
9	**Interventions presently underway :**	• Conservation activities through PSNP Public Work program and mobilization of communities for conservation of NRs.
10	**On-going investment projects:**	• No investment except regular conservation activities being carried out in few of the micro-watersheds (with limited scope)
11	**Existence of NGOs operation in the selected micro-watersheds:**	Organization for Rehabilitation and Development in Amhara (ORDA)
12	**Reasons for selecting the micro-watersheds:**	• Most critical areas in terms of erosion; • Origins for siltation and sedimentation downstream; • Higher reduction effect/impact on sediment transport; • Improvement of food security situations and the

		general livelihood system; • Increase in water potential; • Capacity building possibilities, improvement of technical knowledge; • General bio-diversity improvement.
13	**Development potentials in the selected micro-watersheds:**	• Forest; • Feed/forage; • Honey production; • Eco-tourism; • Small scale irrigation; • Improved livestock .management system.