EASTERN NILE TECHNICAL REGIONAL OFFICE

NBI – Institutional Strengthening Project
PROJECT DELINEATION AND PRIORITIZATION

ANNEX 4.3
JEMA 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

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 Delineated Watersheds 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

[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.

natural resource and environmental base of the countries concerned. A number 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:

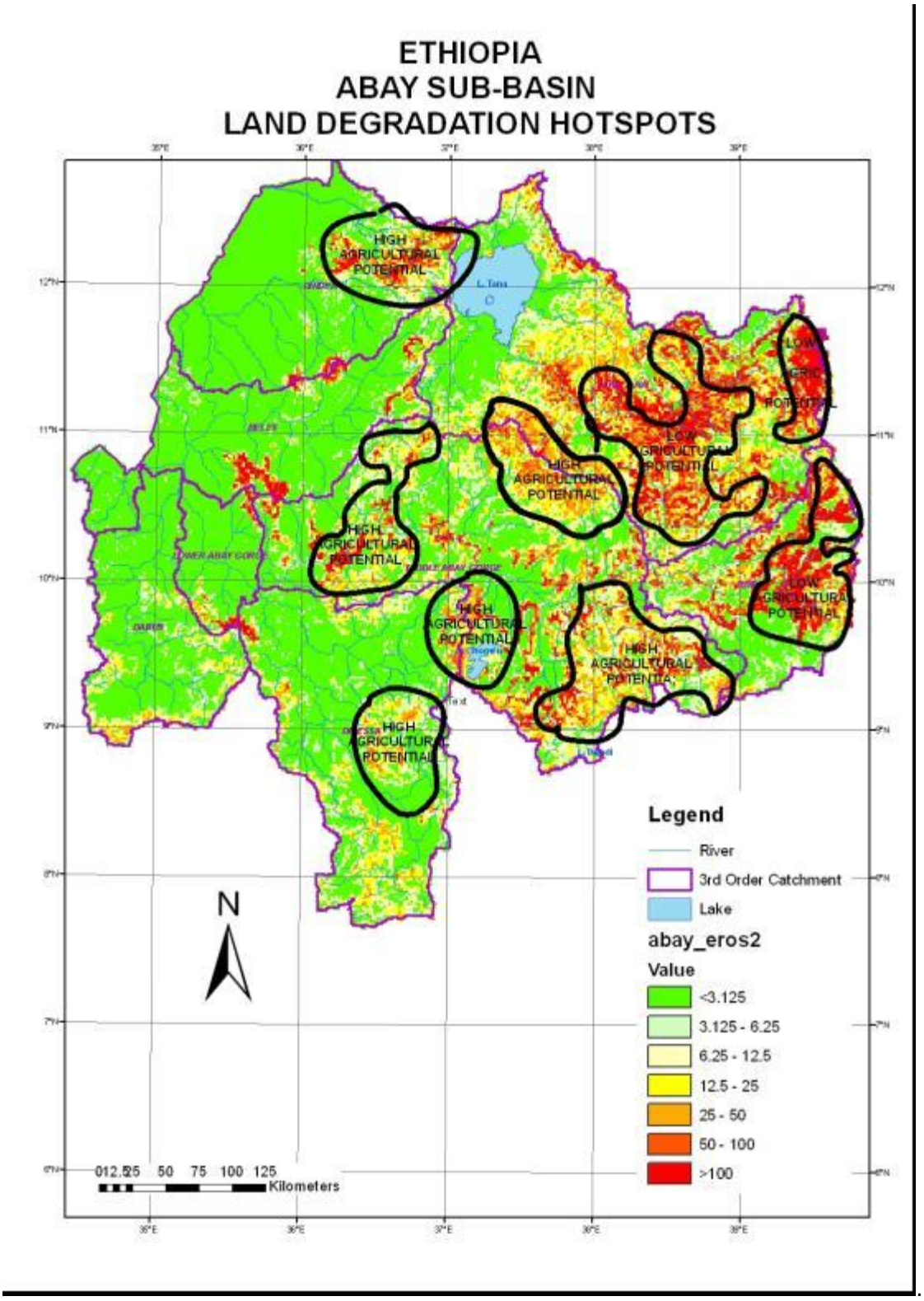
- National Investment Projects
- Cooperative Knowledge Development Projects.

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 Delineated Watershed within Ethiopia. This Project document is concerned with the Jema 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 Jema 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 Delineated Watershed Management

River basins, Delineated Watersheds, 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-basin	5 – 25km^2		Strong
Watershed	25 -2,500km^2	Zamra, Jema	Moderate
Sub-Watershed	2,500 – 10,000km2	Jema 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 Sub-basin level comprises that of the Jema. The Jema Sub-basin comprises the Watersheds of the Jema, Mofer Wiha, Angerwasha and Chacha. The delineated watershed is the Jema. 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 Delineated Watersheds 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)

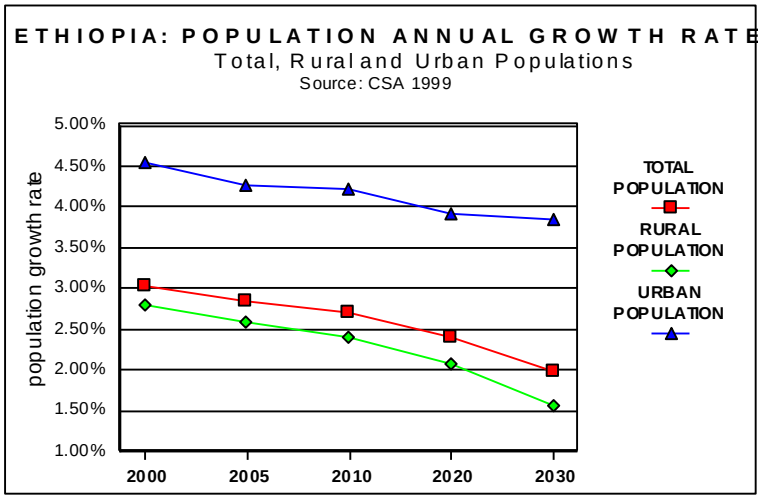
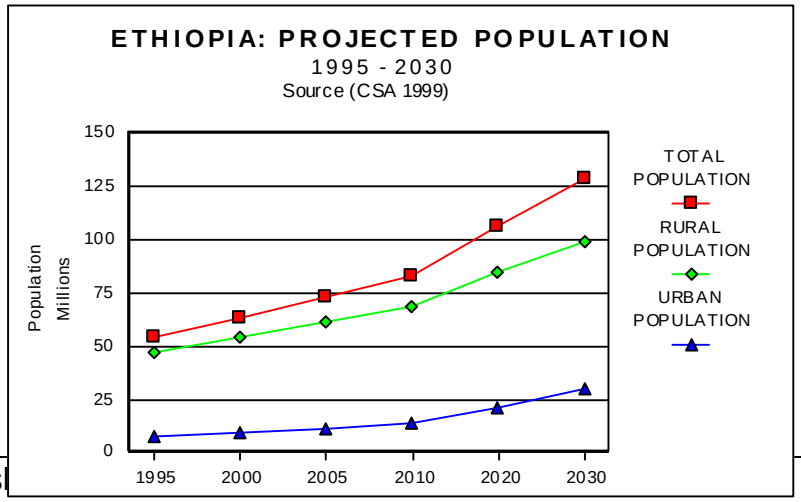
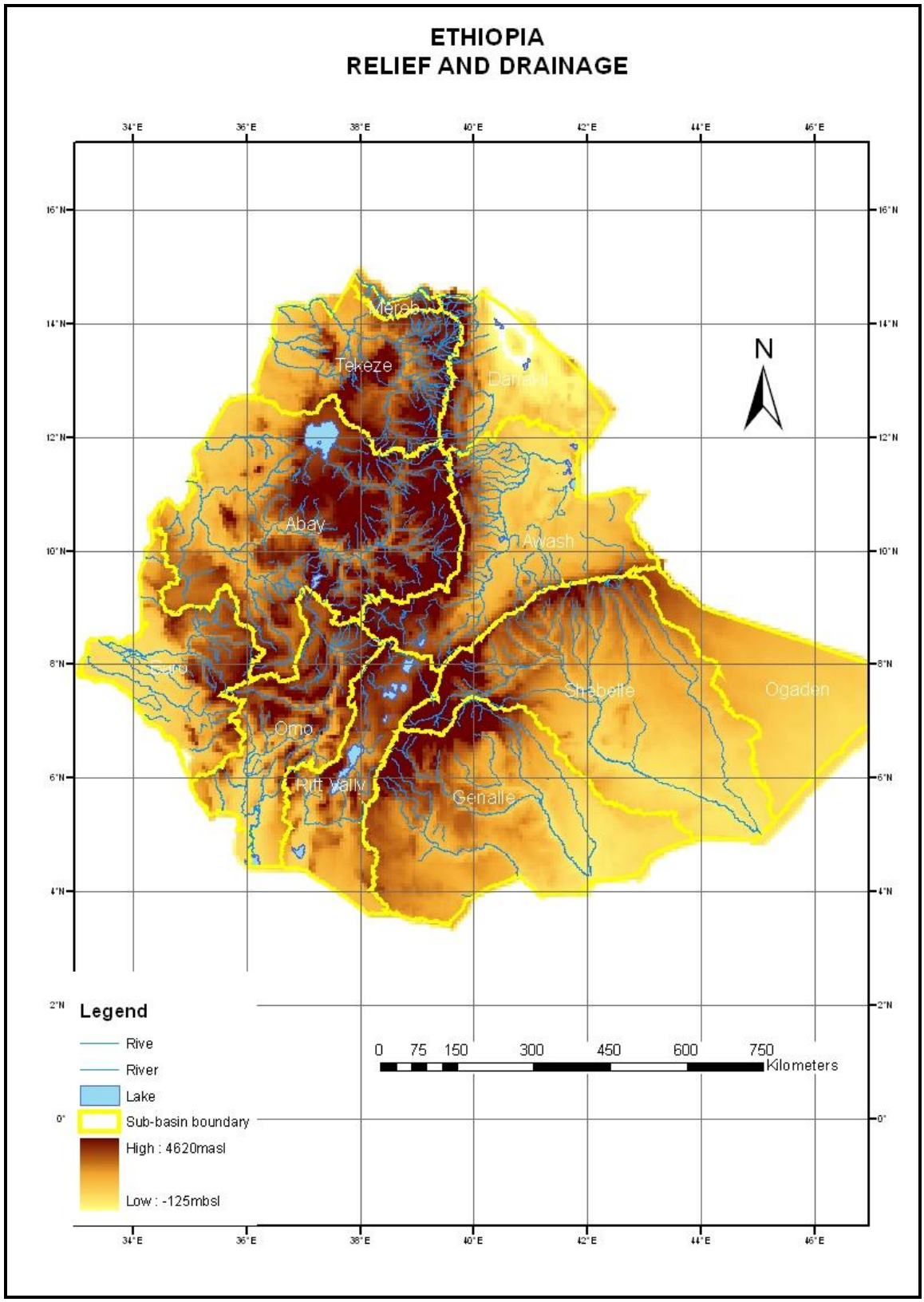


Figure 2. Rural, Urban and Total Population (1995 - 2030)





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.

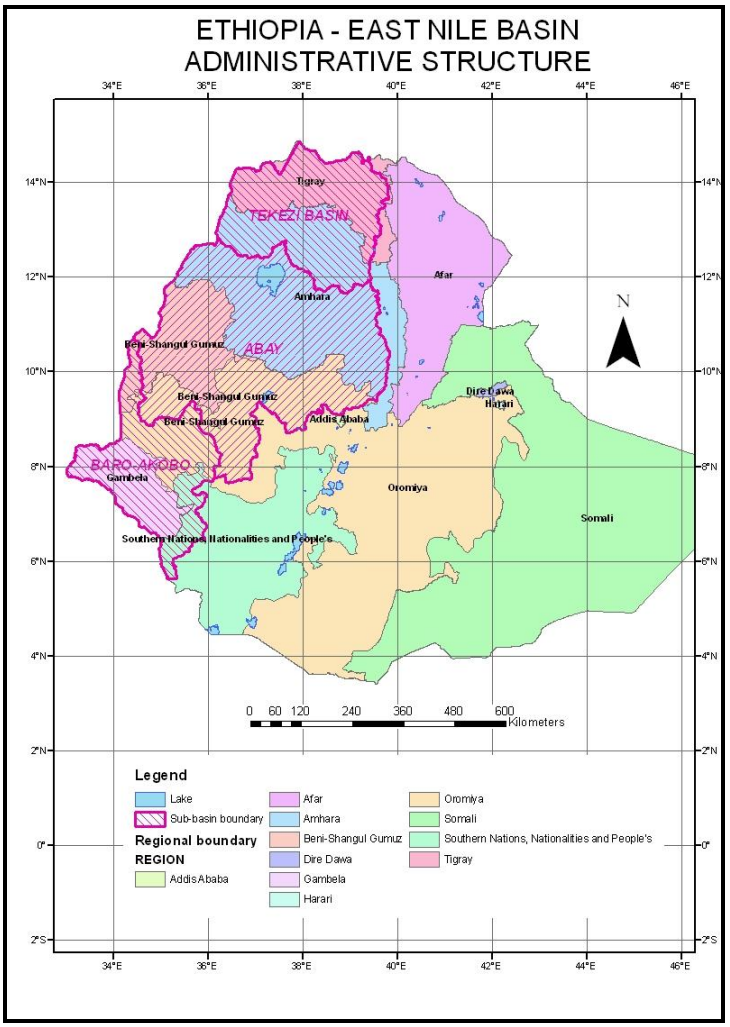
The household energy requirements of this large and fast growing population are supplied almost entirely from traditional energy sources. Biomass energy at the national level provides more than 96.9 percent of the total domestic energy

[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 Delineated Watersheds

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)..

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 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.

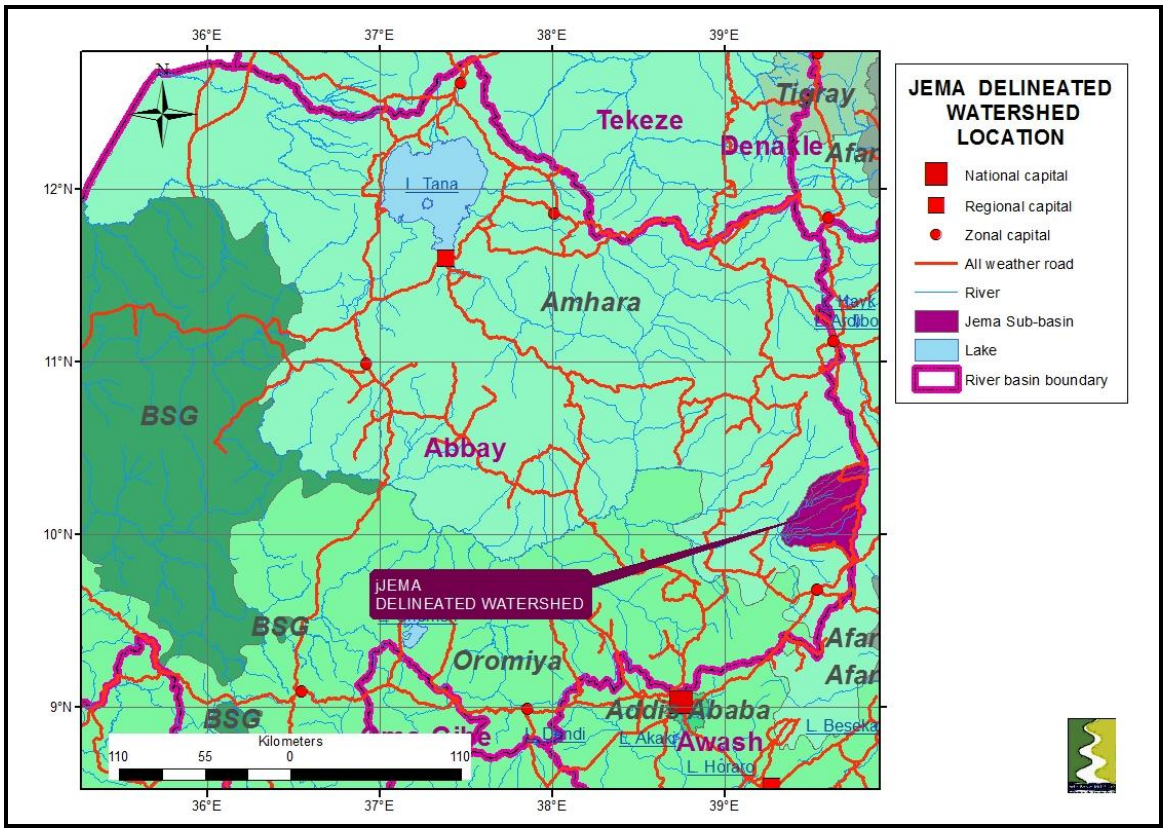
- The Malthusian argument of the negative impacts caused increasing population pressure, and Boserup argument for population induced agricultural intensification may both be correct in the Ethiopian situation. Farmers do respond to population pressure with intensified production, but this may not be 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. JEMA DELINEATED WATERSHED - BIOPHYSICAL AND SOCIO-ECONOMIC SITUATION

3.1 Biophysical Characteristics

3.1.1 Location and Extent

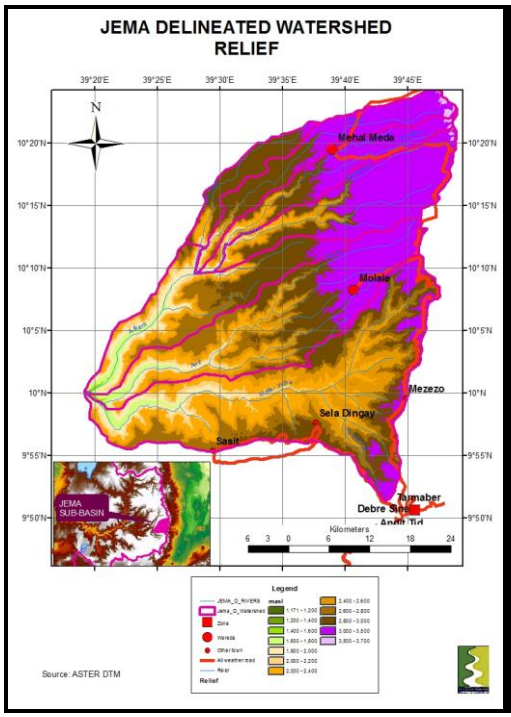
The Jema Delineated Watershed is located in the southern part of the Abbay Delineated Watershed (See Map 5. The area of the Delineated Watershed is 3,241km2. It is sub-divided into 4 Watersheds: Jema, Mofer Wiha, Angerwasha and Chacha.

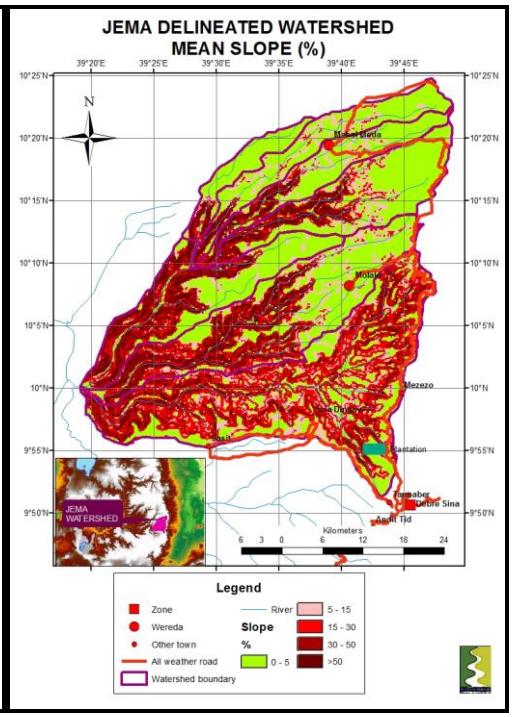


Map 4. Location of Jema Delineated Watershed

3.1.2 Relief and Drainage

The relief comprises a ridge of high ground (above 3,000masl) following the Delineated Watershed boundary on the eastern side. Below the ridge is a plateau between 2,500 to 3,000masl.This plateau is deeply dissected by the Jema River and its tributaries down to 1,2000masl .(Map 5a). Steep slopes are found along the ridge and the deeply dissected rivers and streams whilst the plateau comprises broad flat topped table-lands.





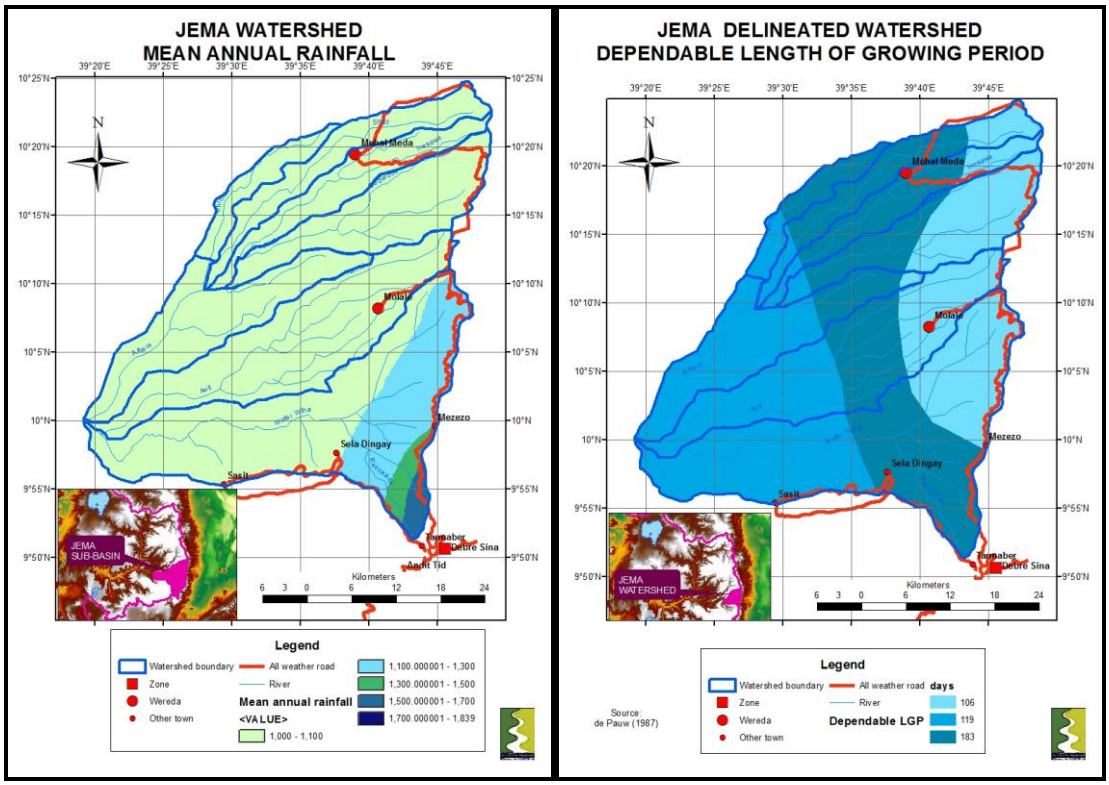
Map 5a Relief. **Map 5b. Slope (%)**

3.1.2 Climate

(I) Rainfall and Length of Growing Period

Mean annual rainfall over the Delineated Watershed (Map 6a) is closely related to altitude with the highest rainfall located in eastern side of the Delineated Watershed (1,500 – 1,800 mm/yr) along the ridge of high ground. Rainfall over the plateau and gorge declines rapidly from east to west down to 1,000 to 1,100mm/yr. The rainfall pattern is bi-modal along the eastern side of the Delineated Watershed, 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.

The dependable (4 years in 5) length of growing period is 183 along the eastern ridge falling rapidly on the plateau to 120 days, but increasing along the western boundary to 170 days (Map 6b).

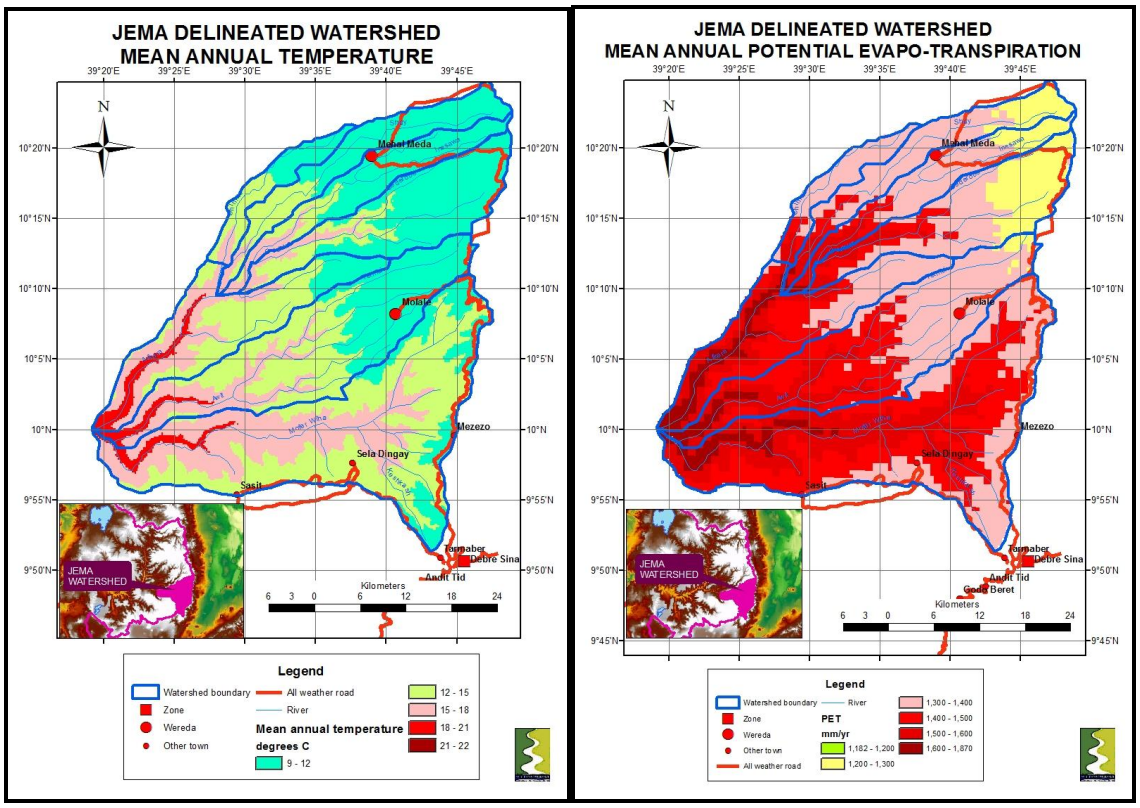


Map 6 (a) Mean annual rainfall **Map 6(b) Length of Growing Period**

(ii) Mean annual temperature and Potential Evapo-transpiration

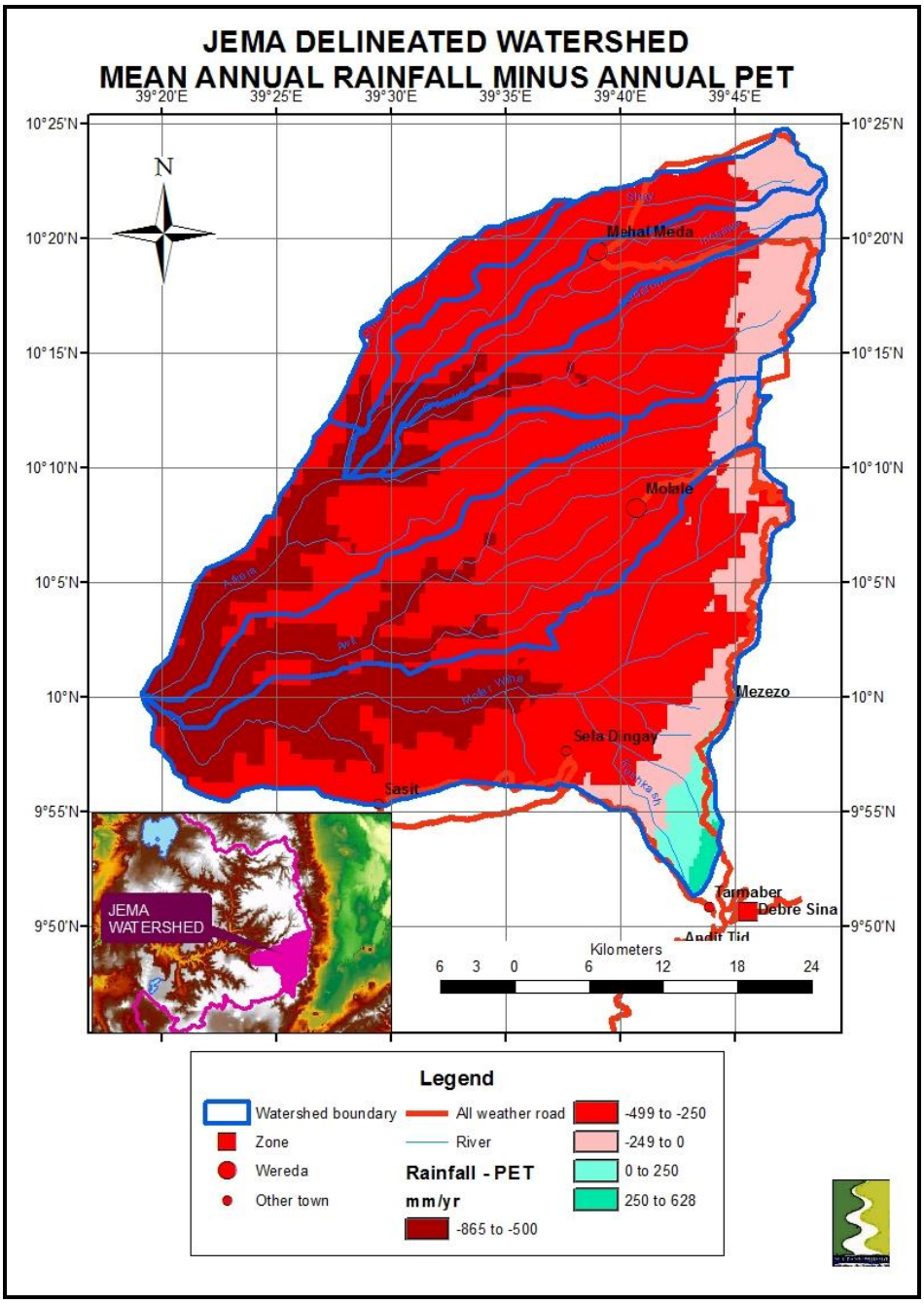
Mean annual temperature (Map 7(a)) is inversely related to altitude. Thus, the lowest temperatures (9 - 15°C) are found at highest altitudes on the watershed on the eastern ridge and the plateau. They rise to 22° C in the gorges..

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 (a) Mean annual temperature (C). Map 7 (b) Mean annual evapo-transpiration.

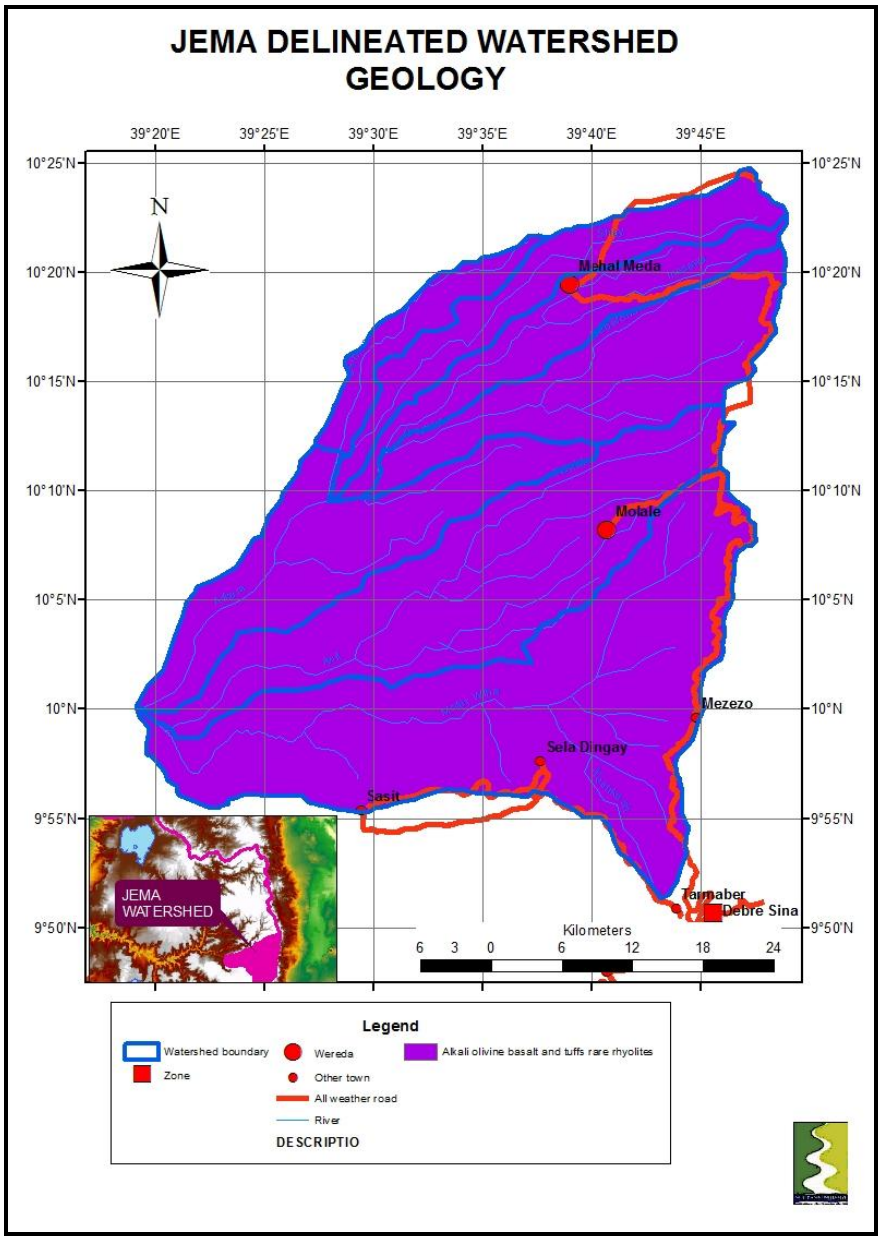
Whilst the annual rainfall levels are moderately high so too are the potential evapotranspiration (PET) rates. Plotting mean annual rainfall minus annual PET indicates negative values over the plateau and in the gorges. Annual rainfall only exceeds PET along the eastern ridge. (Map 8).



Map 8. Mean annual rainfall minus Potential Evapo-transpiration

3.1.3 Geology

The watershed ridge is underlain by (Map 9). On the eastern ridge are rhyolites and tuffs, which cap the main plateau which comprises of trap basalts. In the Gorges are sandstones which overlie limestones.

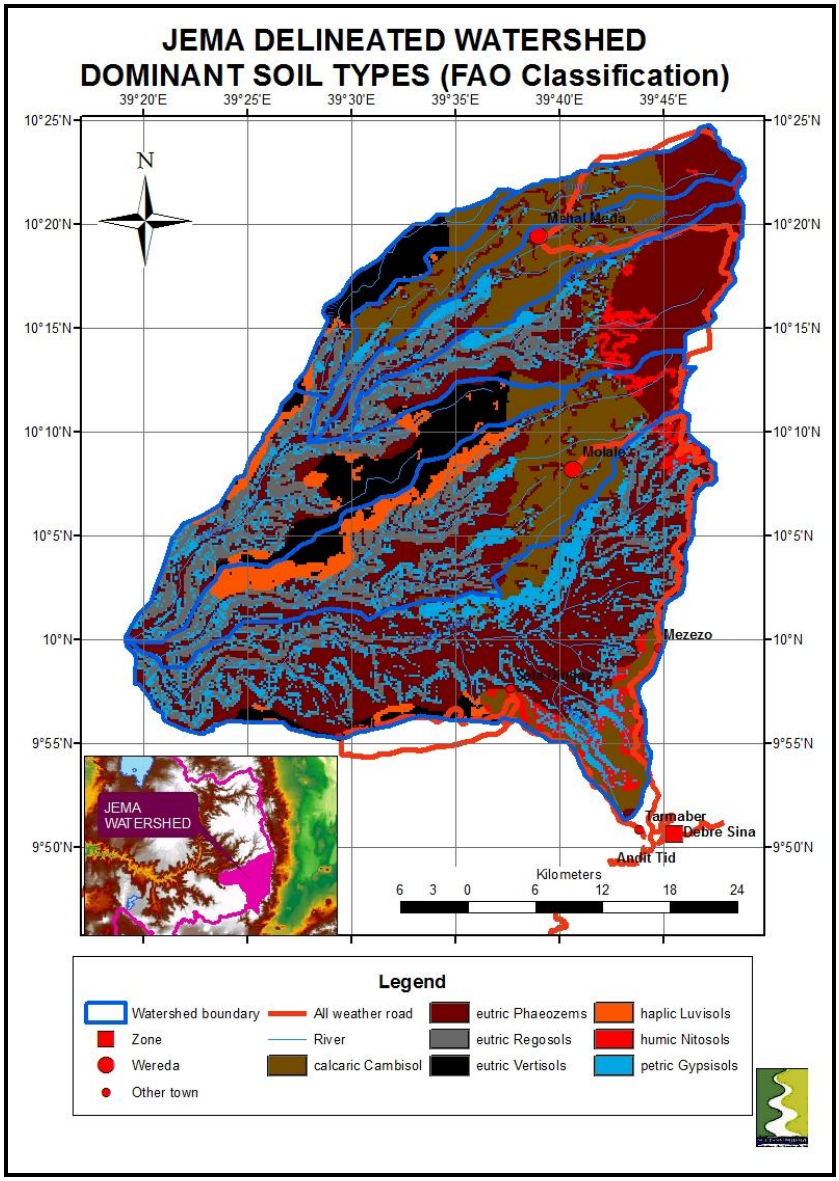


Map 9. Geology

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.

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)

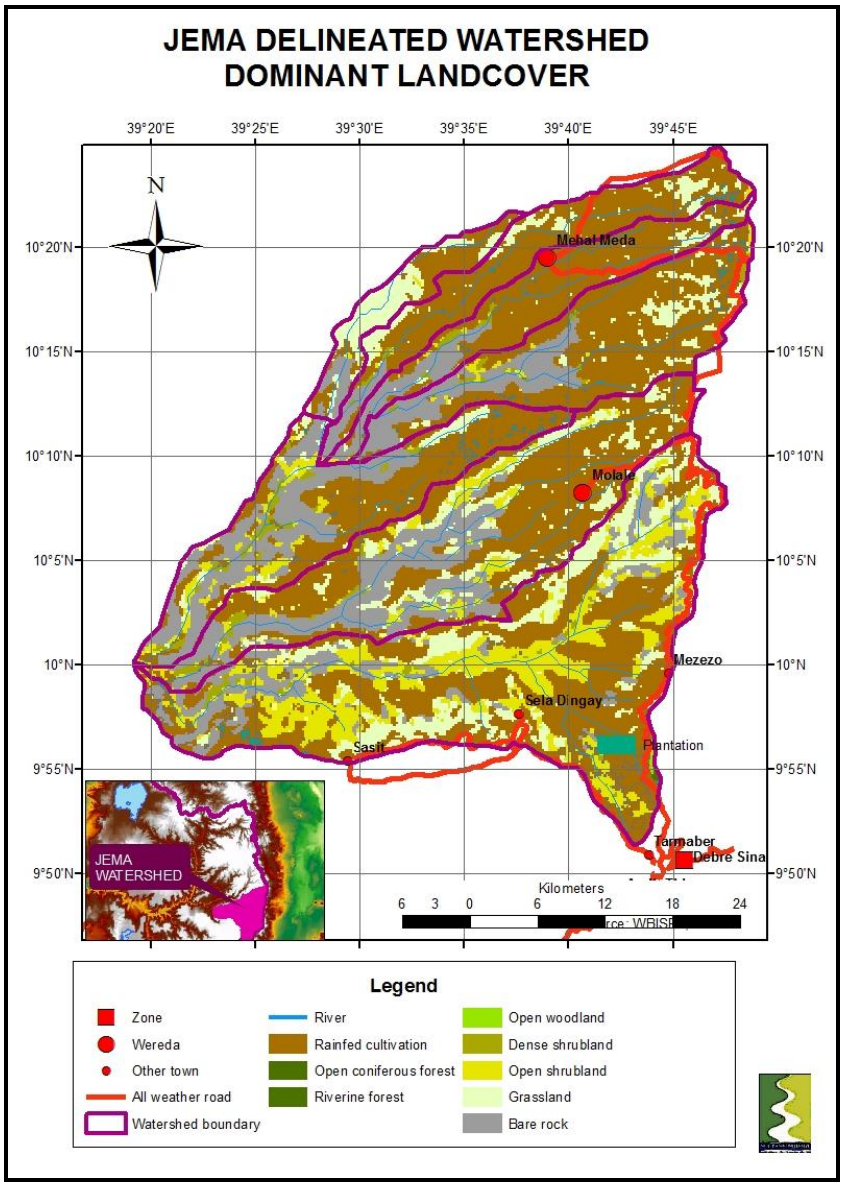
3.1.5 Land Cover / Land Use

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 61 percent of the Delineated Watershed

Table 2. Jema Delineated Watersheds: Dominant Landcover (km2)

Landcover	Area (km2)	Area (%)
Rainfed cultivation	3,558	61%
Grassland	988	17%
Bare rock	778	13%
Open shrubland	419	7%
Bare soil	50	1%
Plantation	7	0%
Open forest	6	0%
Open woodland	1	0%
TOTAL	**5,807**	

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 Delineated Watershed.



Map 9. Dominant Landcover

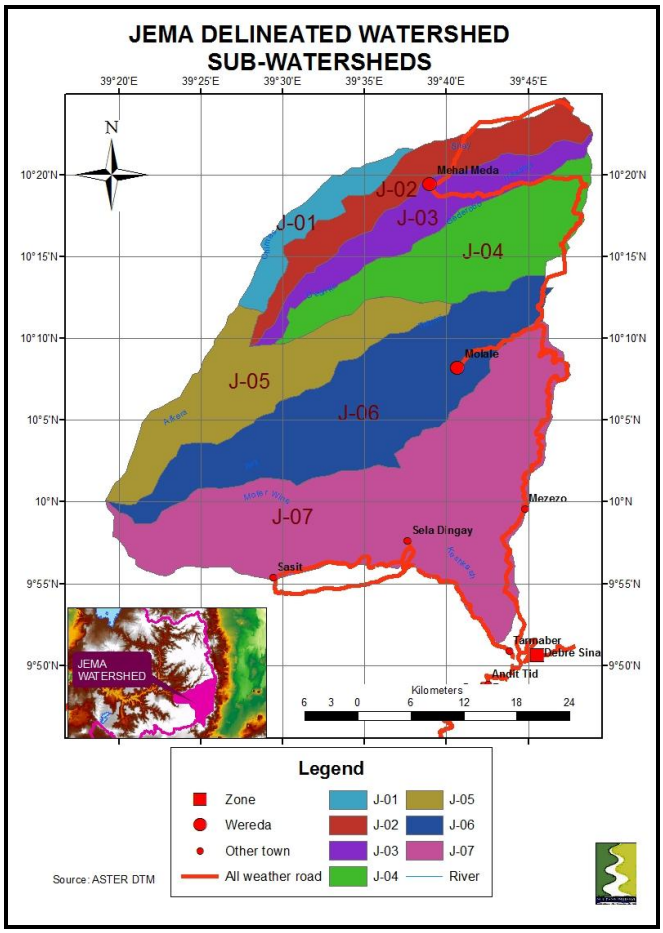
3.1.6 Water Resources

The watershed has been divided into four watersheds (Mofer Wiha, Angerwasha, Chacha and Jema (lower) and 21 Sub-watersheds (table 3, Map 10).

Watershed	Sub-watershed	Area (km2)
Angerwasha	ANG-01	576
Angerwasha	ANG-02	314
Angerwasha	ANG-03	235
Angerwasha	ANG-04	64
Angerwasha	ANG-05	106
		1,295
Chacha	CHA_01	736
Chacha	CHA-02	388
		1,124

Watershed	Sub-watershed	Area (km2)
Jema (lower)	JEM-01	287
Jema (lower)	JEM-02	609
Jema (lower)	JEM-03	724
Jema (lower)	JEM-04	288
		1,908
Mofer Wiha	MF-01	71
Mofer Wiha	MF-02	156
Mofer Wiha	MF-03	145
Mofer Wiha	MF-04	248
Mofer Wiha	MF-05	255
Mofer Wiha	MF-06	411
Mofer Wiha	MF-07	666
		1,952

Table 3. Jema Delineated Watershed: Watersheds and Sub-watersheds



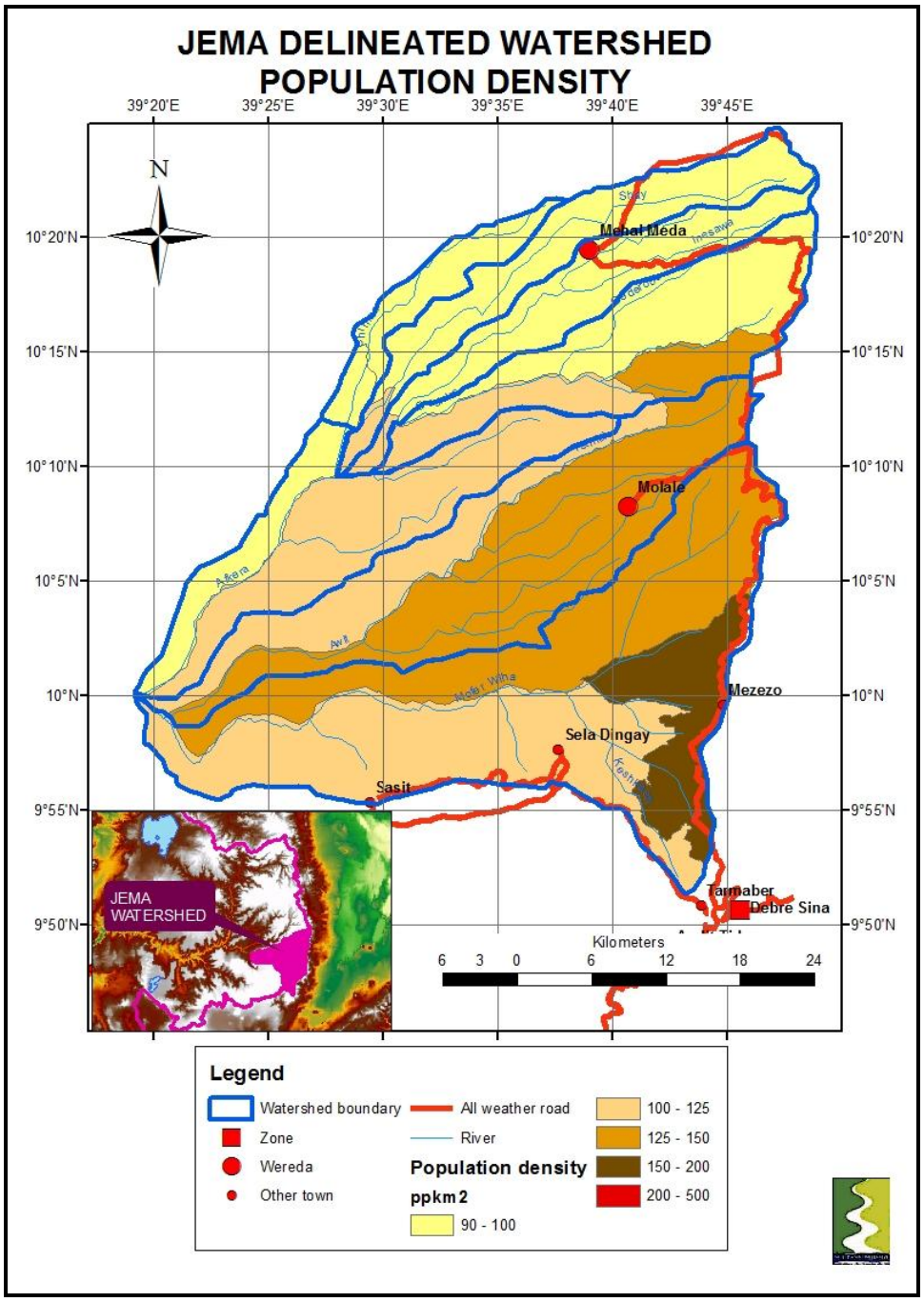
Map 10. Watersheds and Sub-watersheds

3.2 Population Distribution

The Delineated Watershed falls within (but not wholly within) 6 Woredas. 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. Rural woreda densities range from 91 to 169 ppkm2 Densities are highest on the plateau and watershed ridge.

Table 3. Total population, households, population density and household size within Jema Delineated Watersheds.

Woreda	Population (2007)	Density (ppkm2)
Menz Gera Meder	117,207	99
Menze Mama Mider	97,404	140
Tarma Ber	98,429	169
Mojana Wedera	80,399	122
Menz Keya Geberal	52,877	91
Menz Lalo Meder	41,323	101
TOTAL	**487,639**	



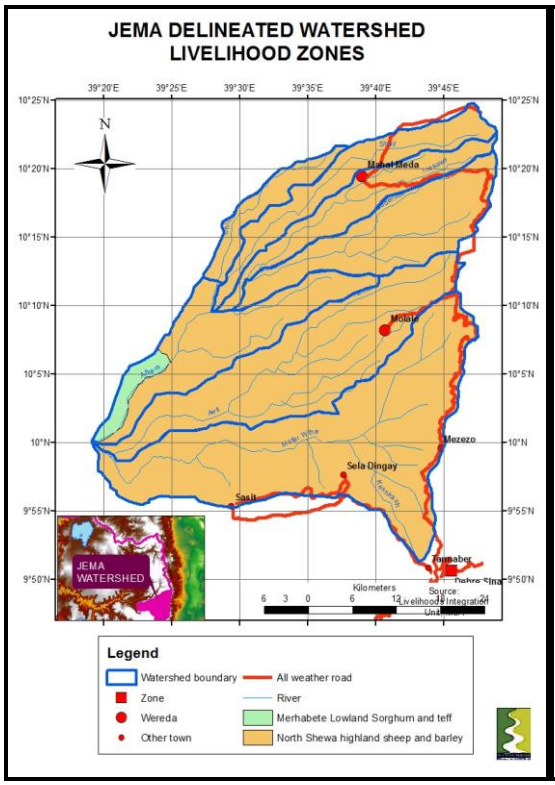
Map 11. Population Density and Distribution

3.3 Livelihood Zones (LZ)

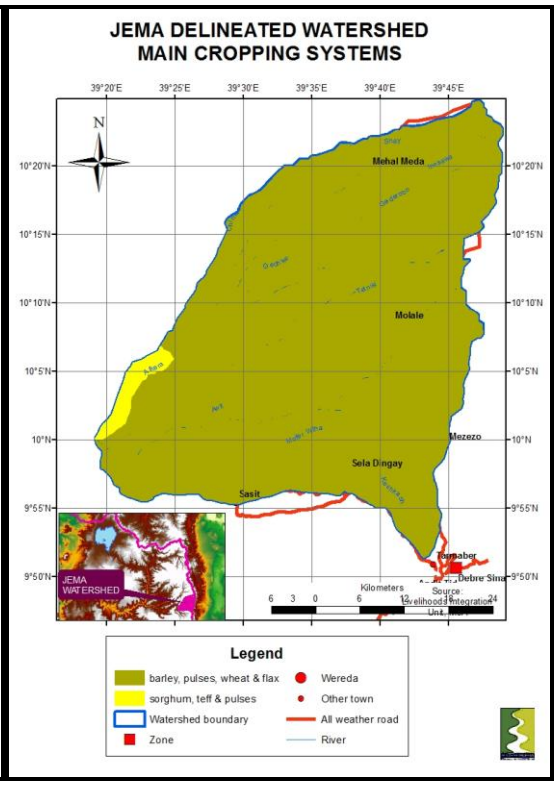
The Livelihoods Integration Unit (LIU) has identified two Livelihood Zones within the Jema Delineated Watershed. The Zones and major cropping systems are shown in Maps 12 (a) and 12 (b). They are detailed below.

- North Shewa Highland: Wheat and Teff
- Merhabete Lowland: Sorghum and Teff

Merhabete Lowland only comprises a small part of the lower Watershed.



Map 12(a) Livelihood Zones



Map 12 (b) Major Cropping Systems

3.3.1 North Shewa Highland: Sheep and Barley

This livelihood zone lies in the following woredas: Menze Lalo Meder, Menze Mama Midir, Gera Midir, Mojan Wedera and Tarma Ber. The topography is predominantly mountainous and agro ecologically is entirely highland *dega* with eucalyptus and other exotic trees.

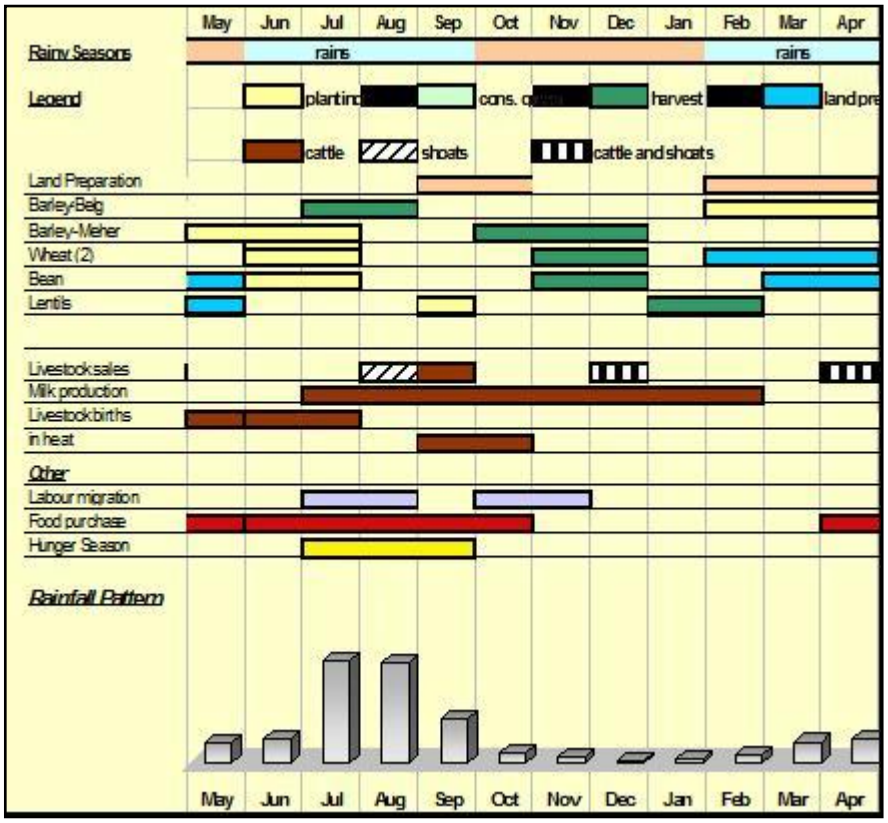
Agriculture is rain fed and the area is dependent on two season production: *meher* and *belg.* The *meher* is the most important one. The major crops grown in the area are barley, bean and wheat. Flax and lentils are also planted in the LZ for sale. Oxen are used as traction power. Land preparation, weeding and harvesting are the most laborious agricultural activities. There is no labor hiring and payment in the LZ. Households have a social arrangement called *debo* and *jigi* in which households contribute labor (weeding and harvesting) to their neighbors. The household that receives labor provides food. The community provides labor in this fashion to each household in turn. Both artificial (Urea and

DAP) and natural (compost) fertilizers are used. African bollworm and aphids are the main crop diseases affecting both barley and bean.

The main livestock are cattle, sheep and equines. Sheep are usually sold and occasionally slaughtered during the main holidays while equines are used as pack animal. Black leg, the lumpy skin diseases (LCD), pasteurellosis and sheep pox are the major livestock diseases affecting both sheep and cattle. Cows are the only animals milked. Skins, butter and eggs are the livestock products sold to generate cash income.

Migratory labor, firewood and charcoal, and sheep wool sale are other sources of cash income. Shoa robit , Antsokiya, Debre Birhan are places where people are moving to get employment weeding and harvesting. The eucalyptus tree is used for firewood sale particularly for the poorer households. Sale of sheep wool as an income generating activity is unique to the area and done by households in each wealth group. This is an important source as the livelihood zone is close to the Debre Birhan blanket factory.

Figure 3. Seasonal Calendar: North Shewa Highland: Sheep and Barley

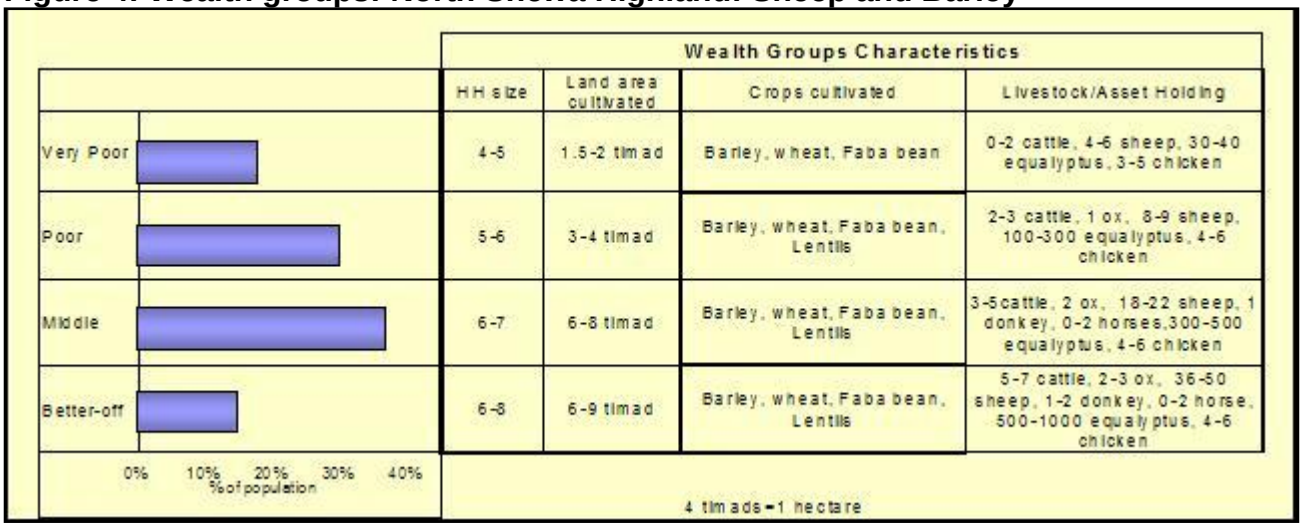


There four seasons in the LZ. These are: kiremt/long rains (June - August), tibi / winter (September - November), meher / harvest (December - February), bega/

summer (March - May). The livelihood zone benefits form two harvests: belg and meher. The main belg crop is barley which is planted in February- March and harvested in July –August. The other crops are short cycle crops in June and July and harvested in November and December. In December and April, both sheep and cattle are sold. This is when there is high demand for sheep for the holiday celebrations and cattle are required for the upcoming agricultural activities. Cattle are in-heat between June-July, which is the time when the kiremt rain starts. The cattle give birth in May-July and milking continues through to February.

The labor migration is July –November when there are weeding and different urban activities abundant. The main purchase duration stars in April when the stock from the own harvest depletes and ends in November.

Figure 4: Wealth groups: North Shewa Highland: Sheep and Barley



The wealth in the livelihood zone is determined by the ownership of livestock (oxen, cattle, sheep, horses), land cultivated and eucalyptus tree owned. The poorer group does not possess plough oxen and other determinants of wealth increase from the very poor to the better off wealth group.

The crops grown by all wealth groups are nearly similar except the very poor do not grow lentils (an important source of income).

Lack of money, plough oxen and shortage of cultivated land are factors limiting crop production by the poor wealth group. Poor households access oxen from the better-off in return for labor, or practice Mekenajo (ie combine two single ox owned by different households to cultivate each other's land). While the crop production constraints facing the better off wealth group include shortage of land and lack of money to buy agricultural inputs. The middle and better-off households rent-in land from the poorer wealth and the final harvest is shared equally.

3.3.4 Merhabete Lowland: Sorghum and Teff

The livelihood zone falls in the following administrative woredas: Ensaro, Merahbete, Moretna Jiru, Saya Debirna Wayu and Gera Midir. The road connecting Addis and Lalibela via Alemketema crosses this LZ and the Jema, Wonchit, Jara and Betu rivers drain into the LZ. The topography is hilly with many gorges. Bushes and indigenous Acacia are the main vegetation. The population is sparsely populated and the annual rainfall ranges from 800-100mm. The soil is moderately fertile and is dominated by sandy soil, clay loam soil and in some parts Vertisols. The area is potentially moderately productive.

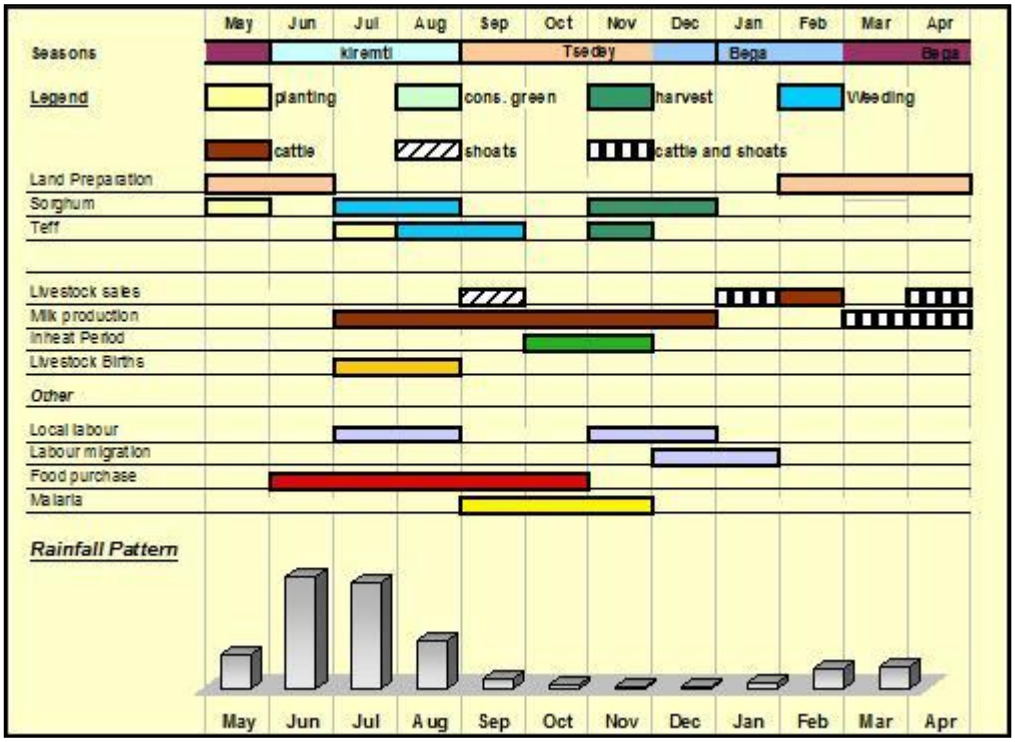
Sorghum, teff and bean are the most important crops grown in the area. Teff is the main crop sold to make cash income to cover household expenses. Labor is needed for land preparation, weeding and harvesting. Men prepare the land, while both men and women do all other labor. The better off hire laborers to do the weeding and harvesting. Sorghum midge, bollworm and wollo bush cricket are the main crop pests affecting both sorghum and teff. The sorghum midge is peculiar to this LZ and started to infest the crop during the reference year. No artificial fertilizer is used in the LZ.

Goat, cattle and equine are the main livestock reared. The equines are used for local transportation and the oxen are used as a traction power. Cattle and shoat are important income sources in the area. In addition to livestock sales, livestock products like butter, skin, and eggs are sold to generate cash. Goats are sold at younger age but cattle are sold at the middle and older age. Shoats are occasionally slaughtered during holidays by better off households. Milking cows are replaced from within the heard while oxen are replaced from both within the herd and through purchase. The main livestock diseases are black leg, anthrax, pasteurellosis and sheep pox. Treatment and vaccine is being provided by the government and also available on the market.

Local labor, firewood sales and migration labor are quite important in generating cash income particularly for the poorer wealth groups. Local labor is predominantly agricultural weeding and harvesting. Firewood is collected by men and women and sold in the near-by towns. Migratory labor (male) is to Nazareth (Oromiya region) and Wolkite (SNNPR) in search of agricultural labor.

There is no productive safety net program (PSNP) in the LZ as the LZ is self-sufficient.

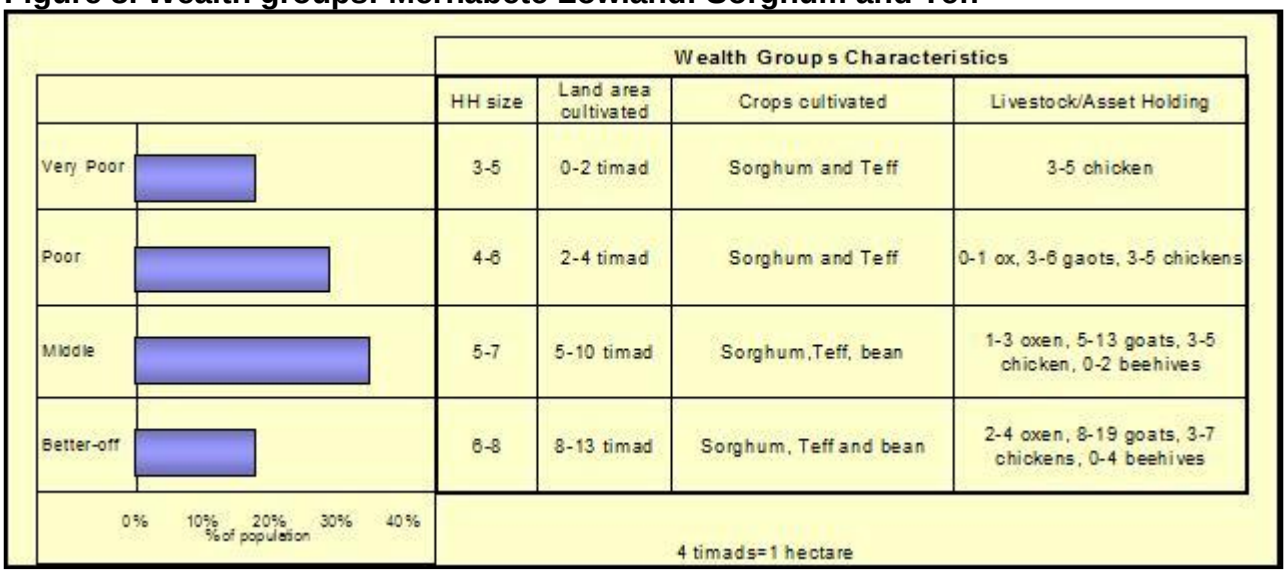
Figure 7. Seasonal calendar: Merhabete Lowland: Sorghum and Teff



There are four seasons in the LZ. These are Kiremt/long rain (June-August/September), Tsedey (September-November), Bega (December-February) and Belg/ short rains (March-May). The consumption year runs from November to October. Agriculture in the LZ is bimodal it uses the Belg rain in May for sorghum and kiremt rain for teff and other crops.

The land preparation for sorghum extends from February to April while that of teff is from March to June. Sorghum and teff are planted in May and July respectively. Weeding for both crops takes place in the months July-September. Beans are a short cycle crop grown in the meher season. The main harvesting month is November for both crops and sorghum continues until December. Cattle are in-heat following the increased availability of pasture in the kiremt rains. Births peak in July/August and milk production starts at this time and continues for the next six months.

Figure 8. Wealth groups: Merhabete Lowland: Sorghum and Teff



Wealth Groups Characteristics			
HH size	Land area cultivated	Crops cultivated	Livestock/Asset Holding
3-5	0-2 timad	Sorghum and Teff	3-5 chicken
4-6	2-4 timad	Sorghum and Teff	0-1 ox, 3-6 gaots, 3-5 chickens
5-7	5-10 timad	Sorghum,Teff, bean	1-3 oxen, 5-13 goats, 3-5 chicken, 0-2 beehives
6-8	8-13 timad	Sorghum, Teff and bean	2-4 oxen, 8-19 goats, 3-7 chickens, 0-4 beehives

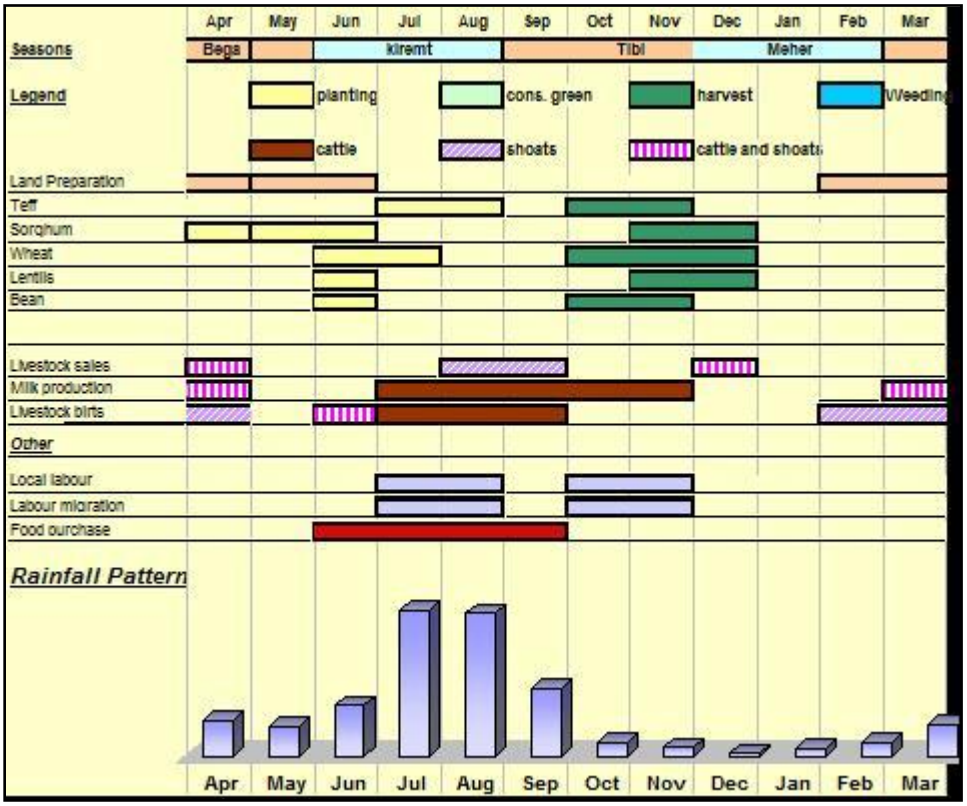
4 timads=1 hectare

The household size and land cultivated increases from the very poor to the better off wealth groups. Except the very poor who only own chicken, all the other wealth groups possesses ox, goat and chicken. Livestock holdings increase across the wealth groups from poor to better off. The middle and better off also own beehives.

All wealth groups grow sorghum and teff, the middle and better off households also produce some beans.

The poor lack plough oxen and money to boost their production while better off are constrained by insufficient land, and poor awareness of artificial fertilizer application. Land rental in/out arrangement between the poor and the better off wealth group enable the better-off to access more land for cultivation - the crop is shared equally. Whilst the poor group exchanges labor in return for the use of plough oxen.

Figure 9. Seasonal Calendar: Minjar: Teff and Sorghum



There are four seasons: kiremt/long rains (June-August), Tibi/Spring (September-November), meher,/harvest (December-February), bega/summer (March-May). The consumption year extends from October to September. The LZ is unimodal (depends only on the meher harvest). The land preparation commences from February and continues until the planting time. Planting is done in May-June for long cycle crop: sorghum and June – August for short cycle crops. Harvesting continues for three months (October – December). In most cases, the cattle birth occurs July- August and that of shoats is February to April. The milking continues for five months in July-November.

The sale of shoat is mainly during holidays like: April (Easter/Fasika), in September (New Year/ Meskerem), and in January during the (Epiphany/Timkat) celebrations. In the months, April and December there is also sale of cattle which may be associated with the demand for the upcoming agricultural season.

The labor employment opportunity is in the months July-August and October – November which is the time when weeding and harvesting activities are taking place. The food purchase starts in June and continues until the end of the hungry season, September.

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 Abay 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.

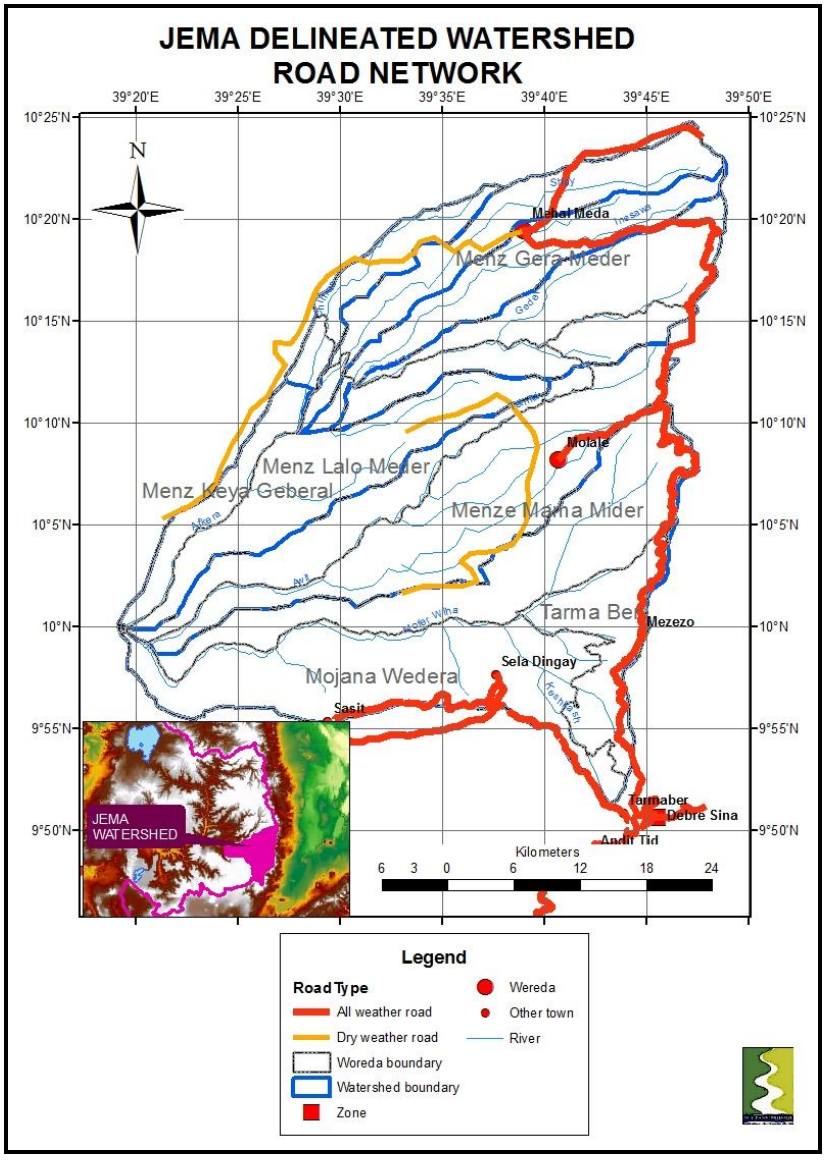
Table 4. Percent Population Immunized, Percent Population vulnerable to and Area Exposed to Malaria in the Abay River Basin.

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

The main north road from Addis Ababa to Makelle lies to the southeastern part of the Delineated Watershed. Just before the Debre Sina tunnels the there is a junction to Molale and Mehel Meda. To the west of the Delineated Watershed the Addis Ababa to Adua passes through Alem Ketema. A gravel road is under construction from Mehel Meda to Alem Ketema.



Map 15. Road network.

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

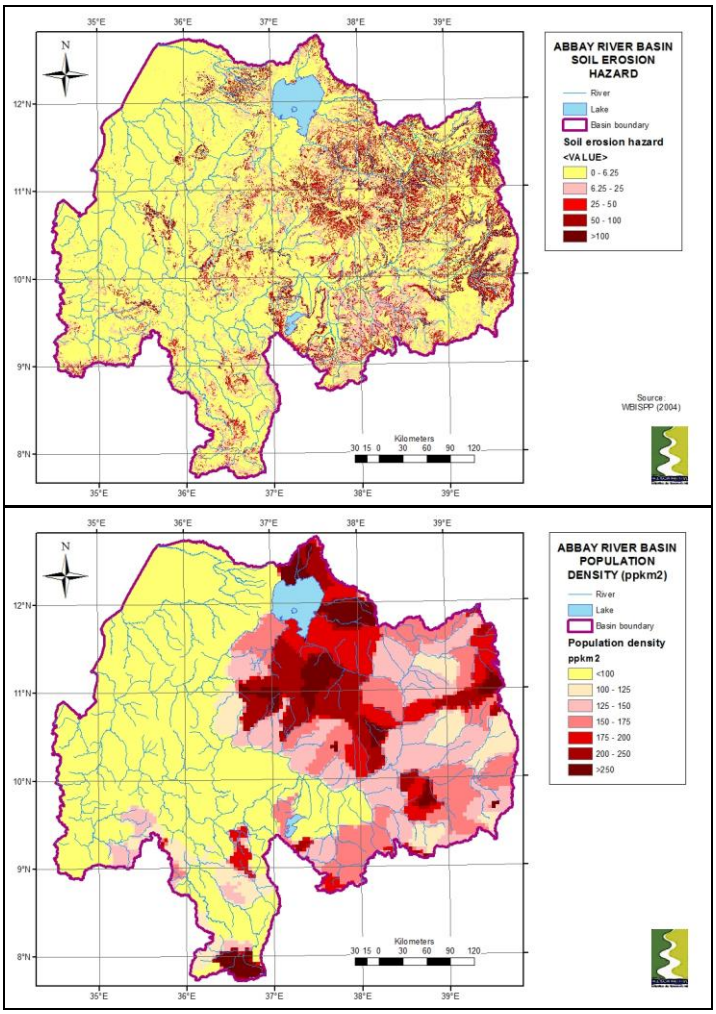
negatively related to high discount rates. However, where a technology is risk reducing (e.g. terraces that conserve soil moisture) adoption is much more likely.

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. Amhara Region has also enacted Proclamations for the Administration and Use of Rural land. Currently a land registration programme is underway 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 Jema Delineated Watersheds

4.2.1 Assessment of the Extent Soil Degradation

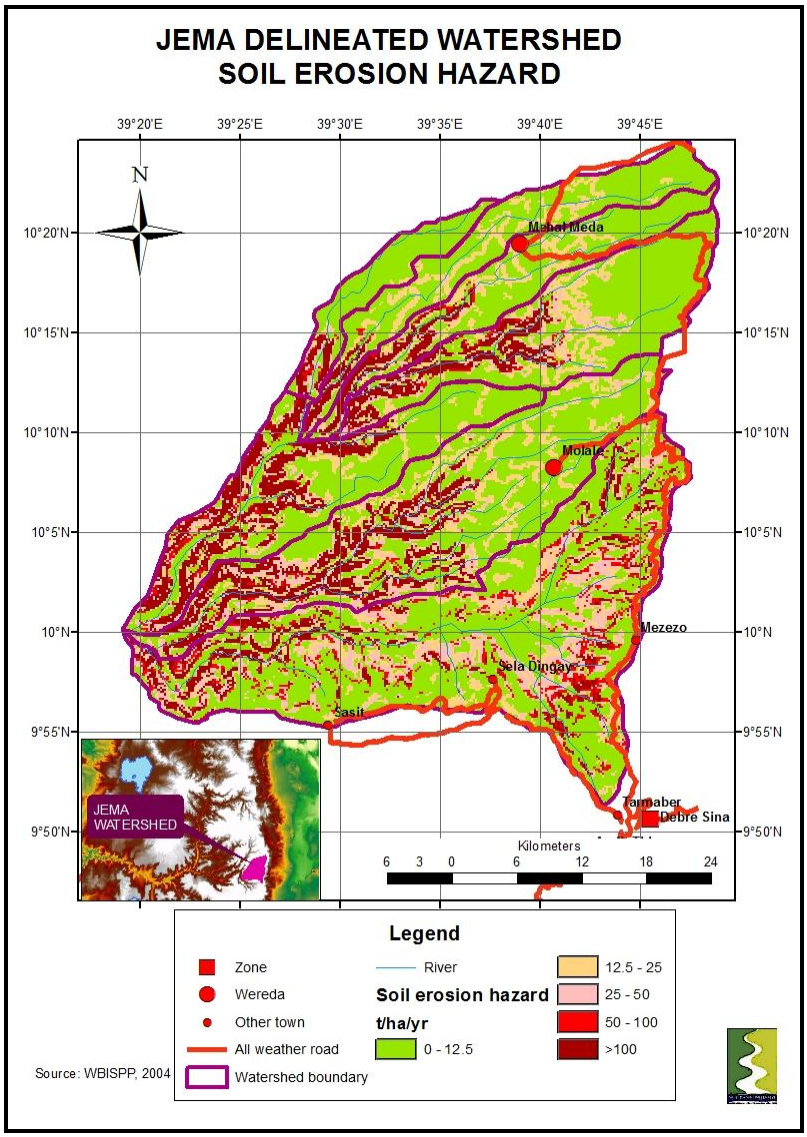
(i) Sheet and Rill Erosion

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

The highest soil loss rates are found on the steep slopes of deeply incised rivers. Locally, areas of high erosion are found on the eastern ridge. Some 43 percent of the Watershed is losing 1mm or more topsoil every year (table5).

Table 5: Jema Delineated Watershed: Soil loss rates by area:

T/ha/yr	Area (ha)	Area (%)
0 - 12.5	110,384	57%
12.5 - 25	26,747	14%
25 - 50	19,534	10%
50 - 100	8,699	5%
>100	27,431	14%
TOTAL	**192,795**	



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

(ii) Biological Erosion

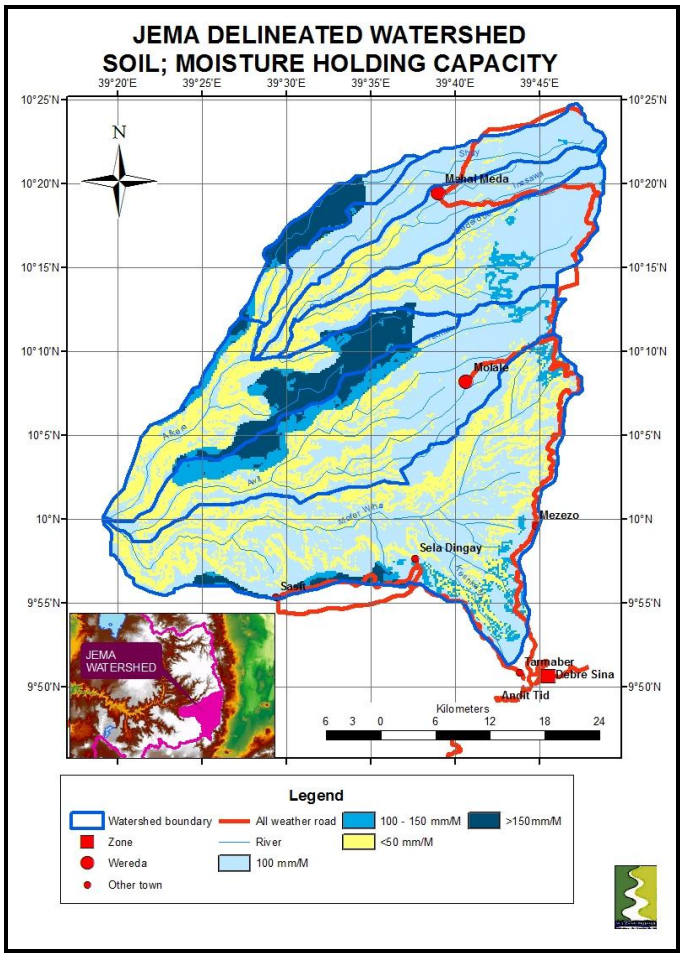
Biological erosion includes the loss of organic matter and soil nutrients. The former is caused by soil erosion and by the lack of replacement organic matter after cropping. Nutrient losses are caused by breaches in the nutrient cycle (particularly Nitrogen) caused by crop residue and grain removal from 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 for the old Woredas in table 5.

Table 5. Net Nitrogen losses and consequent grain losses due to lack of replacement from grain, residue and dung removal

Old Woreda	N loss (tons/yr)	Grain loss (tons/yr)
Gera Miderna Keya Gabriel	183	1,101
Lalo Midirna Mama Midir	146	877
Mafud Mezezona Migena	91	544
TOTAL	**420**	**2,522**

(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 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.

4.2.2 Assessment of the Extent Deforestation and Degradation of Vegetation Cover in the Jema Watersheds

Open shrubland cover some 7 percent of the area of the Watershed. Most of this is confinbed to the steep gorges. Cultivation and grassland cover cover some 61 and 17 percent of the total area respectively. The remainder of the area is plantation, bare rock, bare soil or wetland.

(i) 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 three old woredas in the Jema Watersheds of Gera Medir na Keyu Gabriel, Lalo Medir na Mamo Medir and Mafud Mize na Migena fuelwood consumption exceed sustainable supply by 163 percent, 177 percent and 165 percent respectively. These figures suggest that degradation of woody biomass in the Delineated Jema Watershed is taking place.

(ii) 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 three old woredas in the Delineated watershed to be 180 percent, 308 percent and 99 percent. These indicate severe livestock feed deficits and consequent low livestock productivities.

4.2.3 Assessment of the Extent Reforestation and Increases of Vegetation Cover in the Jema 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.

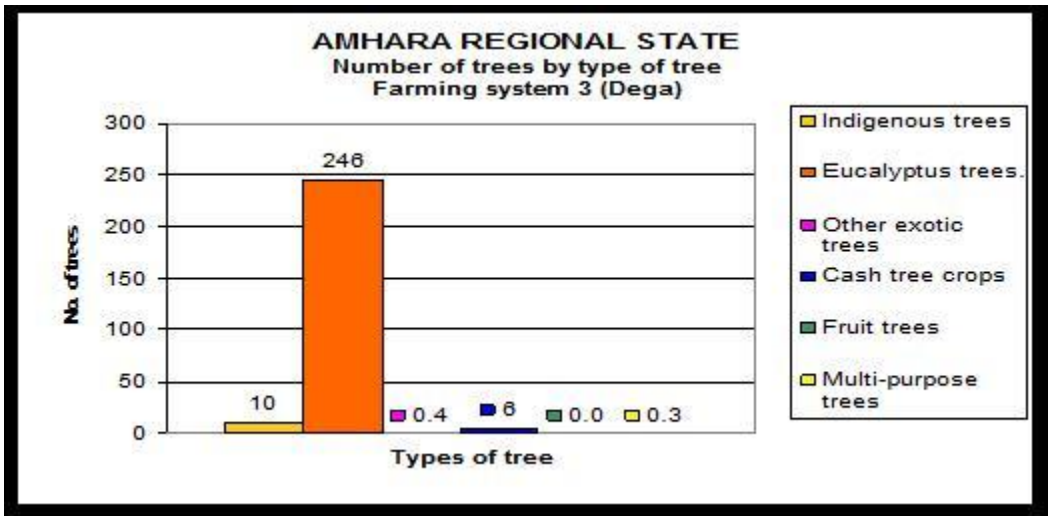
In 2002 the proportions of farmers having the six main types of trees on their farms is as follows:

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.

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.

(ii) 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 in the Jema Delineated watershed 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.

As indicated above, it is likely that there has been little expansion of cropland in the highlands of the Abbay Basin as land allocations ceased due to the shortage of cropland.

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 three old woredas was 20 percent, 20 percent and 29 percent respectively. Much of the erosion is taking place on the degraded grasslands and shrub lands on the steep slopes of the gorges.

However, one of the main causes of soil nutrient depletion: burning of dung and residues and grain removal from fields without replenishment continue. These have been indicated in para. 4.2.1 (ii).

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 Delineated Watersheds 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.

Sustainable Land Management Project (SLMP): The higher-level objective of the proposed SLM project i s to provide assistance to smallholder farmers to adopt sustainable land management practices on a wider scale to (a) reverse land degradation in agricultural landscapes; (b) increase agricultural productivity and income growth; (c) protect ecosystem integrity and functions. The project operates in 177 watersheds at present but this number may increase as more funding becomes available. The watersheds are located in so called “high potential” areas in contrast to the PSNP.

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 three woredas in the Jema watersheds 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.

5.1.3 Irrigation development

Small dam construction has faced considerable problems of various kinds, both technical and organizational: low construction standards, no sediment monitoring, lack of coordination with MoARD resulting in delay or lack of watershed protection, severe siltation problems, lack of follow up by MoARD in irrigation management and extension, single-event watershed protection instead of long-term watershed management provisions.

Irrigation planning, dam site selection, implementation and watershed protection (if undertaken) have all followed a top down approach, with obvious consequences. Land users in the watershed and in downstream areas have no sense of project ownership and have no commitment to maintenance of watershed protection measures. Cases are also observed where the local population was strongly against construction of a dam (Mulder, 2002).

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.

(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. However, 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 Amhara 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 Delineated Jema Watershed with land holdings for cropping and access to communal grazing and forested lands;
- Landless rural households residing within the Delineated Jema 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 Delineated

Watersheds, many of these “bundles” will comprise technological, institutional and policy components.

Most technological interventions are targeted at the agricultural[3]/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.

[3] 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 Delineated Watersheds 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 Domain:

Highland: Medium Agricultural Potential: Low Market Access

5.3.5 Technological Interventions by Development Domain

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

Overall Strategies: Low Market Access

The opportunities for marketable agricultural development in this Domain are good with their reasonable access to the Debre Birhan 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

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.

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.

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

Jema Watershed

1	**Region:**	Amhara
2	**Zone:**	North Shewa
3	**Contact Location:**	North Shewa Office of Agriculture
4	**Persons contacted:**	• Dr Solomon Gizaw (NRM Coordinator); • Sisay Gizaw (Forester); • Eshetu Werku (NRM specialist); • Getaneh Teklemariam (SWC Expert).
5	**Contact Address:**	Dr Solomon Gizaw, Tel.: 0911 630235
6	**Micro-watersheds major land use/cover (estimate):**	• Cultivate land (60%); • Bare land (10%); • Bush land (5%); • Grass land (10%) • Forest (1%); • Shrub land (10%); • Settlement (4%).
7	**Noticed environmental trends since early 1980s:**	• Climatic change (e.g. erratic and short rains, increase in temperature, low humidity; • Deforestation and general depletion of vegetation cover; • Formation of gullies and bare land development; • Reduction of surface water potential; • General eco-system depletion.
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 :**	• SWC; • Moisture and water harvesting; • Area closure and replanting; • Introduction and management of Highland fruits.
10	**On-going investment projects:**	• There is no private or public investment as such.
11	**Existence of NGOs operation in the selected micro-**	• SLM around Debre Berhan Town; • MERET project in Menz Mama of Molale Zuria-3 Kebeles;

	watersheds:	• World Vision intervention in social infrastructure facility provision in limited area.
12	**Reasons for selecting the micro-watersheds:**	• Watershed stream consideration; • Severity of soil erosion and land degradation; • Existence of Chronic food insecurity; • Serious water resources depletion and impacts of the area if treated and well managed.
13	**Development potentials in the selected micro-watersheds:**	• Improved animal husbandry; • High land fruits; • Eco-tourism including developed Guassa Park; • Improvement of Hallo Bahir (Lake); • Small scale irrigation.