

# Assessment of the headwaters of the Blue Nile in Ethiopia

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World Agroforestry Centre  
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## **ABSTRACT**

The study site of Fogera Woreda is one of 106 woredas of the Amhara National Regional State and is located in the South Gondar Zone, about 65 km north of the Regional capital Bahir Dar town, on the main highway towards Gondar. It is situated to the east of Lake Tana and is 625 km northwest of Addis Ababa. The floodplains of Fogera make up one of the largest wetlands in Ethiopia that form part of the larger Gumera Catchment, which is part of the greater headwaters of the Blue Nile.

The majority of land in Fogera is dedicated to crop production. However, food insecurity and poverty remain high and have been exacerbated by poor land management practices, which has led to rapid soil degradation. State ownership of all Ethiopian land has resulted in insecurity of tenure and limited land improvements by farmers. Water conflicts are also on the rise due to crop species diversification within the landscape, with certain crops (rice) requiring more water than others (legumes).

Integrated natural resource management can be achieved in the site through a development-based approach. The primary goal is to overcome the vicious cycle of poverty and food insecurity, which affects the state of natural resources. The high poverty levels mean that natural resource management is not a priority to the smallholder farmers; ensuring improvements in their economic condition could lead to a change in attitude and promote the conservation of natural resources in the site. A development-based approach would call for the regional government, Woreda Agricultural Office, Development Agents and relevant development and environmental-based NGOs to work together on improving environmental conditions, while reducing the risks of food insecurity. A direct link between natural resource management and market-oriented commodity development (so as to increase income), that has profitable market opportunities, can enhance sustainable land management. Payment for Environmental Services in the region is not a viable option since buyer-to-seller relations are not clear, especially considering that the State owns most of the resources, and Fogera lacks the required markets for environmental services and other “open access” public goods.

**Keywords:** integrated natural resource management, land tenure, food insecurity, poverty, development

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## ACRONYMS

CBNRM	Community-Based Natural Resource Management
CSE	Conservation Strategy of Ethiopia
EFAP	Ethiopia Forestry Action Programme
EIA	Environmental Impact Assessment
EIS	Environmental Information Systems
EPA	The Environmental Protection Authority
EPC	The Environmental Protection Council
EPRDF	Ethiopian Peoples' Revolutionary Democratic Front
ES	Environmental Services
EWNRA	Ethio-Wetlands and Natural Resources Association
FGD	Focus Group Discussion
FJAC	Federal Judicial Administrative Council
GDP	Gross Domestic Product
GNI	Gross National Income
Ha	Hectares
HDI	Human Development Index
HF	House of Federation
HoPR	House of People's Representatives
IBC	Institute of Biodiversity Conservation and Research
INRM	Integrated Natural Resource Management
IPMS	Improving Productivity & Market Success of Ethiopian Farmers
IWMI	International Water Management Institute
IWRM	Integrated Water Resource Management
km <sup>2</sup>	Square Kilometres
Masl	Metres Above Sea Level
MDG	Millennium Development Goals
NGO	Non-Governmental Organization
NRM	Natural Resource Management
PA	Peasant Associations

PALA	Participatory Landscape Analysis
PAPOLD	Participatory Analysis of Poverty, Livelihoods and Environment Dynamics
PES	Payment for Environmental Services
PSCAP	Public Service delivery and Capacity-building Programme
SDRP	Sustainable Development and Poverty Reduction Programme
SLM	Sustainable Land Management
USD	United States Dollar
WTC	Willingness to Compensate
WTP	Willingness to Pay

## **GLOSSARY**

<b><i>Kebele</i></b>	Administrative area below Woreda, equivalent to sub-county or parish
<b><i>Kremt</i></b>	Long rainy season, main rains
<b><i>Noug</i></b>	Niger seed, an oilseed crop ( <i>Guizotia abyssinica</i> )
<b><i>Teff</i></b>	Traditional cereal crop ( <i>Eragrostis tef</i> )
<b><i>Woreda</i></b>	Administrative area below zone, equivalent to district or county

## 1. INTRODUCTION

The Ethiopia study site is located within the headwaters of the Blue Nile. This report focuses on Fogera Woreda, which is part of Amhara National State, situated in northern Ethiopia, and on the shores of Lake Tana within the Gumera Catchment.

The working paper begins by assessing the national natural resource management (NRM) governance and institutional structure. Following on from this, the analysis focuses on the study site, specifically looking at the following: biophysical characteristics; land classifications and tenure; demography and socio-cultural-economic characteristics of the landscape; farming systems and practices; conservation practices of natural resources and the extent of their adoption; local NRM governance system and institutions; assessment of the local ecological knowledge of the landscape (assisted by interviews and discussions with stakeholders); and an analysis of the potential environmental services that the landscape could provide. The paper then takes a thorough look at the drivers of land use/cover change in the headwaters of the Blue Nile. An assessment of the exact patterns of land use/change and an analysis of the drivers, present status of natural resources, and the consequence of this on livelihoods, enables the evaluation of the individual opportunities and constraints that are faced in developing an operational INRM-based strategy within the study site in order to ensure the conservation and preservation of natural resources.

Farmer interviews, landscape appraisals, farming system analyses and focus group discussions (FGD) were carried out within a 15-km radius of Alem Ber and Woreta towns in Fogera district<sup>1</sup>. The aim of these discussions was to establish the socio-economic characteristics of the landscape; analyse the use of the landscape as well as land cover change and the drivers behind them.

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<sup>1</sup> Details of these FGDs and key informant interviews can be found in the Annex

## 2. OVERVIEW OF THE NATIONAL CONTEXT

### 2.1 Location

Ethiopia is a landlocked country located in the Horn of Africa. It is bordered by Eritrea to the north; Sudan and South Sudan to the west; Djibouti and Somalia to the east; and, Kenya to the south. Ethiopia has a total area of 1,104,300 km<sup>2</sup>; 1,000,000 km<sup>2</sup> of which is land and 104,300 km<sup>2</sup> is water (CIA, 2011). Total land area is made up of 34.5% agricultural land, 12.3% forests, 0.9% permanent cropland, 13.6% arable land, and 0.5% irrigated agricultural land (World Bank, 2011a).

### 2.2 Population, health and literacy

A 2011 estimate of the Ethiopian population puts it at 90,873,739 people, with an annual growth rate of 3.2%. Only 17% of the population resides within urban areas, but this is set to increase in the coming years due to an urbanization rate of change of 3.8% (CIA, 2011). Life expectancy for the total population currently stands at 56.56 years – 53.99 years for males and 59.21 years for females (CIA, 2011). The literacy rate for the total population, based on 2003 statistics, stands at 43%, with 50% males and 35% females above the age of 15 being able to read and write (CIA, 2011).

**Table 1: Top 10 causes of death in Ethiopia (2002)**

Top ten causes of death, all ages Ethiopia, 2002			
Causes	Deaths		Years of Life Lost
	(000)	(%)	(%)
All causes	105	100	100
Lower respiratory infections	124	12	14
HIV/AIDS	121	12	12
Perinatal conditions	82	8	10
Diarrhoeal diseases	63	6	7
Tuberculosis	41	4	4
Measles	39	4	5
Cerebrovascular disease	35	3	1
Ischaemic heart disease	32	3	1
Malaria	31	3	4
Syphilis	21	2	2

Source: WHO, 2006

### 2.3 National economy

For the 2009-2010 financial year, Ethiopia's national Gross Domestic Product (GDP) was estimated at USD 29.9 billion, with an annual growth rate of 10.4%. Agriculture makes up 42% of GDP, which is derived from the sale of products such as coffee, cereals, pulses, oilseeds, *khat*, meat, hides and skins. Industry makes up 13% of GDP through the production and sale of textiles, processed foods, construction, cement and hydroelectric power. Services make up a further 45% of the national GDP. A significant amount of the national GDP is also derived from the exploitation of natural resources such as potash, salt, copper and platinum – natural gas is present in Ethiopia, but remains fairly

unexploited at present. GDP per capita stood at USD 365 and the average inflation rate for that financial year was 2.8%. Imports still outweigh exports with exports amounting to USD 2 billion and imports to USD 8.4 billion. Almost all exports are agricultural commodities, especially coffee and oil seed. Other exported products include *khat*, flowers, gold, pulses, leather and leather products. Remittances entering the country stood at USD 2 billion for 2009-2010 (U.S. Department of State, 2010; Federal Ministry of Health & Federal Environmental Protection Authority, 2010). Gross National Income (GNI) stood at USD 223 in 2008, while the Human Development Index (HDI) for Ethiopia stood at 0.389 in the same year (Federal Ministry of Health & Federal Environmental Protection Authority, 2010).

## **2.4 Land cover**

Details related to land cover and land use in Ethiopia are outdated and data rarely includes total land cover amounting to 100%. It was estimated by the government in the late 1980s that 15% of land was under cultivation and 51% was under pasture. They also estimated that over 60% of the cultivated land was cropland. Forestland, which was primarily located in the southwestern region of the country made up 4% of total land area. However, statistics according to the World Bank in 1987, differed, estimating that 13% of the total land area was cropland, 41% pasture and 25% forestland (Wubne, 1991). More current estimates suggest that agricultural land comprises 34.5% of land use, while forest area is 11.7% (World Bank, 2011b).

## **2.5 National governance structure**

### ***i. Historical context***

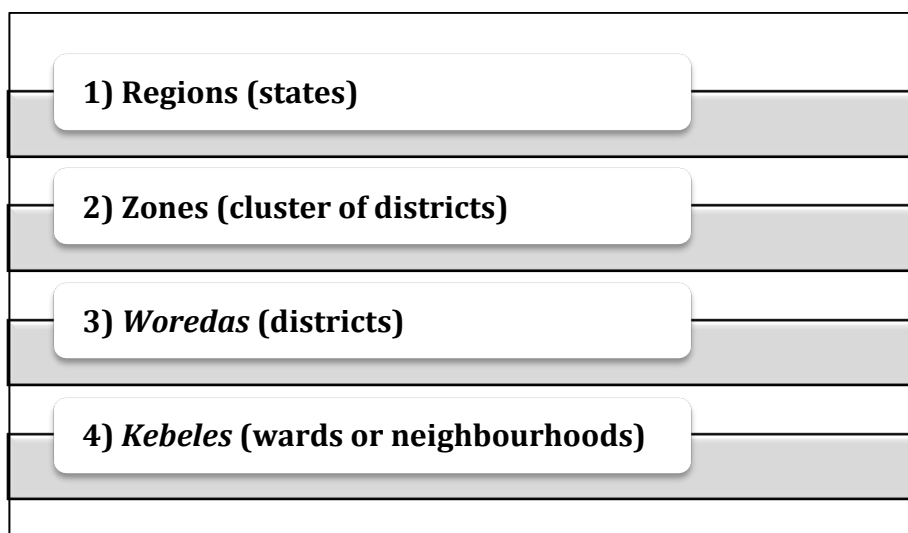
A report by the African Development Bank (2009) described the historical context of the Ethiopian governance structure. A highly centralized monarchy governed Ethiopia for centuries. Emperor Haile Selassie was the last monarch having ascended to the throne in 1931. A political vacuum was left following a popular uprising and a provisional administrative council, known locally as the *Derg*, was set up but collapsed in May 1991. Following this, the Ethiopian People's Revolutionary Democratic Front (EPRDF) took over Addis Ababa. The EPRDF assumed governance responsibilities and convened a National Peace Conference in Addis Ababa, which adopted a Transitional Charter and formed a transitional government. This paved the way for the installation of an elected government under a pluralist political system.

Among the key features of the newly constituted political system were an ethnic-based political map, extensive devolution of power to regions, and a new formula for unity based on equality of nations and nationalities, and voluntary union. Following the adoption of a new constitution in 1995, Ethiopia was transformed into a federal system of government. This new government has now embarked upon broad structural and macroeconomic reforms, which aim to stabilize and transform the economy from a command-driven to a market-oriented one. Once economic stabilization and reconstruction were achieved, the Government developed a longer-term economic and social development agenda (African Development Bank, 2009).

### ***ii. Current federal system of government***

Ethiopia's governance structure can be broken down into six sections (African Development Bank, 2009), which are as follows:

- **Constitution** – The Federal Constitution of 1995 guarantees the fundamental rights and freedoms of the people of Ethiopia. These rights include the right to privacy, liberty, life; freedom of religion, movement, association; the right of assembly, demonstration and petition; rights of women, nations, nationalities and peoples; rights to property and development; and the right to a clean environment.
- **The Legislature** – This is composed of two houses: the House of Federation (HF) and the House of People’s Representatives (HoPR). Both houses are elected for five-year terms on the basis of universal suffrage. Parliament serves as the primary mechanism of accountability, as is the case with most democracies. Under the Constitution, the HoPR is made up of 546 representatives, of which 20 are reserved for minority nationalities to ensure full political representation. The HF is composed of representatives of nations, nationalities, and people, who are elected by the states. Each nation, nationality and peoples is represented by at least one member. The HF is empowered to: interpret the Constitution, decide on issues related to secession; promote equality among nations, nationalities and peoples; resolve misunderstandings arising between states; and, determine the division of revenues derived from the joint federal state tax sources and federal subsidies to be provided to states.
- **Executive Branch** – The executive power is vested in the Prime Minister, under the Constitution. The Prime Minister is the Chief Executive of the government and presides over the Council of Ministers as the chairperson, and is also Commander-in-Chief of the armed forces. The Prime Minister is responsible for the election of the leader of the majority party or coalition of parties in the HoPR. The Prime Minister’s cabinet – whose members are usually part of the HoPR – is agreed upon by the HoPR. The Prime Minister and the Council of Ministers are directly accountable to the HoPR. The Executive Branch in Ethiopia executes laws and implements policies, rules and regulations of government. It is the Prime Minister who ensures the implementation of the laws, policies, directives and decisions adopted by the HoPR.
- **Local Government** – Under the Federal Constitution, government is further divided into a four-tier decentralized framework (Figure 1) consisting of regions (or states), zones (a cluster of districts), Woredas (or districts) and Kebeles (wards or neighbourhoods). The subnational administration is presented in Figure 2. There are nine regions in Ethiopia: Amhara, Tigray, Somalia, Benishangul-Gumuz, Oromia, Southern Nations Nationalities and Peoples, Afar, Harari and Gambella (Figure 3). There are two municipal cities, which are also considered to be urban administrations, Addis Ababa and Dire Diwa. Oromia, Amhara, Southern Nations Nationalities and Peoples, Tigray and Somalia account for 88% of Ethiopia’s population and 82% of its surface area. Regional, Woreda and Kebele councils make up the political representational bodies at sub-national tiers.



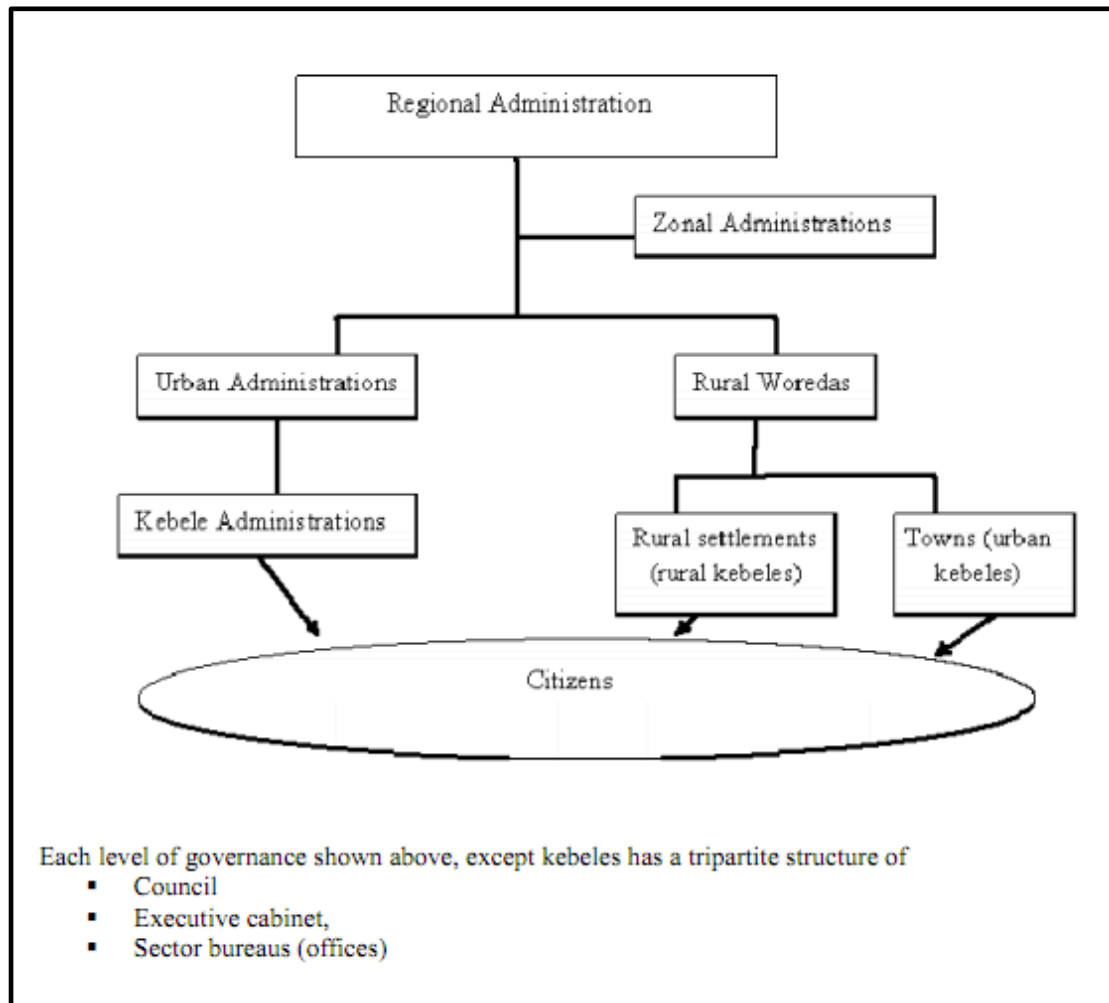
Source: African Development Bank, 2009

**Figure 1: Four-tier decentralization framework of Ethiopia**

- The Judiciary** – The Constitution provides for a three-tier Federal and State Court System. The court system at the federal level comprises the Federal First Instance Courts, Federal High Courts and the Federal Supreme Court. This structure is also incorporated at the State level. The judicial system is made up of religious (Sharia), customary, social and municipal courts. Federal courts have jurisdiction over cases arising under the Constitution, federal laws and international treaties. Supreme federal judicial authority is vested in the Federal Supreme Court. Nominees for the President and Vice President of the Federal Supreme Court are proposed to the HoPR by the Prime Minister, while the remaining judges are chosen by the HoPR from the nominees presented by the Federal Judicial Administrative Council (FJAC). Judges at the State level are appointed in the same manner after nomination by the State President and the State Judicial Commission. City courts are present in Addis Ababa; these courts are either First Instance or Appellate courts. The city charter also establishes Kebele social courts. There are also other bodies that are able to exercise judicial power. These are the labour relations board, the civil service tribunal, the tax appeal commission, and the urban land clearance matters appeal commission.
- Law Enforcement** – The Judiciary system is supported by law enforcement institutions at both the federal and State level. These institutions include: federal and regional level police, Public Prosecution Service, Penitentiary System, Ethiopia Customs Authority, Ethiopia Inland Revenue Authority, and the Federal Ethics and Anti-Corruption Commission. The activities of these institutions are guided by the Constitution and various proclamations and regulations.



### iii. Structure of Sub-National Governments



Source: African Development Bank, 2009

**Figure 2: Ethiopia's Sub-National Government Structure**

### iv. Political parties

The main political parties in Ethiopia are the EPRDF, Unity for Democracy and Justice, Oromo People's Congress, Arena Tigray for Democracy and Sovereignty, Oromo Federalist Democratic Movement, Coalition for Unity and Democracy, the United Ethiopia Democratic Forces and the All Ethiopia Unity Party. There are, however, several other smaller parties.

## 2.6 NRM institutions and governance system

### i. Government ministries

There are two Government ministries that are concerned with NRM in Ethiopia:

- **Ministry of Agriculture** – is in charge of managing all natural resources, except water. Its role was specified in a 2005 Proclamation, which gave it the following mandate: “to develop and implement a strategy for food security, rural development, and natural resources protection; support development of local (through expansion of cooperatives and the provision of credit facilities) and export markets; develop rural infrastructure, promote improved rural technologies, prevent disaster and conduct agricultural research” (Hagos et al. 2009). It is responsible for Sustainable Land Management (SLM) through its SLM Secretariat, as well as water resource management in Ethiopia. The Ministry of Agriculture aims to reduce poverty levels through improved food security, which is achieved through a modern and highly productive agricultural system, utilizing advanced technologies (Federal Ministry of Health & Federal Environmental Protection Authority, 2010).
- **Ministry of Water and Energy** – is the Ministry responsible for the management, development and use of water resources in Ethiopia. It also makes sure that water resource management is integrated and compatible with other natural resources (Federal Ministry of Health & Federal Environmental Protection Authority, 2010). Tasks carried out by the Ministry include basin studies to identify the potential of ground water and surface water, design and construct large and medium-scale irrigation dams, as well as negotiate the terms of national treaties for use of international waters (Merrey & Gebreselassie, 2011). It is also the body responsible for the development of national Integrated Water Resource Management (IWRM) strategies.

#### *ii. Government authorities*

- **The Environmental Protection Authority (EPA)** – the EPA was first established in 1995 alongside Proclamation 9/1995 and was given the task of coordinating and regulating activities in environmental management. In October 2002, the EPA was re-established under Environmental Organs Establishment Proclamation 295/2002. Under the new Proclamation, the aim was to assign responsibilities to several organizations for regulation and monitoring, and environmental protection and planning, and to avoid duplication of efforts and reduce the possibility of conflicts of interest between organizations (Federal Ministry of Health & Federal Environmental Protection Authority, 2010). The Proclamation stipulates the need for environmental organs at the regional level in order to allow for the coordination of environmental activities and to improve the dissemination of environmental information.
- **The Environmental Protection Council (EPC)** – the EPC was re-established under Environmental Organs Establishment Proclamation 295/2002. Its main responsibilities include overseeing the activities of the EPA, as well as environmental units and sectoral agencies concerned with environmental management. The EPC is to ensure that environmental matters among sectoral ministries and agencies are coordinated (Federal Ministry of Health & Federal Environmental Protection Authority, 2010).

## **2.7 National NRM policies, strategies and programmes**

### *i. National NRM policies*

- **Ethiopian Water Sector Policy** – describes a large set of principles, priorities, goals and objectives related to water resources in Ethiopia, although there is a main focus on the development of blue water (CGIAR, 2011). The main objective of the policy is to “enhance and promote all national efforts towards the efficient, equitable and optimum utilization of the available water resources of Ethiopia for significant socio-economic development on a sustainable basis” (Ministry of Water Resources, 2001a). Within this policy are the “Water

Sector Strategy” and the “Water Sector Development Programme”, which are described in the next section.

- **Ethiopian Environmental Policy 1997.** The overall goal of the policy according to Amede et al. (2009) is “to enhance the health and quality of life of all Ethiopians and promote sustainable social and economic development through sound management and utilization of natural, human-made and cultural resources and the environment as a whole”. Environmental Policy in Ethiopia is made up of the “National Action Plan to Control Desertification”; the “Ethiopian Forestry Action Plan”; and the “Climate Change National Adaptation Programme of Action”

## *ii. National strategies and programmes*

- **Agricultural Development-led Industrialisation Strategy (1993-)** – this strategy maintains that agricultural development in Ethiopia is to be the main economic growth mechanism.
- **Participatory Demonstration and Training Extension System, and the National Agricultural Extension Intervention Programme** – these are government initiatives where extension services have been decentralized to the regional level. The programmes aim to train thousands of agricultural specialists (locally known as Development Agents) and base teams of these Agents at the Kebele level in order to improve education on crops, livestock, NRM and, in specific areas, irrigation (Merrey & Gebreselassie, 2011). The agents are also specifically responsible for implementing SLM and NRM Programmes at the Kebele level. However, although several Development Agents are specialists in their field they tend to work as generalists, which defeats the purpose of the programmes (Zakele et al., 2006). Farmer Training Centres are also being established in each Kebele.
- **Sustainable Land Management Programme (2009-2023 in three separate phases)** – the aim of this programme is to reduce the degradation of agricultural landscapes and to improve the land productivity of smallholder farmers. The objectives of the programme are twofold:
  1. To scale up best management practices in SLM practices and technologies for smallholder farmers in the “high potential” (“food secure”) areas that are increasingly becoming vulnerable to land degradation and food insecurity; and
  2. To expand the coverage and enhance the government’s land certification programme, with the aim of strengthening land tenure security for smallholder farmers.

(Ministry of Agriculture, 2012)

- **Agriculture and Rural Development Strategy** – was adopted by the government in March 2002 with the aim of combating desertification; mitigating the effects of drought; improving farming skills; improving the supply, replication and dissemination of technologies; ensuring access to land and security of tenure; resolving the problems of drought-prone regions; improving agricultural marketing systems; promoting rural finance; and, developing the rural energy sector and rural telecommunication network (Ali, 2010).
- **National Capacity Building Programme** – adopted by the government in December 1998, the main aim of the programme is to build the capacity of a private sector-led and more accelerated agricultural-based development strategy by creating an institutional environment and conducive policy, as well as minimising the adverse impacts associated with market failure; and the institutional capacity of private, civil and public societies in discharging their respective roles of responsibility (Ali, 2010).
- **Sustainable Development and Poverty Reduction Strategy** – adopted by the government on July 2002, the strategy outlines the development objectives of the national government, which are aimed at developing a free-market economic system that will allow for rapid development. It highlights the government’s attempt to rid itself of poverty and its dependence on international food aid through pro-poor economic development schemes. It

maintains that environmental protection is integral for sustainable development and highlights three points of action (Ali, 2010):

1. Address land degradation, overgrazing, soil erosion, deforestation, loss of soil fertility and hydrological cycle disruption by specifically focusing on areas that are highly degraded, prone to drought and have issues of food insecurity;
  2. Strengthen institutional and regulatory capacity; and
  3. Strengthen implementation measures targeting the development, sustainable use, preservation and management of biodiversity resources.
- **National Food Security Strategy** – was established in 1996 and updated in 2002. The main objective of this strategy is to ensure household food security. It focuses predominantly on areas that have a history of food insecurity and have low levels of rainfall. The strategy also addresses rehabilitation of the environment through the promotion of the reversal of land degradation in order to create landscapes which utilize sustainable agricultural practices that increase crop yields of high value crops, while also promoting water harvesting (CGIAR, 2011).
  - **Climate Change National Adaptation Programme of Action** – analyses the potential impacts that climate change can have on Ethiopia. It also provides a list of 11 adaptation projects, which integrate NRM (CGIAR, 2011). The Programme of Action recognizes the importance of Integrated Natural Resource Management (INRM) and highlights the importance of community-based strategies to rehabilitate degraded ecosystems.
  - **National Action Plan to Control Desertification (2007-2012)** – aims to target areas that are prone to desertification and develop adaptation strategies in collaboration with those strategies targeting climate change (CGIAR, 2011).
  - **Ethiopian Forestry Action Plan (1994-2014)** – the main aim of the plan is to increase agricultural production, while reducing land degradation; conserve forests ecosystems, including their wildlife and genetic resources; and to increase sustainable forest and tree production throughout the country, but particularly in areas that have experienced rapid forest cover loss over the last 2-3 decades (CGIAR, 2011). The plan also aims to take action on the “Forest Development, Conservation and Utilization Proclamation No. 542/2007” that defines forest ownership; promotes forest development, forest technology and markets for forest products; designates, demarcates and registers State forests; conserves and develops administration of State forests; creates laws and regulations for the production and movement of forest products; outlines prohibitions of both State and protected forests; defines penalties for illegal activities in and around forests; and outlines the powers of Ministries and Regional States.
  - **Ethiopian National Biodiversity Strategy and Action Plan** – this plan is led by the Institute for Biodiversity Conservation. Its main objective is to conserve examples of all Ethiopia’s ecosystems that remain, by promoting protected areas. It also aims to make sure that all remaining natural ecosystems are sustainably managed and used by 2020. An additional objective of the Action Plan is to develop conservation programmes, which effectively conserve the rich agrobiodiversity of the country (CGIAR, 2011).
  - **Ethiopian Water Sector Strategy (2002-2016)** – is described as “a set of short, medium and long-term action programmes to realise the achievement of development goals and water-related policies” (Ministry of Water Resources, 2001b). The aim of the strategy is to bring together the two goals of development and, water resource availability and conservation. It further states that water resources need to be available for consumption, irrigation and power generation (CGIAR, 2011). Improving the availability of water and conserving valuable water resources should eventually facilitate poverty alleviation goals as well address food insecurity. The strategy further elaborates the Ethiopian Water Resources Management Policy, which is set out in Proclamation No. 197/2000.

- **Water Sector Development Programmes (2002-2016)** – these comprise the following separate sub-programmes: Water Supply and Sewerage Development; Irrigation Development; Hydropower Development; Water Resource Development; and Institution and Capacity Building (Ministry of Water Resources, 2002). The programmes were initiated in 2002, and will run until 2016. They deal with issues such as development of infrastructure, promotion of capacity building, and creation and strengthening of institutions (CGIAR, 2011).

### *iii. International environmental conventions*

Ethiopia has ratified and is a party to the following international Conventions and Protocols:

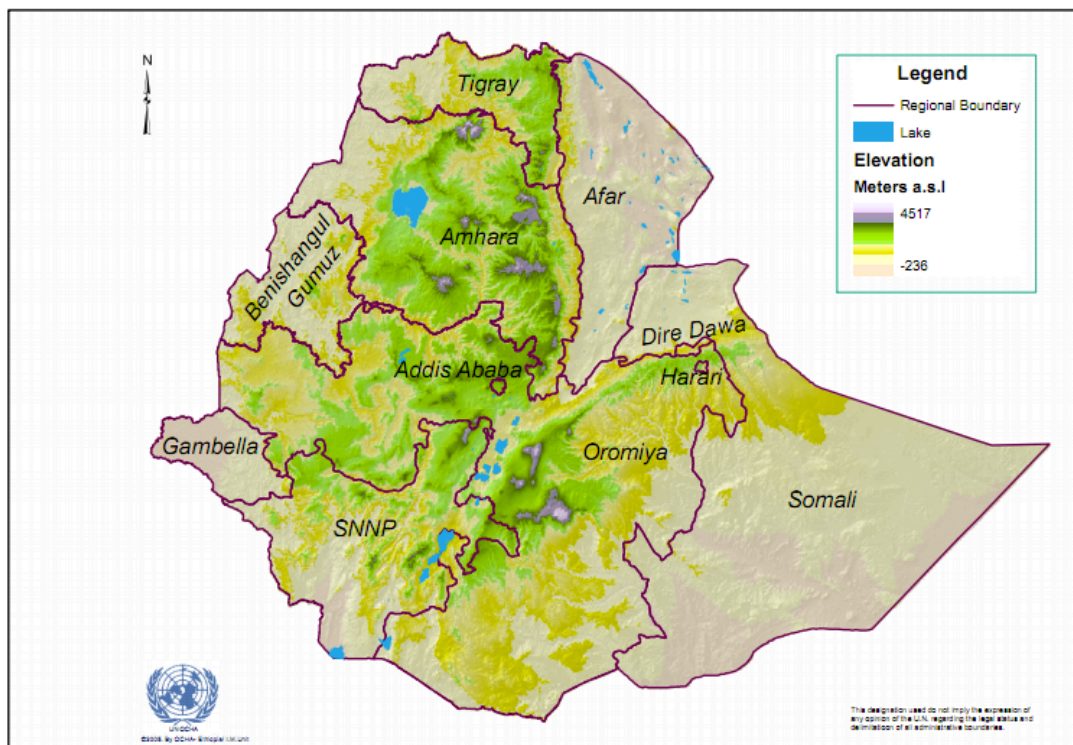
- The Vienna Convention on Diplomatic Relations
- Convention of Biological Diversity
- The Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade
- The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal
- Stockholm Convention on Persistent Organic Pollutants
- The Montreal Protocol on Substances That Deplete the Ozone Layer
- United Nations Convention to Combat Desertification.

### 3. CHARACTERISTICS OF THE HEADWATERS OF THE BLUE NILE

#### 3.1 Location and general information

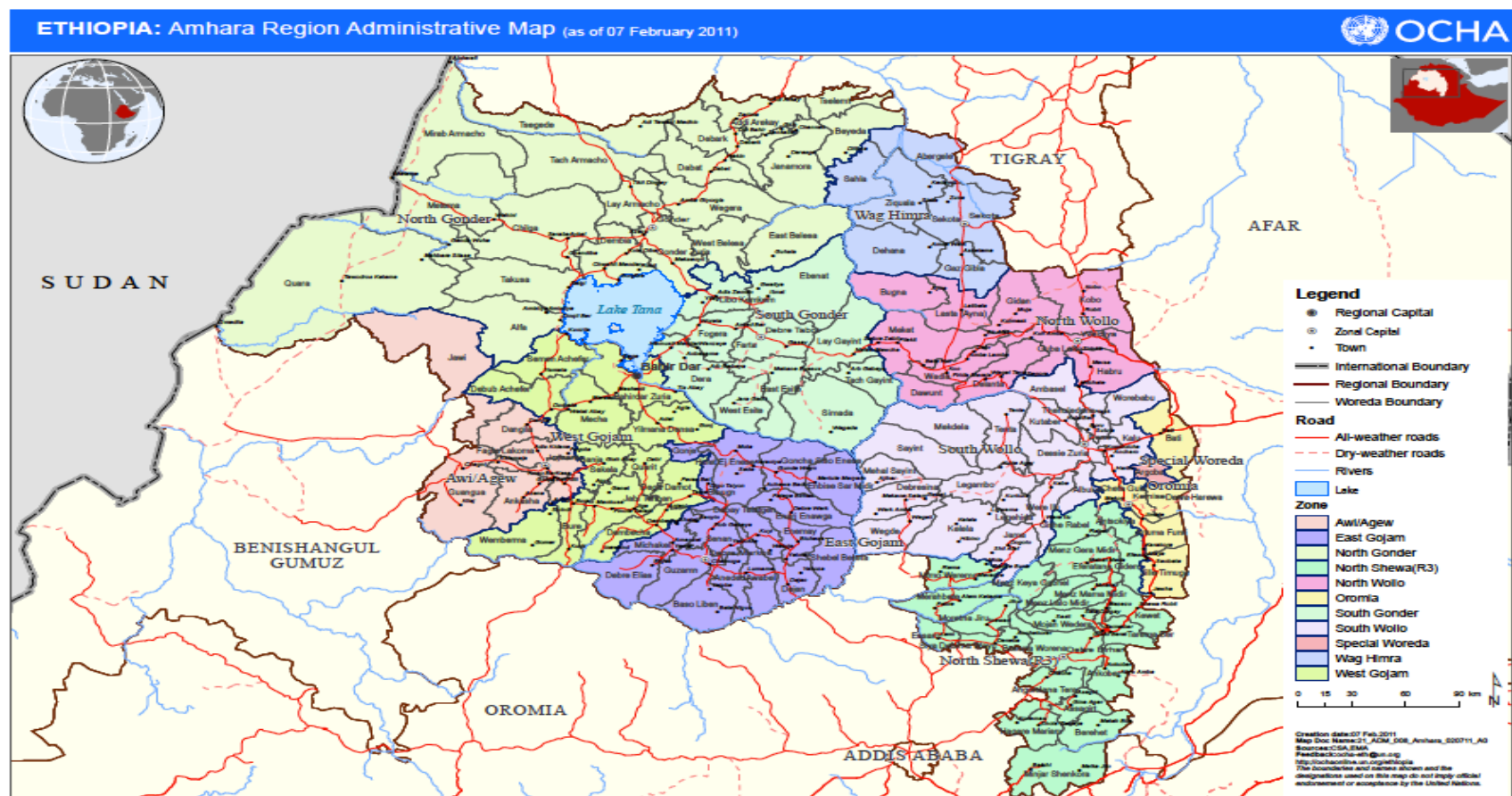
##### *i. Location*

Fogera Woreda is one of the 106 Woredas of the Amhara National Regional State (Figure 4) and is found in the South Gondar Zone, around 65 km north of the Regional capital Bahir Dar town, on the main highway to Gondar. It is situated to the east of Lake Tana and is 625 km northwest of Addis Ababa. The floodplains of Fogera form one of the largest wetlands in Ethiopia (Anteneh et al., 2012), which form part of the larger Gumera Catchment (see Figure 5), hence the reason for the choice in this specific study site as part of the headwaters of the Blue Nile. Woreta is the capital of the Woreda and the other major town within the district is Alem Ber. The Woreda is divided into 25 rural Peasant Associations (PAs) and 5 urban Kebeles (IPMS Ethiopia, 2005). Fogera is bordered to the north by Libu Kem Woreda, Dera Woreda to the south and Farta Woreda to the east (Ministry of Foreign Affairs - Finland, 2010).



Source: UN-OCHA, 2008

Figure 3: Map of Ethiopian Regional States



Source: UN-OCHA, 2011

Figure 4: Map of the Amhara Region







## **ii. Land classification**

The total land area of Fogera is 102,807 ha categorised as arable land 69,745 ha (67.8%), grazing land 14,987 ha (14.57%), forestland 4,795 ha (4.7%) and the remaining area is used for housing, roads and other infrastructure (Ergano et al., 2010).

## **iii. Land tenure**

Land is classified as public property in Ethiopia and therefore belongs to the State, under the 1995 Constitution: “Land is a common property of the nations, nationalities and people of Ethiopia, and shall not be subject to sale or to other means of transfer”. This has been the case since the radical land reform, which occurred in 1975. Tenants have the right to use the land, but they have no right to sell, mortgage or exchange it. Possession of land by tenants is conditional upon them being residents in that village. Periodic redistribution of land by the central government, which has been actively discouraged by the regional administrative bodies since 1991, is still carried out to accommodate the growing population (Mulat, 1999).

Land redistribution in the Amhara region has not occurred since 1996, when land was given to landless youth and former soldiers who were returning to the region. This move was very controversial as the government supposedly reduced the landholding of farmers who apparently had affiliations with the former governments (Gebreselassie, 2006).

Land policy within the Federal Democratic Republic of Ethiopia remains fairly unchanged over the last three decades. The current EDRDF-led government adopted similar land policy from its predecessor, the *Derg* regime (Crewett et al., 2008).

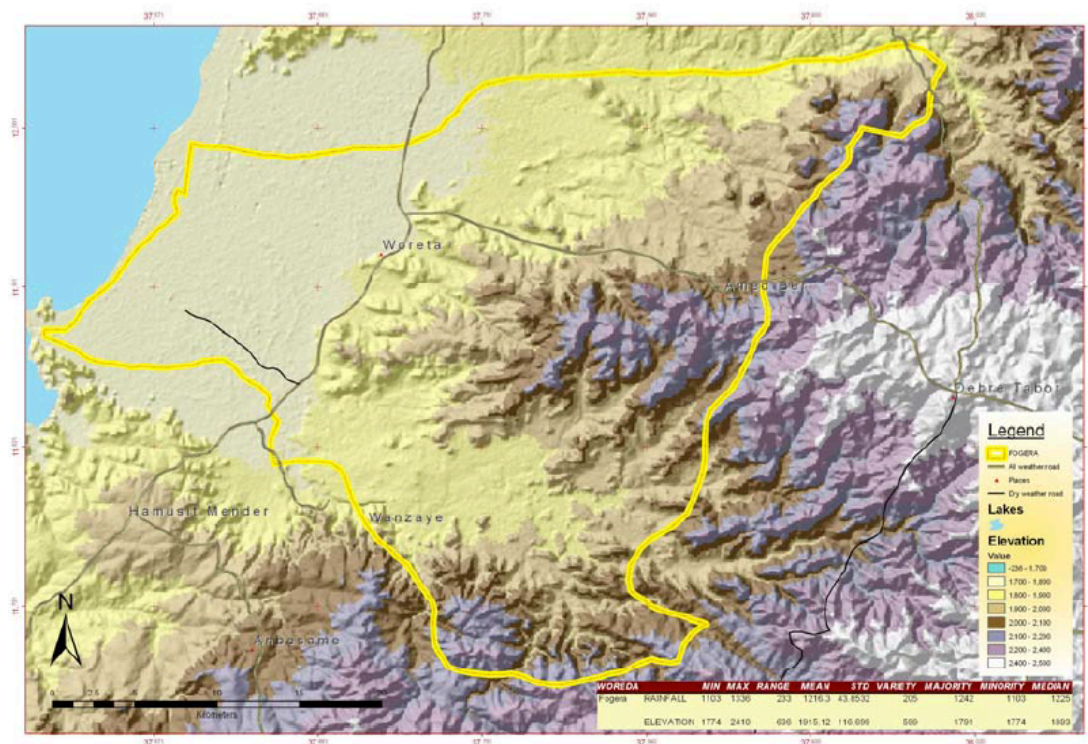
Proclamation No. 89/1997 on Rural Land Administration and Use slightly changed land policy in Ethiopia in the sense that it allowed farmers to lease their land, pass it on to family members, and use their land as collateral in order to borrow money (ARD, Inc., 2007). However, there is a caveat that land must be of a certain size if it is to be passed on to other family members. Title certificates can be issued to farmers by the Federal States under land administration rules, which allow for new lease contracts to be drawn up between themselves and other farmers, and ensures that they are not displaced from their land at a later date. Also mentioned within this proclamation is the possibility of redistributing or changing communal land into private holdings (Adenew & Abdi, 2005). While this proclamation applies to national land policy, the people within Fogera Woreda do not practise any of these changes.

Access to land by individual farmers remains crucial due to the high dependence on agricultural production for subsistence and income generation. The issue of land being classified as public property in Ethiopia has been a subject of contentious debate. On the one hand, many said that it reduced the tensions and exploitative nature of the relationship between tenants and landlords, as tenants were now free to use the land as they desired (Crewett et al., 2008). On the other hand, levels of poverty and food insecurity are on the increase and the government has failed to provide citizens with enough land for subsistence and to allow for rural development. Rural employment opportunities are few and little attempt has been made by the EDRDF-led government to create jobs so that farmers' incomes are not entirely dependent on the marketing of produce from their land (Gebreselassie, 2006). Debates also question how the current tenure system of Ethiopia affects farmer investments on land, land management, non-farm sector development and factor mobility (Gebremedhin & Nega, 2005).

### 3.2 Biophysical characteristics

#### i. Topography, soil types and conditions, and types of vegetation

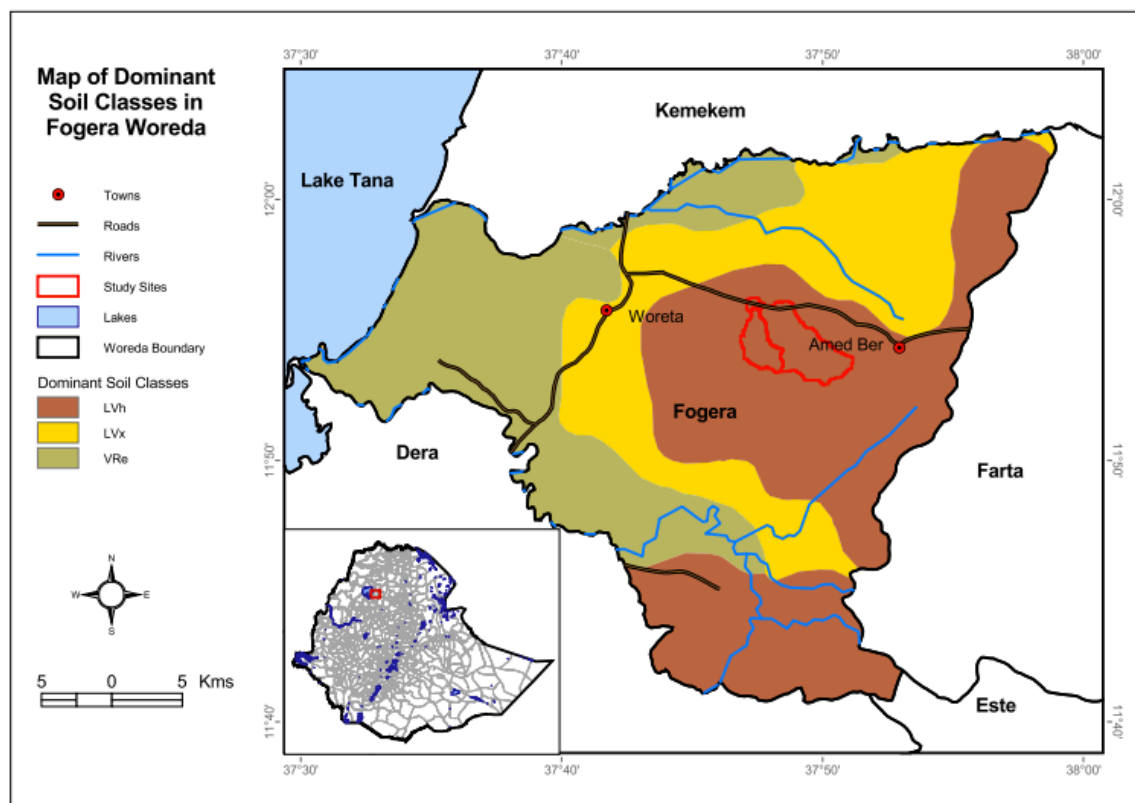
The Fogera Woreda elevation ranges between 1774 and 2400 masl (Figure 6) in a climatic zone locally classified as *Woina Dega*, meaning temperate (IPMS Ethiopia, 2005; Ergano et al., 2010).



Source: IPMS Ethiopia, 2005

**Figure 6: Altitude Map of Fogera**

The Fogera Woreda Office of Agriculture states that there are two dominant soil types in Fogera (Figure 7): black clay soils (ferric vertisols), in the plains of the district; and, orthic luvisols of relatively low fertility in the medium and high altitude areas (IPMS Ethiopia, 2005; Campbell, 2005). Annual floods from the nearby rivers deposit very fertile alluvial vertisols on the lower plains of Fogera, thus increasing the potential of high productivity when the land is not flooded (Ministry of Foreign Affairs - Finland, 2010).



Source: CGIAR, 2011

**Figure 7: Dominant soil classes in Fogera Woreda**

Fogera Woreda has high agricultural potential and is able to grow a fairly diverse range of perennial and annual crops (Table 2). However, natural vegetation has been severely degraded over the years due to growing population and the expansion of cultivated land. Few patches of natural vegetation remain in Fogera and tree cover is sparse, dominated by *Acacia tortilis* (World Agroforestry Centre, 2011). Eucalyptus woodlots are common near households; the wood is used as house construction material and fuel (although the burning of cow dung is more common). Rice is the most common food crop in Fogera. Other common crops are maize, millet, barley, teff, Niger seed, legumes, wheat and pepper. Fogera does not have any large natural forests (Alemsaga Forest is the nearest, and only a small part lies in Fogera), and the majority of fauna in the district is found directly next to, or within close proximity to Lake Tana (Campbell, 2005).

**Table 2: Agroecological zones in Fogera Woreda**

Altitude range (masl)	Dominant crop and livestock
1700-1800	Rice, finger millet, horticultural crops, noug, fish, cattle, sheep
1900-2000	Cereals (maize, teff, finger millet), noug, vegetables, apiculture, cattle, goats
2000-2400	Barley, horse beans, potato, apiculture, sheep, cattle

Source: Adapted from IPMS Ethiopia, 2005

## **ii. Climate, rainfall and effect on agriculture**

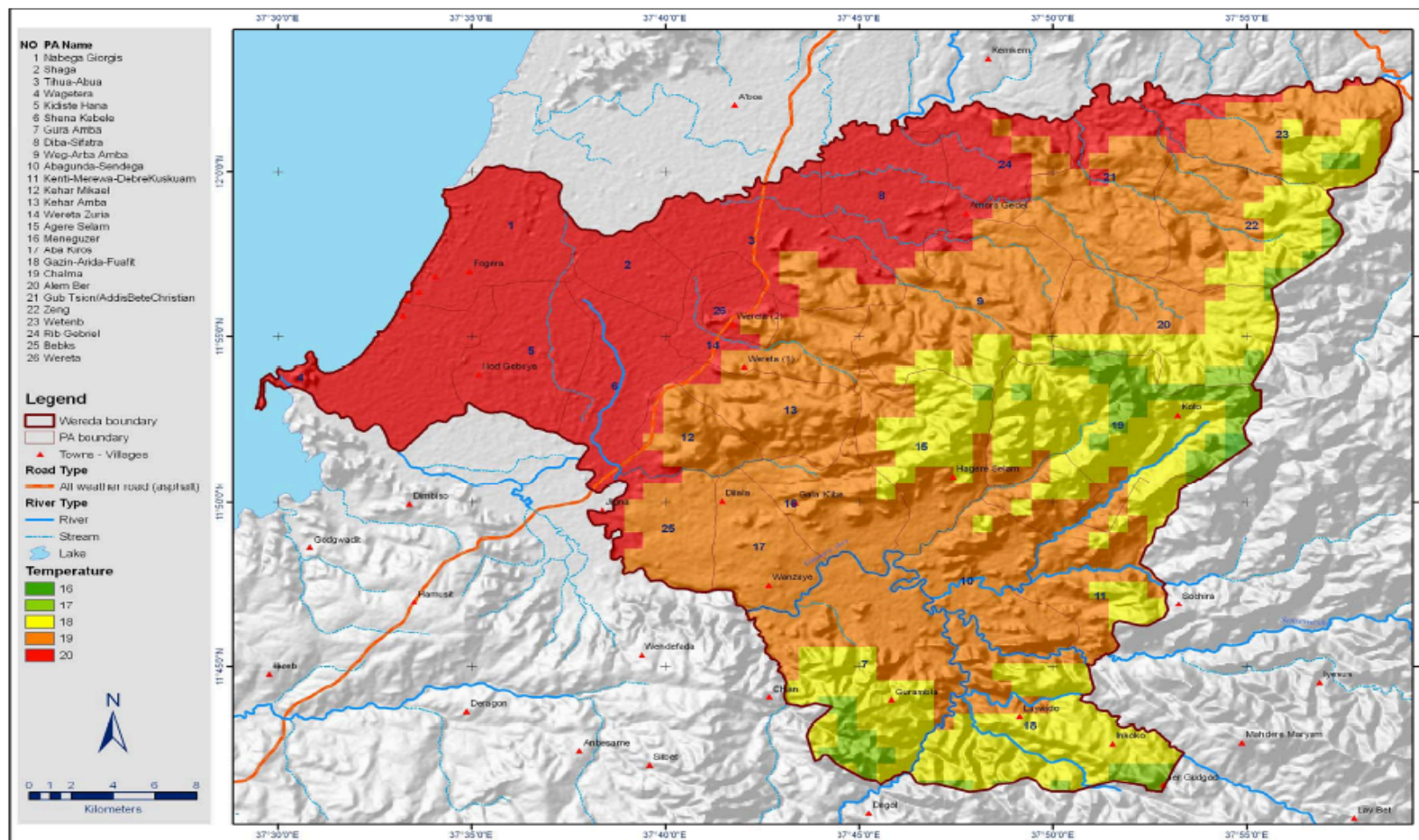
Given the low altitude of the study site, temperatures remain fairly high (Figure 8), but rainfall is typically abundant (Figure 9). Fogera Woreda has a mean annual rainfall of 1216.3 mm, but rainfall ranges from 974-1516 mm<sup>2</sup> (IPMS Ethiopia, 2005; Zamadim et al., 2010). The rainfall pattern can be described as mono-modal, locally known as the *kremt* rains, occurring from June to September (Ergano et al., 2010; FEG Consulting Group, 2007).

Land cultivation is planned around the *kremt* rains (Figure 10). During the months of February and May land is prepared for cultivation, and toward the end of May, long-cycle crops such as rice, maize and finger millet are sown. In August, land is prepared a second time for the cultivation of short-cycle crops, such as chickpea and vetch, which are then planted in September. Maize and finger millet are harvested in October, ready for consumption, and the rice harvest begins in November and can last until December. In January chickpea and vetch are harvested (FEG Consulting Group, 2007).

The livestock production season is marked by the births of both cattle and small stock in June; during this time pastures regenerate and the many water bodies are refilled due to the rains. July to November is the main lactation period. Livestock sales occur throughout the year, but sales increase during religious festivals, which take place in January (Christmas and Epiphany), April (Easter) and September (New Year). However, the purchase of oxen (used for ploughing) increases between February and March, when land is being prepared for cultivation; and the sales of oxen increase between October and November when ploughing is complete (FEG Consulting Group, 2007).

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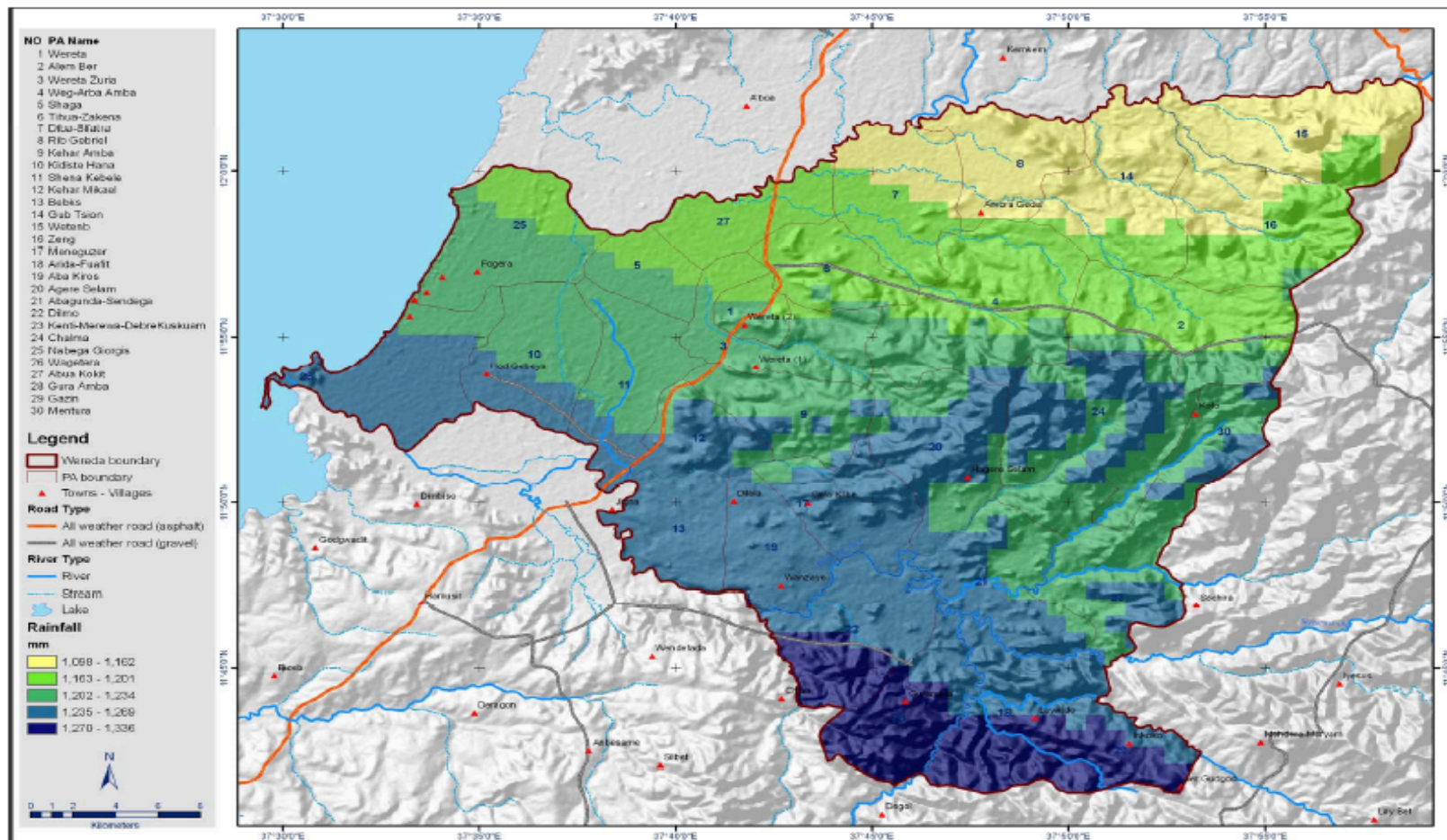
<sup>2</sup> Fogera Woreda does not have a rain gauge, which makes meteorological monitoring difficult



Source: IPMS, 2007

Figure 8: Fogera Woreda mean annual temperature

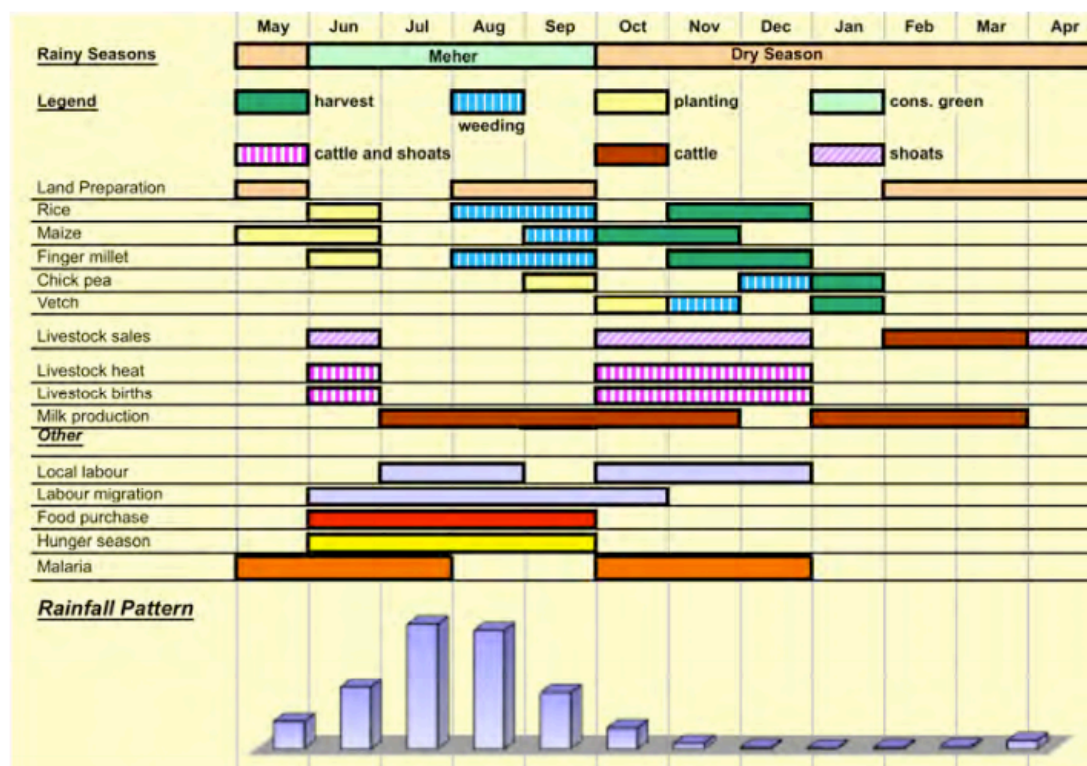




Source: IPMS, 2007

Figure 9: Fogera Woreda annual rainfall

Figure 10: Fogera Woreda seasonal calendar



Source: FEG Consulting Group, 2007

### iii. Water bodies and sources

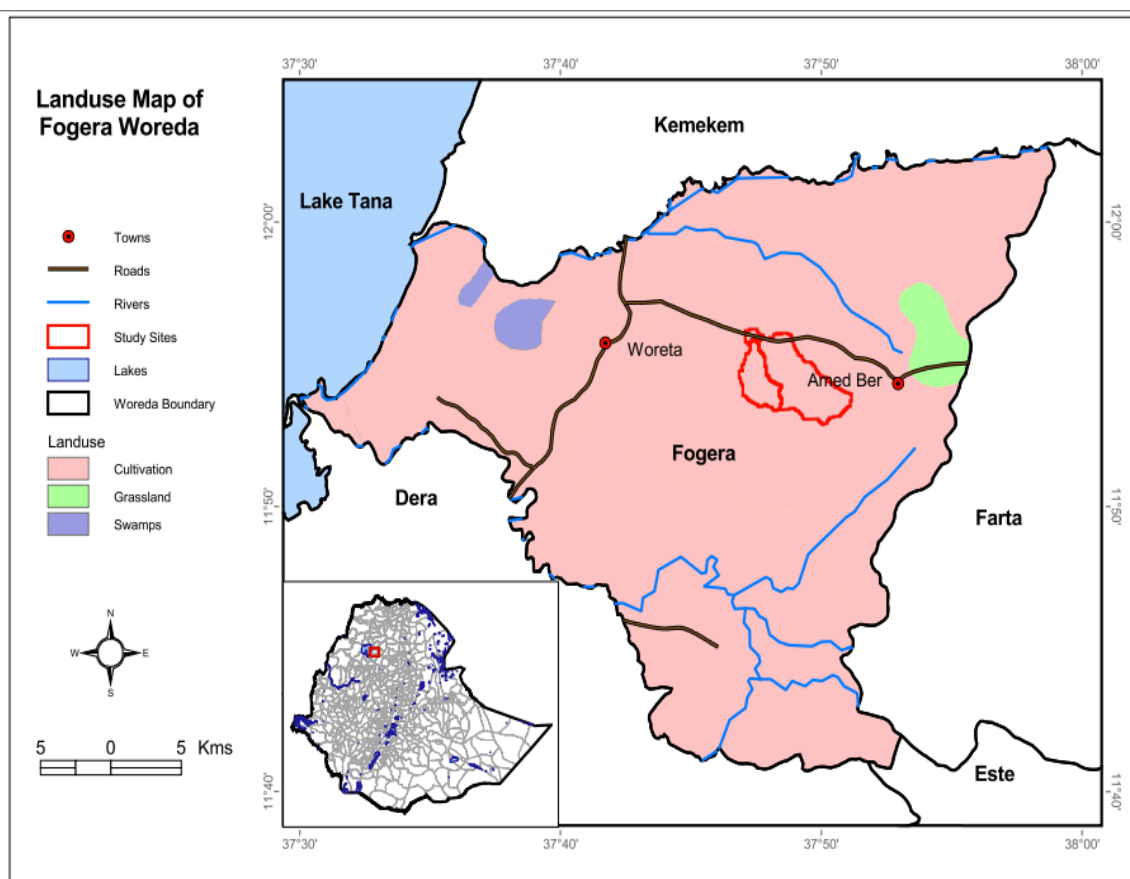
Fogera Woreda has 77 perennial and 38 intermittent rivers. The two major rivers are the Gumara River and the Reb River, both of which drain into Lake Tana. Lake Tana has a surface area of between 3000 and 3500 km<sup>2</sup> depending on rainfall and is Ethiopia's largest lake, as well as the source of the Blue Nile. Domestic water supply and water for irrigation is usually obtained from one of the 155 springs in the area, using 820 pumps (Zamadim et al., 2010; IPMS Ethiopia, 2005).

Farmers commonly irrigate their land using traditional water diversion canals, but the use of small pumps is becoming increasingly common. Shallow wells are also common in Fogera, but the fairly shallow (2-4m) water table prevents them being dug too deep to avoid collapse (Zamadim et al., 2010).

### iv. Land use

There is a lot of confusion surrounding land use data on Fogera Woreda. Multiple statistics exist (most of which have been mentioned below), but due to the lack of research in the area, no data has been deemed entirely correct.

According to a Woreda Agricultural Officer, land use in Fogera Woreda is divided into: 2885.3 ha cultivated land, 478 ha forest, 531.25 ha livestock grazing land and 6 ha of gullies.



Source: World Agroforestry Centre, 2011

**Figure 11: Land use in Fogera Woreda**

Information gathered from the Woreda Office of Agriculture, (Table 3) differed from what was given by the Woreda Agricultural Officer:

**Table 3: Land use and land cover in Fogera Woreda**

Land use/land cover	Area coverage (ha)	% Area coverage
Land devoted to crop production	51,472	43
Grazing Land	26,999	23
Wetlands	23,354	20
Infrastructure and settlement	7,075	6
Unproductive land (slopes)	4,375	4
Forest land	2,190	2
Swamp land	1,698	1
Perennial crop	2,190	2

Source: Extracted from Eguavoen et al., 2011



### **3.3 Demography, socio-cultural-economic characteristics**

#### ***i. Population, household size, education level, landholding and farm size***

Statistics from 2008 show that the population in Fogera Woreda was 226,594 – 48.94% were female and 51.06% male. The majority of the population resided in rural areas, while an estimated 5.4% lived in the urban areas (Ministry of Foreign Affairs - Finland, 2010).

From focus group discussions (FGDs) and transect walks alongside local farmers conducted during the site study, the average household size was 5.6 persons. However, other studies in the area had mentioned a household size of eight persons (Ergano et al., 2010).

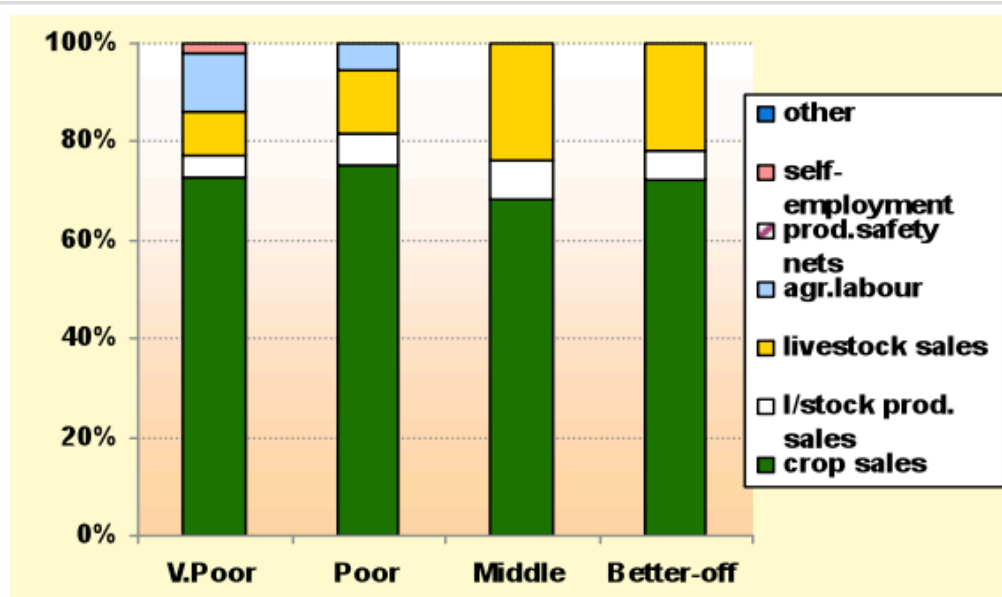
From FGDs the majority of the rural farmers had basic primary school education, yet literacy levels remained low. Fogera Woreda has one high school (from grades 9-10), four junior secondary schools (from grades 5-8) and 28 elementary schools (IPMS Ethiopia, 2005).

Average landholding and farm size in Fogera stands at 1.5 ha (according to focus groups discussions), but larger studies found minimum landholding amongst rural farmers to stand at 0.5 ha and the maximum landholding at 3.0 ha (IPMS Ethiopia, 2005).

#### ***ii. Income structure and sources of livelihood***

The majority of farmers in Fogera Woreda rely on the sale of crops and other agricultural products for generation of income (Figure 12), and are almost entirely dependent on their farm – the main crop sold is rice, followed by maize, pulses, teff, chickpeas and millet (FEG Consulting Group, 2007). Alternatively income is earned from sale of sand and stones from nearby rivers and sale of livestock (particularly after ploughing season) and timber (for construction and firewood).

June to September marks the hunger season, when the majority of households run out of food. Food purchases rise steadily from the month of March, and it is common for members from poorer households to go in search of paid work (e.g. daily labour in construction or on farms during the harvesting and weeding season) due to a significant reduction in cash income generated from the sale of farm produce (FEG Consulting Group, 2007).



The graph provides a breakdown of total cash income according to income source.

Annual income (ETB)	V.Poor	Poor	Middle	Better-off
	2,200-3,000	3,000-3,800	5,000-7,000	8,000-10,000

Source: Extracted from FEG Consulting Group, 2007

Figure 12: Sources of income in a good year (2005-06)

### iii. Health and nutrition status

Malaria is common in the area during the rainy season, particularly between the months of May and July, and October and December when the rains have ended (FEG Consulting Group, 2007).

Other common ailments mentioned by FGD participants were HIV/AIDS and malnutrition, which is particularly common during the dry season when food supply is at its lowest (Table 3).

## 3.4 Farming systems and practices

### i. Farming systems

There are two main farming systems in Fogera Woreda: Rice/Fish/Horticulture/Livestock and Cereals/Oil Crops/Horticulture/Livestock/Apiculture Systems (Table 4).

A wide variety of agricultural products are produced for subsistence: x-jinga variety rice, teff, maize, finger millet, barley, chickpeas, lentils, fenugreek, basil, coriander, onions, peppers, garlic, tomatoes, noug, safflower, groundnuts, rapeseed, linseed, sugarcane, papaya, guava, honey, cattle, sheep and goats). However, only a small proportion of these are sold at local

markets: 'gumara' and white rice varieties, onions, peppers, tomatoes, noug, chickpeas, honey, cattle, sheep and goats<sup>3</sup> (IPMS Ethiopia, 2005; Ministry of Foreign Affairs - Finland, 2010)

From interviews with farmers the majority of the crops sold at nearby markets are the excess harvest, not consumed for subsistence. As individual landholdings are relatively small yet family sizes are large, producing crops solely for marketing is not realistic.

## ***ii. Farming practices***

The majority of farm work is carried out manually by both female and male family members. Farmers located within the Fogera plains often use oxen ploughing. Rice-producing Kebeles often hire labour for weeding. In the mid-high elevation areas, farmers have terraced their land to prevent soil erosion, under the instruction of the Woreda Agricultural Office.

Irrigation is highly valued in Fogera, with approximately 40% of cultivated land being irrigated. It is often carried out in the dry season through the use of canals diverting water from nearby rivers. These canals are destroyed by annual flooding and have to be rebuilt every year. However, drives through the landscape showed that modern irrigation structures were being built in the area. These will be able to withstand the hazards of the rainy season and thus reduce the labour required annually to rebuild the canals. Water is also pumped from nearby rivers, channels and streams (Ministry of Foreign Affairs - Finland, 2010).

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<sup>3</sup> See annex for details on FGDs and farmer interviews, which were used to generate some of this information

**Table 3: Top ten causes of morbidity in Fogera Woreda in 2008-2009**

Rank	Fogera Woreda	
	Disease	Cases in 2008 – 2009 (% of all cases)
1	Malaria	26,674 (42)
2	Pneumonia	7,045 (12)
3	Diarrhoeal diseases	5,970 (10)
4	Helminthiasis	2,174 (5)
5	Acute upper respiratory tract infections	2,053 (4)
6	Acute bronchitis	1,920 (3)
7	Infections of the skin and subcutaneous tissue	1,686 (3)
8	Trachoma	1,616 (3)
9	Dyspepsia (gastritis)	1,374 (3)
10	Tonsiopharyngitis	1,267 (2)

Source: Extracted from Minsitry of Water Resources of Ethiopia, 2010

**Table 4: Farming systems in Fogera Woreda**

<b>Farming System</b>	<b>Elevation Level</b>	<b>Dominant Crops</b>	<b>Description</b>
<b>Rice/Fish/Horticulture/Livestock System</b>	Fogera Plains (low elevation)	<ul style="list-style-type: none"> <li>• Cereals (rice - 4516 ha, teff, maize)</li> <li>• Pulses (chickpea, lentil)</li> <li>• Spices (fenugreek, basil, coriander)</li> <li>• Horticulture (onion, garlic, pepper and tomatoes)</li> <li>• Noug, safflower and finger millet</li> </ul>	<ul style="list-style-type: none"> <li>• Until recently the Fogera plains were used for livestock production</li> <li>• During the rainy season this area is barely accessible due to flooding – rice growing is dominant</li> <li>• With other subsistence crops namely: teff, finger millet and noug.</li> <li>• During the dry season: livestock grazing, onions planted in areas, which can take advantage of irrigation channels or are near a water pump</li> <li>• Areas of the Fogera plains that border Lake Tana, are used for fishing</li> </ul>
<b>Cereals/Oil Crops/Horticulture/Livestock/Apiculture System</b>	Mid-level and Highlands	<ul style="list-style-type: none"> <li>• Cereals (finger millet, maize, teff and barley)</li> <li>• Oil crops (noug, rapeseed, linseed, groundnut)</li> <li>• Horticulture (onion, pepper, tomatoes)</li> <li>• Sugar cane</li> <li>• Fruits (papaya, guava)</li> </ul>	<ul style="list-style-type: none"> <li>• Variable terrain with mid to high altitude hilly areas, as well as flat bottomlands.</li> <li>• Horticulture and oil crops, alongside cereals, dominate</li> <li>• Honey production is common, particularly at the higher elevation levels</li> <li>• Several farmers in the area own cattle, sheep, and goats consumed (particularly during the holiday seasons) or sold at market after the ploughing season and during the dry season</li> </ul>

Source: IPMS Ethiopia, 2005

### 3.5 Local NRM issues

#### *i. Issues and threats*

Soil degradation is a common problem in Fogera Woreda, particularly in the highlands where the slopes are steep. This situation is exacerbated by the continued loss of vegetation, resulting in the siltation of the lower lying plains and Lake Tana (Campbell, 2005).

Investments in land improvements have remained low, primarily due to land tenure insecurity. Due to lack of contractual agreements between farmers and the government, there is often little incentive for farmers to invest in land, which is not legally theirs (Gebreselassie, 2006).

Rapid population growth in Fogera has added to the struggle with food insecurity among farmers. It has been argued that the amount of land given to individual farmers is not sufficient, particularly given the subsistence nature of farming in the area and the need to improve income earning opportunities from the sale of crops at market (Gebreselassie, 2006). As family size increases, farmers are forced to apply more intensified farming methods on their land. However, productivity has reduced due to nutrient depletion since soil improvement practices are not employed as often as they should be.

High levels of poverty exist and are likely to increase even more amongst the subsistence farmers of Fogera Woreda, who do not have many alternatives to earning income outside of agriculture. More pressure is likely to be exerted on land and other resources in order to get more out of them, which in turn can lead to reduced household assets when land productivity reduces or stops altogether (Kassie et al., 2000; Shifereaw & Holden, 1997) and eventually to land degradation.

Access to water, particularly for irrigation, has been a growing source of conflict over the last five years. FGDs and individual interviews with farmers highlighted conflicts between upstream and downstream users of the nearby rivers. Upstream users have diverted the rivers in order to irrigate their land, which means that less water flows to the downstream users. In extreme cases, rivers have dried up entirely during the dry season. Crop choice has also resulted in water access conflicts, since those farmers who have planted rice need more water than those who have planted maize, and thus often create canal diversions across other farmers' plots in order to access the water. Upstream erosion could also reduce water availability for downstream users.

Transect walks on local farms showed that several farmers, within a 15-km radius of Alem Ber and Woreta towns in Fogera Woreda, were using irrigation canals to irrigate their farms. The presence of irrigation schemes was commonly seen on the farms surrounding Alem Ber and Woreta. There is high irrigation potential in 27 rural Kebeles located within Fogera (Ergano et al., 2010). The Ethiopian government is currently embarking upon irrigation and hydropower development projects in the Gumera Catchment, including a dam to irrigate 23,000 ha of surrounding land. This will improve the irrigation potential of Fogera Woreda and reduce reliance on rain (Ministry of Water Resources, 2005).

Deforestation is a problem that was rife following the shift from the Social *Derg* regime to the current EPRDF regime. At present, the majority of the surrounding hillsides in Fogera have been deforested and converted to cultivated lands, apart from the Alemsaga Forest, which is managed by the government through the Ethiopia Forestry Action Programme

(EFAP). There is need to improve forest cover in the area and to encourage wider species diversity.

Variations in climate pose a significant and realistic threat to NRM in Fogera. Interviewed farmers mentioned the unpredictability of weather patterns and late onset of annual rains. Dry spells and heightened incidences of drought and flooding are becoming common due to erratic rainfall patterns. Traditional agricultural practices remain strong in spite of the need to improve farm productivity while accommodating changing weather patterns. Farmer education and training by local Farmers' Training Centres (which are currently not very well equipped and lack financial backing) on NRM would facilitate the adoption of improved farming practices. Training in sustainable NRM-based initiatives (e.g. rainwater harvesting, use of high yielding crop varieties, fertilizer use, improved irrigation methods) that will enable farmers to reduce the risk of food insecurity through higher crop yields, while remaining considerate of traditional values, remain valuable.

NRM is only now becoming a national priority. An interview with the local Woreda Agricultural Officer highlighted how five years ago there was a significant lack of awareness, particularly by rural communities, regarding what NRM was and why it is important. Presently, education on NRM is on the rise and farmers, despite reluctance to change their traditional farming methods, are beginning to see the benefits of NRM-based initiatives, such as those mentioned in the paragraph above, when it comes to improving farm productivity and resource quality.

#### *ii. Conservation practices and extent of adoption*

Common forms of soil conservation practices in Fogera Woreda include (Ergano et al., 2010):

- **Crop rotation** – legume crops (e.g. grasspea and chickpea) are used in order to improve soil fertility
- **Contour ploughing and bunding** – are often used to prevent soil erosion from water run-off
- **Compost** – used by farmers to improve soil fertility
- **Terracing** – commonly used in the higher elevation farms to prevent soil erosion
- **Gully rehabilitation**
- **Agroforestry** – distribution of seedlings
- **Watershed development**
- **Manure** – often used on farms and plays an important role in the nutrient cycling process.

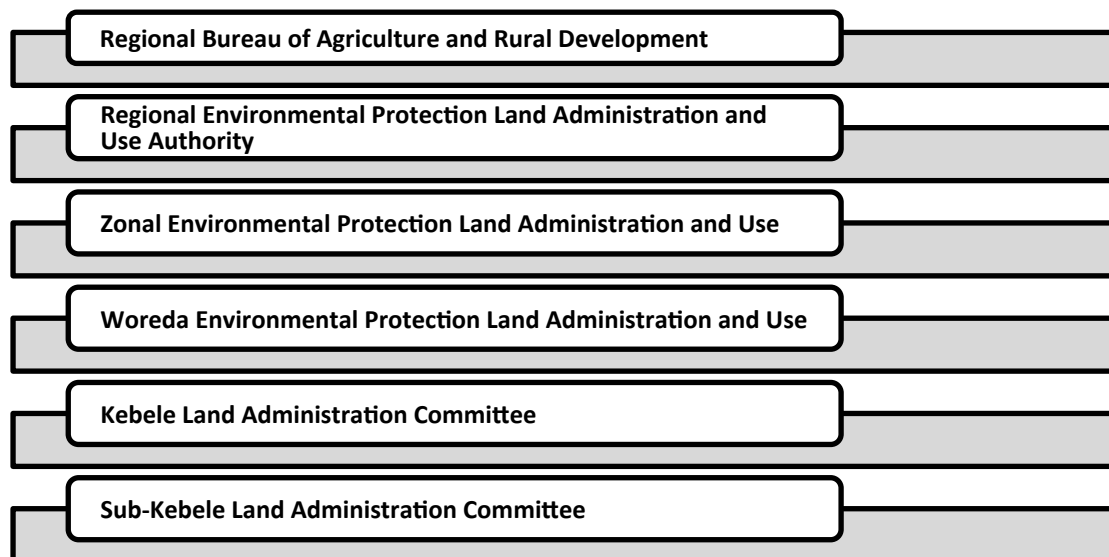
According to farmer interviews, it is not common to fallow land although they are aware of its benefits. This is mainly due to the lack of flexibility considering that there is only one planting season. The introduction of new crop varieties has also reduced fallow time on farms where it is practised.

### **3.6 Local governance system**

Regional governments are responsible for any administrative duties at the local level. However, the federal government is still responsible for the formulation of policies. Figures 13 and 14 indicate the local administrative institutions for land and agriculture.

Local governance is headed by the Kebele administration. The administrative unit plays a decisive role in local governance and is tasked with the following roles: making decisions on

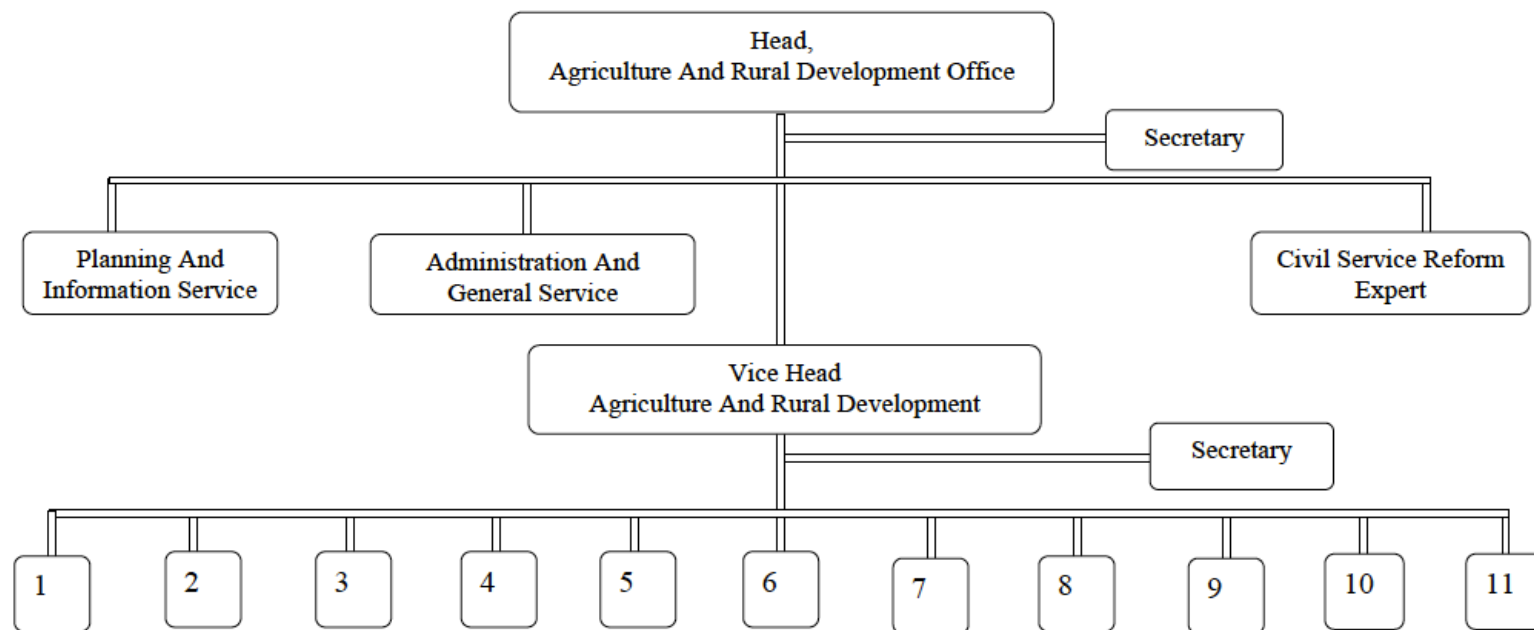
community action interventions; rehabilitation schemes; targeting specific groups for food aid and food-for-work schemes; identifying problems affecting the Kebele population; developing regulations for resource use; developing credit schemes; regulating credit repayments and tax collection; ensuring the security of the Kebele; and resolving minor legal issues (Desta et al., 2000).



Source: Adenew & Abdi, 2005

**Figure 13: Land administration institutions in the Amhara region**





**Legend**

1. Extension & Home Science Desk
2. Animal & Fisheries Resource Development & Protection Desk
3. Crop Production Technology Promotion & Protection Desk
4. Natural Resources Development & Protection Desk
5. Environmental Protection, Land Utilization & Administration Desk
6. Cooperatives Promotion Desk

7. Water & Mining Desk
8. Rural Road Construction Desk
9. Rural Energy
10. DPPC & Food Security
11. Input supply And Credit Service

Source: IPMS Ethiopia, 2005

Figure 14: Administrative structure of the Fogera Woreda Bureau of Agriculture

### 3.7 Local and international NRM institutions

#### *i. Formal NRM Institutions and Organizations*

- **Woreda Office of Administration** – facilitates the administrative structures in Fogera Woreda toward the development agenda of the government. The office also plays an important role in government NRM activities that are already underway in the area (Ergano et al., 2010).
- **Woreda Office of Agriculture** – is active at the regional level and is authorised by the Constitution to promote agricultural development at the local level. The decentralized governance system of Ethiopia allows for these offices to devise and implement their own policies specific to the ecosystems within the Woreda, and are considered to be the executing agencies of the Ministry of Agriculture at the regional level (Merrey & Gebreselassie, 2011). Tasks that the Woreda Office of Agriculture is responsible for include: coordinating food security programmes; developing laws on the conservation and utilization of forest and wildlife resources in the area; providing agricultural extension services; providing support for irrigation development and water harvesting; and promoting market-led agriculture development by creating efficient forms of agricultural inputs and product marketing systems (Merrey & Gebreselassie, 2011; Hagos et al., 2009). In Fogera, extension services specifically target improved livestock and crop production, and NRM (Ergano et al., 2010).
- **Amhara Regional Agricultural Research Institute** – is the regional representative of the Ethiopian Institute of Agricultural Research, which is an autonomous body within the Ministry of Agriculture. It is tasked with carrying out regional agricultural research and aims to also strengthen the links between research institutions and agricultural extension services at the regional level (Merrey & Gebreselassie, 2011).
- **Woreda Cooperative Promotion Office** – the Ethiopian government has actively promoted cooperatives since 1994. They are supposed to act as a mechanism for the commercialisation of agriculture, aimed at both inputs and outputs (Merrey & Gebreselassie, 2011). In Fogera, the Cooperative Promotion Office works alongside the Office of Agriculture in creating farmer cooperatives and identifying potential commodities and sectors where farmer cooperative participation can be feasible in the improvement of income generation and improved market linkages (Ergano et al., 2010).
- **The Orthodox Church** – from interviews with key informants in Fogera it was noted that the local population in Fogera Woreda place very high value on their faith and the Orthodox Church is considered to have a great deal of authority over the activities of its members. The church actively assists in local development and is involved in the conservation of natural resources, education, health services and the provision of clean water (Merrey & Gebreselassie, 2011).
- **Adet and Andassa Agricultural Research Centres** – are heavily involved in the demonstration of improved agricultural technologies, which facilitate in the improvement of food security and NRM activities (Ergano et al., 2010).
- **Woreda Office of Communication and Public Relations** – assists in mobilising the community for NRM activities through various forms of publicity (Ergano et al., 2010).
- **Woreda Office of Youth and Sport** – mobilises the community and assists in campaigning for NRM activities (Ergano et al., 2010).

- **Woreda Peace and Security** – control the illegal distribution of farm lands and also assists in conflict resolution between members of the community.
- **Woreda Office of Women's Affairs** – provides training to women in improved agricultural techniques and assist in improving farm activities (Ergano et al., 2010).
- **Farmer Cooperatives** – often rent out farming equipment (particularly during the ploughing season) to farmers at a subsidised rate. Cooperatives provide credit that enables farmers to purchase seeds and fertilizer, and invest in irrigation (Ergano et al., 2010). They are also responsible the trading of grain.

#### *ii. Informal local NRM institutions and rules*

- **Informal farmers associations** – rural farmer participants in FGDs mentioned that although their farmland is owned by the State, they are directly responsible for its use, and the State does not determine what practices they must use to cultivate the land. In the case of Fogera, it was noted that small-scale community-based NRM (CBNRM) activities are developed by the communities and penalties are enforced if natural resources are not correctly utilized. For example, overuse or pollution of a common water resource could lead to penalties such as, forcing farmers to dig 5-10 metres of terraces, and if they refuse a financial penalty of 30 ETB (equivalent to USD 1.7) can be imposed.
- Farmers also play a crucial role in testing improved agricultural technologies and provide an educational platform for the discussion of both traditional and modern farming techniques (Ergano et al., 2010).

#### *iii. NGOs*

- **Ethio-Wetlands and Natural Resources Association (EWNRA)** – carries out development projects and community-based studies on wetlands throughout Ethiopia. EWNRA specialises in the sustainable management of wetlands and associated natural resources. In Fogera, they have carried out extensive watershed treatment and improved land productivity through biophysical soil and water conservation works in five Kebeles (Ergano et al., 2010).
- **Improving Productivity & Market Success (IPMS) of Ethiopian farmers** – working together with the Ministry of Agriculture, IPMS is involved in the delivery of improved agricultural technologies e.g. improved seed varieties and high value crops (tomatoes, onions, NERICA rice) (Ergano et al., 2010). It is also concerned with improving access to markets for farmers and networking with the local community in order to recognize which areas should be targeted by NRM strategies in order to stabilize food security through improved land productivity.

### **3.8 Environmental Services (ES) and Payment for Environmental Services (PES) as a potential management option**

Investing in natural resources is one of the key elements for ensuring food security, an issue that is of key importance in the study site. Conflicts between upstream and downstream land users of the Gumera watershed are on the rise due to increased competition for water, especially for irrigation. Upstream areas are experiencing rapid soil erosion, while downstream users are facing problems of sedimentation caused by upstream erosion and reduced quantities of water (Haileslassie, et al., 2008). Large-scale irrigation schemes are beginning to emerge in the area, which is putting an added stress on water resource availability, particularly for downstream users. At present, there is a niche for a resource conservation model that will facilitate dialogue between both upstream and downstream

land users and enable the creation of an equitable and sustainable approach to managing the resource, while making sure that all benefit from conservation of the common resource – essentially, PES could be a potential option for achieving this.

IWRM is of utmost importance, especially considering that farmers depend mainly on their farms and poverty levels are high in the area. Possible water-related environmental services potential future investment in the woreda include: watershed restoration; integrated watershed management; nutrient cycling; provisioning of food and fresh water; erosion control; local climate regulation; sedimentation retention and transport; improving soil formation; and flood regulation (UNEP, 2009).

Given the high poverty level and limited access to credit in Fogera Woreda, a scenario where beneficiaries compensate providers of ES through payments is unlikely. A study by Amenayehu et al. (2009) on the prospect of PES for improved land and water management practices, found that participating households were willing to pay for environmental services, but in the form of labour rather than cash. The study also found that access to education and credit; size of arable land; and the number of livestock had a positive influence on downstream farmers' willingness to pay (WTP) for restoration of ES and willingness to compensate (WTC) for improved ecosystem regulation services.

In order for PES to be a feasible resource-management option in Fogera the following areas need to be addressed:

- **Property rights** – PES is not a possibility if property rights over the natural resources do not lie with the communities who are the ES providers. Currently all land is owned by the State and land tenure remains insecure as farmers do not have any contractual agreements between themselves and the Ethiopian government.
- **Government involvement** – the government should create a functioning market where buyers and sellers are clearly identified. All potential ES are public goods, and in the case of Ethiopia, all resources belong to the State too, even though farmers have access and user rights. A creative PES scheme will need to be generated that bypasses the need for property rights of ES providers, for example by allowing payments to be potentially split between government bodies and participating communities. Government financial assistance would definitely be required in setting up a PES scheme, which often involves high transaction costs that cannot be met by the rural farmers considering their lack of significant disposable income and limited access to credit.
- **Development of national legal and regulatory frameworks** – if PES is to be a possible NRM option in Fogera Woreda it should be stressed that frameworks must maintain that PES schemes be poverty-oriented and clearly address hunger and poverty reduction. Legal and regulatory frameworks need to be developed in order to allow for the development of effective markets and for PES and other NRM options to be integrated into national policy and promoted nationwide.

## 4. DRIVERS OF LAND USE CHANGE, STATE OF NATURAL RESOURCES AND CONSEQUENCES OF CHANGE

### 4.1 Patterns of land cover/land use change

Farmers had strong knowledge about changes in land cover and land use; in some cases, they were able to mention specific years in which cropping patterns had changed. Together with a more concentrated study carried out in the study site by the International Water Management Institute (IWMI), we are able to gain a clear idea of the exact ecological and production system changes that have occurred over the last five decades.

#### *i. Ecological changes*

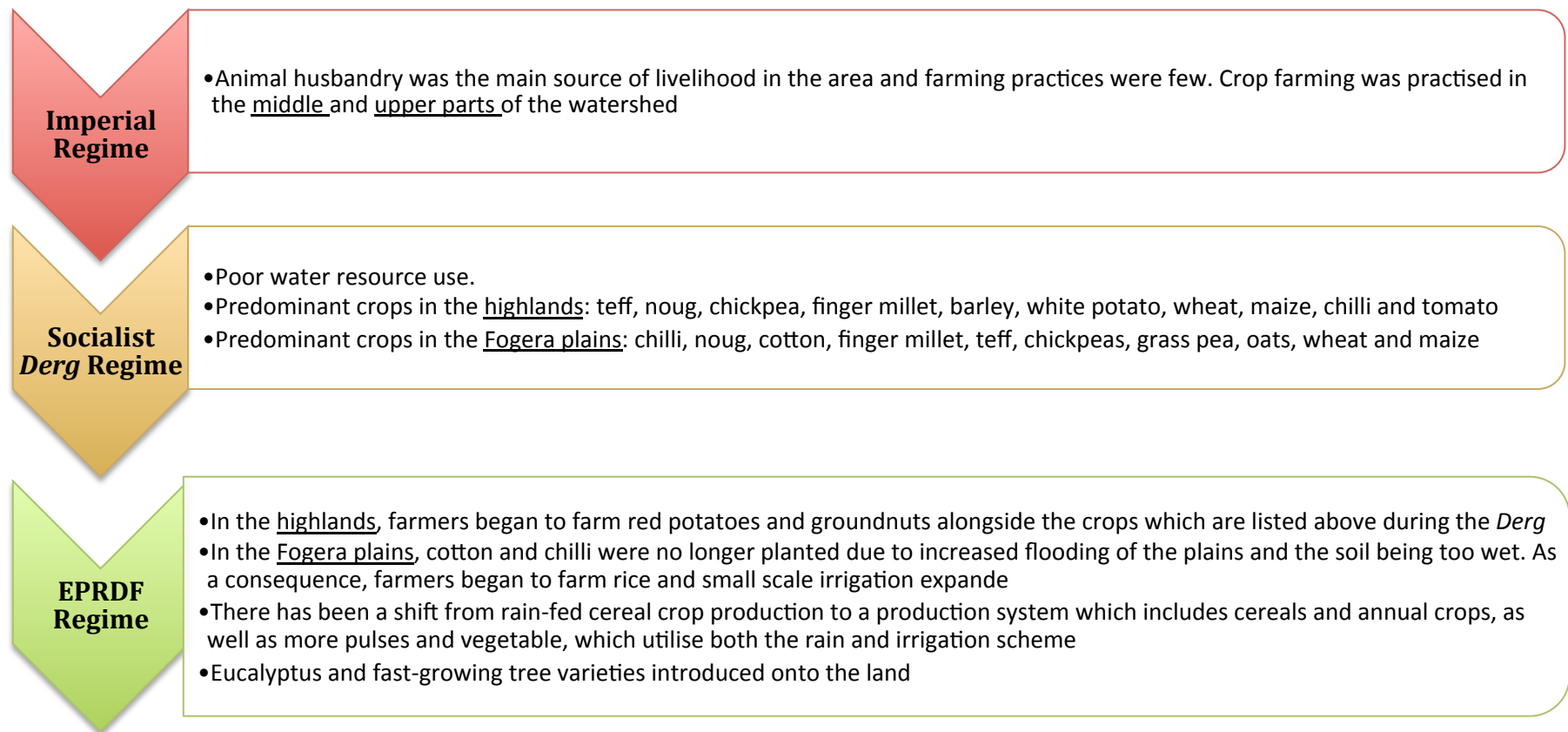
During the imperial regime of Ethiopia (1930-1974) the majority of the upper catchment area of Fogera was covered by forest and population levels were very low. Biodiversity levels were high and wildlife was abundant. Livestock numbers were high and the majority of the population were either pastoralists or agro-pastoralists. The main source of livelihood was livestock husbandry and there was very little reliance on the cultivation of crops (Leminih, 2011). Pastoralists relied on natural grasses growing in the Fogera plains after annual flooding during rainy seasons (Gebremedhin et al., 2010).

During the socialist *Derg* regime (1974-1991) population levels began to rise in Fogera, yet forest cover remained high and largely untouched. However, toward the end, deforestation did begin to occur, particularly for charcoal. While forests remained fairly well protected, environmental awareness and education remained almost non-existent (Leminih, 2011). During this period grazing land began to decline due to the conversion of land for rice cultivation. What little grazing land remained deteriorated further as a result of the invasion of the thorny *Hygrophilla auriculata* weed (Gebremedhin et al., 2010).

Under the current EPRDF regime, excessive deforestation began to occur, to the present state where little-to-no forest cover exists in Fogera. Forestland increasingly began to be converted into farmland, and the only sign of forest expansion has been the planting of eucalyptus woodlots on farms. According to local informants, weather patterns have changed: the long rains, which usually occur between June and August, now begin in mid-July and cases of drought are on the rise, which affects the availability of livestock feed (Leminih, 2011). Animal husbandry has been replaced by crop cultivation as a source of livelihood, and livestock populations are consequently significantly lower at present. (See Figure 15).

ii. *Changes in crop patterns and production system*

Figure 15: Changes in agricultural land use patterns in Fogera Woreda



Source: Information gathered from FGDs and Leminih, 2011

## **4.2 Drivers of land cover/use change**

### ***i. Shifts in national governance and institutional changes***

During the Imperial regime, access to land was granted through a kinship-based scheme called “*Rist*”. Under the *Rist* system, access to land was determined by blood lineage, so land could only be transferred if sufficient proof existed that the land belonged to an ancestor of the same bloodline (i.e. through either the mother’s or father’s descent). Once this right-to-land had been ascertained, the new landholder had the right to transfer the land to either relatives or other persons. Therefore, ownership could be classified as being semi-private or family-owned (Leminih, 2011).

Land reform began to take place under the *Derg* regime, which transferred all ownership of land to the State, meaning that the State was the only body allowed to allocate land, except in rural areas where it was the task of Peasant Associations. Under this regime land could no longer be sold, exchanged, and inheritance of land was only allowed upon death and was limited to direct family members. Landholders of more than 10 ha had their land confiscated and it was re-allocated to those who either had very little or no land. In Fogera, previously forested land was converted to cultivated land and the lack of administration meant that access and use of resources was virtually unrestricted, resulting in rapid deterioration of the environment (Leminih, 2011). Further land redistribution took place in 1989, where farmers who had previously been given land in the last land reform had parts of their land taken away.

### ***ii. Population growth and migration***

During the *Derg* regime several migrants entered Fogera under the land reform system and were allocated portions to cultivate. It was believed that that every Ethiopian should be able to feed his family directly from his own land. This put added stress on resources and caused the rapid conversion of landscapes to farmland in order to accommodate the growing population.

However, contrary to what these reforms intended, population growth in Fogera has resulted in a parallel growth in the levels of landlessness. As a consequence, emigration from Fogera is on the rise, and natural ecosystem rehabilitation is likely.

### ***iii. Change in weather patterns***

Weather patterns are no longer as predictable as they used to be, with the late onset of the long rains between June and August. As a consequence investments rainwater harvesting is becoming common, in the form of ponds located on the Fogera plains.

Cases of drought are also on the rise in Fogera and the risk of livestock death due to feed and water shortage has increased, which has resulted in further reduction of livestock numbers.

Higher levels of rain experienced over a decade ago meant that nearby rivers burst their banks and caused higher levels of flooding on the Fogera plains. Prior to this flooding, chilli and cotton were often planted, but as the soil was either too wet or permanently flooded, farmers resorted to investing in rice paddies (although this was subsidised by the government). During the drier months, the farmers are now also used to grow more vegetables, such as onions and tomatoes.

#### **iv. Expansion of irrigation**

Irrigation through canals was traditionally practised in the area. However, as new crop varieties, such as *khat* and rice, are increasingly being planted due to expanded irrigation schemes, competition for water resources increase. As a consequence, irrigation channels have increased in size and more large-scale irrigation schemes are beginning to materialise. An example is the government-funded dam in Gumera catchment. Increased irrigation water use also means that farmers can plant certain crops throughout the year and no longer have to rely on the rainy and dry seasons for annual planting and harvest seasons.

#### **v. Use of fertilizer and improved seed varieties**

Farmers are beginning to increase the use of fertilizers on their land in order to maintain soil fertility. Manure is still the most common fertilizer used, but compost made from a mixture of manure, weeds and crop residues is increasingly being utilized. Use of chemical fertilizers is also increasing as it becomes more readily available in the Woreda.

The national government and extension agents are increasingly making improved seed varieties available to the farmers of Fogera. These seed varieties specifically aim to improve crop yields and subsequently improve food security in the area.

#### **vi. Technical support from abroad and the national government**

Under the socialist *Derg* regime farmers in Fogera received technical support from North Korean experts who supported the growing of the X-Jinga rice variety on large cooperative-run farms. However, production ceased when the EPRDF regime took over the national government in the early 1990s. This also saw the withdrawal of North Korean support; and, as a consequence weakened extension services, limited rice research and resulted in the liquidation of cooperatives. However, the Adet Agricultural Research Centre renewed interest in rice over a decade ago through the strengthening of rice research and its release of three rice varieties that were suitable for the Fogera ecosystems: Gumara, Tigaba and Kokit (Ministry of Foreign Affairs - Finland, 2010).

The national government, through the assistance of the Woreda Agricultural Office, has often provided seeds to rural farmers at a subsidised cost. Agricultural Officers also recommend crop varieties to farmers, which will improve their food production levels.

#### **vii. Market drivers and income earning opportunities**

There has been a shift toward high value crops, particularly over the last five years, which can generate more cash income and improve standards of living for Fogera inhabitants. Farmers are also planting crop varieties based on the demand by purchasers in nearby markets.

Eucalyptus and fast-growing tree varieties are increasingly being planted on farms in the form of woodlots. There is increased demand for wood for fuel and construction, and the sale of these trees further increases household income levels, thus reducing the high dependence on farms by farmers as a livelihood source. The fairly recent planting of *khat* on farms is also seen as a prospective income earner.



#### 4.3 Status of natural resources

Literature and research on the status of natural resources within Fogera Woreda is sparse. Therefore, this section has relied on the information provided by key informants and stakeholders of the landscape, as well as discussions with staff from the University of Bahir Dar.

Although Fogera has an abundance of **water resources**, signs of reduced availability, particularly for downstream users, are beginning to show. This decrease in availability has been attributed to an increase in irrigation schemes in the area and a shift to crops that require more water (e.g. rice and *khat*).

The level of siltation in the **wetlands** of Fogera Woreda has increased because of population growth and poor land use by rural farmers, which has resulted in the erosion of water catchments. Degradation of water catchments continues and overgrazing is becoming all too common due to the deterioration of the Fogera plains. Wetlands are also increasingly being converted into land that is permanently being cultivated. The level of water being held within the wetlands has reduced due to deforestation of the surrounding area and catchment degradation, which has reduced the water flow into the wetlands through infiltration. Wetlands are also being continually degraded due to the plantation of fast growing tree species, such as eucalyptus.

At present **forests** take up a very small proportion of the land cover in the study. The nearby Alemsaga Forest is all that remains of dense forest cover in the area, and this is currently being managed by the State to prevent further encroachment by growing populations. Current consumption of wood significantly outweighs the natural sustainable rate of production and little effort has been made in reforestation. Woodlots of eucalyptus are increasingly being planted on farms, but few indigenous tree species remain in Fogera Woreda. Few Wanza trees can be seen by the riverbanks and there is a small population of acacia. In the plains, some farmers mentioned that they have planted papaya, mango, banana and guava trees on their farms, the fruits of which can be sold at market.

Levels of **biodiversity** continue to decline in Fogera to a point of very low-level productivity. Wildlife numbers are declining due to habitat destruction and there is limited flora species diversity. However, the area is known for its diversity in water birds.

The quality of **soil resources** is declining due to continued land degradation and lack of conservation efforts in the study site. Soil erosion by water, particularly in the highlands, is common on agricultural land despite the use of terracing. Soil nutrient depletion is also common due to limited use of natural and chemical fertilizers and declining fallow periods. Low soil fertility levels, combined with high levels of soil erosion, are negatively affecting food productivity due to declining crop yields, which in turn affects levels of poverty in Fogera Woreda. A study on agricultural land in the Amhara region, which also applies specifically to the Fogera study site, highlighted how continued land degradation is being caused by limited recycling of crop residues and dung to the soil, limited application of external sources of plant nutrients, as well as overgrazing and deforestation (Desta et al., 2000).

The surface area taken up by **grazing lands** in Fogera has declined since the mid 1970s. The Fogera plains were previously dedicated to livestock grazing, but as it continued to be flooded over longer periods of time, it began to be converted into rice paddies, and what little remains has been infested by weeds. Due to limited availability of grazing lands

livestock populations began to decline, relying more on residues of rice and millet, as well as natural hay grass (Ergano et al., 2010).

#### **4.4 Consequences to livelihoods**

Inequitable access to water over the last 3 to 5 years is now a major cause of conflict amongst the population of Fogera. Soil erosion in the upstream areas of Fogera has caused increased levels of sedimentation in the water being used by downstream users. Large-scale irrigation schemes, such as the Gamera dam, which is currently under construction, are going to have an even bigger negative effect on water being supplied to downstream users who also utilize small-scale irrigation for their crops. Conflicts are also beginning to arise among neighbouring farmers who are competing over the quantity of water that they are able to receive on their land – those farming *khat* and rice need more water than those who are farming cereal crops – and the diversion of canals by individual farmers.

Declining soil nutrient levels have had a negative effect on crop yields; as a consequence farmers are not able to produce enough food to feed their families. Consequently, farmers may have to find alternative income earning opportunities in order to generate enough income to purchase food at markets and the high dependence on their farms will decline.

Changing weather patterns are affecting the planting seasons in Fogera as the long rains are beginning up to two months later than usual. Farmers are now also finding themselves having to invest in new crop varieties that have a high resilience to extreme weather conditions, such as flooding and drought.

## **5. OPPORTUNITIES AND CONSTRAINTS/WEAKNESSES FOR INRM IN THE HEADWATERS OF THE BLUE NILE**

The rapid conversion of forests, grazing lands and wetlands to cultivated land over the last three decades has led to the severe degradation of the Fogera landscape. Natural resources are increasingly at risk due to irresponsible usage, which is putting farmers' main sources of livelihood in jeopardy. But there are opportunities for INRM in the study site:

- A few years ago NRM was barely mentioned in political circles. However, at present, the national government has made NRM a national priority, which has been solidified by the SLM Secretariat under the Ministry of Agriculture. This means that taking action against natural resource degradation is easier since the government also considers it an area of great importance and is already assisting in mobilising the population around the issue.
- The decentralized nature of the Ethiopian governance system makes education on INRM easier. The presence of Development Agents at the Woreda level means that information from both government agencies and NGOs aligned with the government can be easily disseminated.
- There are several institutions in Fogera Woreda that are concerned with NRM, meaning that in time, INRM will be a well-recognized concept by rural farmers in Fogera Woreda.
- Farmer participants in interviews and FGDs expressed willingness to learn about INRM and ways of improving the productivity of their land. They understood that natural resources were finite and that it was necessary to implement strategies in order to conserve them and manage them more appropriately at the local level.
- The youth in Fogera are particularly interested in INRM as a way of improving their livelihoods and breaking the poverty cycle in the area (Leminih, 2011).
- Farmers in Fogera Woreda were particularly interested in finding solutions to improve food availability through increased land productivity, particularly during the hunger season between June and September. It has been shown that local farmers are already beginning to adopt strategies such as expanded use of irrigation, increased use in fertilizers, and use of improved seed varieties as ways of rehabilitating their land and improving crop yields (Leminih, 2011). This shows that there is a willingness to adopt strategies that improve food security, and that INRM-based solutions will not be so difficult to integrate into the day-to-day lives of farmers.
- Manual labour on farms in Fogera continues to be intensive as farmland becomes less fertile. Farmers are looking for ways to reduce the amount of manual labour required on their land and ways to rehabilitate it.

While the opportunities for INRM are there, there are also several hindering constraints that can stand in the way of INRM solutions to improved resource management:

- Land tenure remains with the State, which also means that property rights of resources within cultivated lands also belong to the State. This suggests that any INRM-based solution would have to go through the State for national approval, as rural dwellers are apprehensive to utilize resource management tools that aren't supported by the government due to the risk of being penalised.
- Tenure insecurity also means that less value is being placed on natural resources; farmers are less willing to invest in land that is not legally theirs, despite stating that they are able to use their land as they wish.

- Traditional agricultural practices remain ingrained in the minds of farmers in Fogera Woreda. It is difficult to convince farmers to change the techniques that they have used for years overnight. Cultural pride remains strong in Fogera, and any INRM strategies would have to take this into serious consideration. Farmers are less likely to adopt NRM techniques if they differ too strongly from the agricultural practices that they have used for decades.
- Poverty levels remain high in Fogera Woreda and can stand in the way of INRM if solutions require higher levels of credit than what the farmers have available or are able to gain access to. Income earning opportunities, besides farming, remain low in the area, meaning that, should it be required for farmers to get a loan in order to adopt new practices, it would prove very difficult to pay the loan back as income levels are not stable.
- Population growth, access to land and food insecurity could all hinder the prospects of INRM. Household size remains large in the study site and farmers have to make sure that their land produces enough to feed the family. As a consequence, agricultural practices are intensified in order to harvest as much as possible, which leads to rapid degradation of the land and often overconsumption of water resources. It is very difficult to convince farmers to change their ways when feeding their family throughout the years remains of utmost importance and there is the risk that INRM-based solutions will not provide immediate resolutions to their problems.
- Landholding size is very small in relation to household size. Farmers often complained that they were not given enough land by the State in order to improve income-earning opportunities from the sale of their crops at market, as well as improve food security for themselves. If INRM is to have an impact in Fogera Woreda it would have to be adopted by as many individual farms as possible, which can prove difficult as there are so many.
- Levels of education and literacy rates remain very low in Fogera Woreda. This could make the education of farmers on the benefits of INRM very difficult since they will not easily grasp the benefits of such strategies in the long-run when they are comfortable with the practices that they have known for a long time.
- Conflicts between upstream and downstream resource users have become increasingly violent in the last couple of years, highlighting the limited amount of cohesion among various community members. Making everybody see how INRM can be beneficial to the community can prove to be very difficult.

## 6. CONCLUSION

The Fogera district and the wetlands within have had to deal with increased rain variability and a rise in the occurrence of drought. This highlights the necessity and urgency in adopting newer technologies.

INRM can be achieved in the site through a development-based approach. The primary goal is to overcome the vicious cycle of poverty and food insecurity, which affects the state of natural resources in the study site. The high poverty levels of the study mean that NRM is not a priority for the smallholder farmers; ensuring improvements in their economic condition could lead to a change in their attitude and ensure the conservation of natural resources in the site. A development-based approach would call for the regional government, Woreda Agricultural Office, Development Agents and relevant development and environment-based NGOs to work together toward improving environmental conditions, while reducing the risks of food insecurity. A direct link between NRM and market-oriented commodity development (so as to increase income), that has profitable market opportunities, can enhance SLM. PES in the region is not a viable option as buyer-to-seller relations are not clear and Fogera lacks the required markets for environmental services and other “open access” public goods.

A development-based approach to NRM requires that markets for the sale of farm produce be accessible. The first problem with this scenario is that access to an all-weather road network in Fogera is limited and the market structure at the Kebele level is weak. This means that it is increasingly difficult for farmers to sell their produce and gain an added source of income. Market prices also need to be stabilized to ensure that farmers earn maximum profit through the sale of their produce. The potential income for other actors within the value chain, which can include middlemen and food processors, should also be considered. Price information also needs to become more readily available. Information regarding market demand also needs to be made easily accessible to ensure that farmers are not taking products to market that won't sell and will end up as waste. Levels of income can be further increased if the Ethiopian government promotes the exporting of farm produce. Currently, export markets are not well established.

A common problem associated with loss in a potential source of income is the waste of farm produce. Farmers are often unable to sell a lot of their produce in markets due to seasonal oversupply of particular crops. It is, therefore, essential that the storage and preservation of crops be encouraged so that they can be used when crop harvests fail due to drought and flooding, and improve income generation for the farmers in Fogera. A potential solution is the use of post-harvest technologies, such as drying facilities, which improve and lengthen shelf life, so that unused and unsold crops can be kept in storage and used during the hunger season between June and September.

Participatory approaches to NRM, such as CBNRM, also need to be encouraged as studies have shown that this facilitates the adoption of NRM-based interventions in the landscape. Currently social capital in Fogera Woreda is low; cohesion amongst the community needs to be promoted.

It seems safe to say that land tenure insecurity is standing in the way of NRM-based practices. Studies have shown that individual land ownership increases the chances of conservation methods being adopted in order to preserve and maintain natural resource security (Shiferaw & Holden, 1999; Gebremedhin & Swinton, 2003). However, property rights are not secure in Ethiopia due to complete State ownership of land and the natural resources present on that land. Therefore, a push to allow for land privatisation and titling

would be ideal, but is not likely to be adopted anytime soon. A more realistic option would be to encourage the creation of land rental markets and enhance tenure security. There is need to establish solid property rights in order to improve both resource availability and ensure future conservation of resources. Without solid property rights PES is not a viable option, as without such rights sellers of ES cannot be sure that they will reap the rewards of their good management.

Agriculture within Fogera is mostly rainfed, but difficulties in attaining desired crop yields have arisen due to seasonal rainfall variability and the frequency of droughts and longer dry spells. Therefore, it is key that irrigation be more widespread and that farmers switch to more resilient crop varieties to lower the risk of food insecurity.

The development of new production systems in Fogera has significantly increased surface water use. However, there is lack of equitable access and use of water among households; as well as a weak institutional system presence (there are not enough Development Agents and Woreda Agricultural Officers to cover the entire region and allow for proper monitoring) that is able to regulate and monitor equitable use within the community. Lack of a strong national institutional monitoring presence has been more obvious during conflicts that have arisen between communities whose water use varies due to differing production systems (e.g. *khat* uses more water than cereal crops) (Leminih, 2011). It is therefore critical for access rights of water resources to be established so as to limit overuse, and for standards to be collectively agreed upon by user groups, with upstream users keeping the needs of downstream users in mind.

In order to lessen the risks caused by drought, improved rainwater management strategies need to be adopted so as to increase water availability in times when access is limited. More efficient use of existing irrigation facilities, such as shallow well and river diversion, and rainwater harvesting also needs to be encouraged.

Signs of improvement in the governance structure are beginning to emerge. Policies are being developed which aim to tackle the rehabilitation of degraded landscapes and SLM is a national priority within the Ministry of Agriculture. The presence of several institutions that are concerned with NRM in Fogera Woreda means that signs of early INRM adoption are emerging.

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## ANNEXES

### 1. ANNEX 1: Transect walk information

Transect Number	1 (Upper elevation level)	2 (Middle elevation level)	3 (Lower elevation level)	4 (Lower elevation level)
<b>Description</b>	<ul style="list-style-type: none"> <li>○ <u>Coordinates:</u> 11.93243, 37.81105</li> <li>○ <u>Elevation:</u> 2033m</li> <li>○ <u>Soil type:</u> Moist, due to the rainy season. Difficult workability as it's rocky. Dark brown in colour (similar to milk chocolate)</li> <li>○ <u>Topography:</u> 30°-40° downward slope. Terracing, but slightly concave</li> <li>○ <u>Water source and access rights:</u> Reliant on rain</li> <li>○ <u>Tenure:</u> Government owned, but can use land as he pleases. Just can't sell it. Can exchange and with another farmer upon agreements. Pays land tax to Government</li> <li>○ <u>Crops:</u> Only plants barley. But has tried to plant beans, finger millet, peas and teff, but land was too rocky.</li> <li>○ 14 years on land</li> <li>○ <u>Household size:</u> 4</li> <li>○ <u>Production/yield:</u> 400 kg per hectare</li> <li>○ <u>Number of livestock:</u> 9</li> </ul>	<ul style="list-style-type: none"> <li>○ <u>Coordinates:</u> 11.98785, 37.71054</li> <li>○ <u>Elevation:</u> 1887m</li> <li>○ More trees</li> <li>○ Redder soil</li> </ul>	<ul style="list-style-type: none"> <li>○ <u>Coordinates:</u> 11.79976, 37.56939</li> <li>○ <u>Elevation:</u> 1739m</li> <li>○ <u>Soil:</u> dark brown, very wet due to flooding. Easy workability</li> <li>○ <u>Topography:</u> flat</li> <li>○ <u>Water source:</u> river nearby and canals have been created to divert water</li> <li>○ <u>What happens with rain:</u> rain floods land which allows for the planting of rice</li> <li>○ <u>Trees:</u> Eucalyptus woodlot. Used as farm boundary, for firewood and house construction. Also sell timber</li> <li>○ <u>Farm size:</u> 0.5 hectares</li> </ul>	<ul style="list-style-type: none"> <li>○ <u>Coordinates:</u> 11.98780, 37.71055</li> <li>○ <u>Elevation:</u> 1754m</li> <li>○ <u>Soil:</u> dark brown, very wet due to flooding. Easy workability</li> <li>○ <u>Ploughing method:</u> use of ox</li> <li>○ <u>Crops:</u> plants rice during rainy season and then chickpeas once rice has been harvested</li> <li>○ <u>Water source:</u> irrigates through canals and relies on rain water</li> </ul>

## 2. ANNEX 2: Participatory Landscape Analysis (PALA) and Participatory Analysis of Poverty, Livelihoods and Environment Dynamics (PAPOLD)

### PaLA

*9 males and 1 female participant*

Coordinates: 11.79976, 37.56939

Elevation: 1735 m

### Stakeholder Interview Questions

- **What are the key land uses? Land use and water management practices?**
  - ⇒ Comprehensive land use plans
  - ⇒ Water sources (surface vs. groundwater); water harvesting practices, soil-water conservation activities and other land management activities
  - ⇒ Area irrigated/nos. and types of livestock
  
- Settlement, grazing land, farming, planting of trees (many eucalyptus woodlots), to get groundwater
- Surface, ground and rainwater harvesting → water sources
- Plant crops during the rainy season
- Make canals for irrigation purposes
- Soil conservation: plant trees and build terraces to prevent soil erosion
- Soil fertility: make compost and use animal dung
- Irrigated land: Avg. 41% → the rest is rain-fed
- Livestock: Avg. 10 including cattle, horses, mules, donkeys and chickens
  
- **What tree species are planted, maintained, protected and for what purpose (include vegetables)? Current/past?**
  - ⇒ If trees were planted, why? By whom?
  - ⇒ Agroforestry?
  
- Eucalyptus, Acacia and Wanza
  - ❖ Eucalyptus: firewood, house construction and timber
  - ❖ Acacia: firewood, fencing, to protect from soil erosion (plant it on sloppy areas and next to river bank (name of river = Rib) → anchors soil through fibrous roots)
  - ❖ Wanza: fodder, animal feed, timber, house construction, firewood and human consumption
  
- **What crops do you plant?**
  
- Rice, chickpea, oats, grasspea, tomato, onion, maize, teff, dagusa, lentils, sunflowers, sorghum and spinach
  
- **What products are consumed/marketed?**
  - ⇒ Top 3 commercial crops

- ⇒ Top 3 food crops
- ⇒ What is the average production per acre?

- Commercial: rice, chickpea, grass pea, dagusa, teff, tomato, oat, onion, sorghum and spinach
- Consumption: everything except sunflower
- **Average production yield/product?** (Measured in kg's per unit area (hectare/acre) of a particular crop)
  - Dagusa = 1,200kg per hectare
  - Teff = 400 kg per hectare
  - Rice = 5,000 kg per hectare
  - Chickpea = 800 kg per hectare
  - Grass pea = 1,000 kg per hectare
  - Oats = 2,500 kg per hectare
  - Tomatoes = 24,000 kg per hectare
  - Onion = 15,000 kg per hectare
  - Sorghum = 400 kg per hectare
  - Sunflower = 400 kg per hectare
- **How many seasons can they plant in a year?**
  - 2 seasons
    - ❖ Dry: October-April
    - ❖ Rainy: May-September

### Timeline

Changes (List predominant crops and highlight any changes over time)				Why? (What was the reason for the change?)	Who and what are the drivers? (Internal and external)
1970-1980	1980-1990	1990-2000	2000-present		
<ul style="list-style-type: none"> <li>▪ Chili</li> <li>▪ Nug</li> <li>▪ Cotton</li> <li>▪ Dagusa</li> <li>▪ Teff</li> <li>▪ Chickpeas</li> <li>▪ Grass pea</li> <li>▪ Oats</li> <li>▪ Wheat</li> <li>▪ Maize</li> </ul>	Remained the same	<ul style="list-style-type: none"> <li>▪ Rice</li> <li>▪ Tomato</li> <li>▪ Onion</li> </ul> <p>As well as the others → except cotton and chilli</p>	Remained the same	<ul style="list-style-type: none"> <li>▪ Stopped planting cotton and chilli in 1986 due to overflowing of river and subsequent transformation of landscape</li> <li>▪ More flooding led to the planting of rice</li> <li>▪ Due to more water being available they planted onions and tomatoes</li> </ul>	<ul style="list-style-type: none"> <li>▪ Changes driven by government who suggested new crops for the changed landscape</li> <li>▪ Government provided seeds at a subsidised cost</li> </ul>

## PAPOLD

- **What are the 3 main causes of poverty in the area?**
  - Climate change/variability, health problems (particularly malaria), problems with market prices (prices are very low) and laziness
- **What is the education level of the household head?**
  - Avg. primary school education
- **Sources of livelihood (both on- and off-farm)**
  - Animal husbandry, selling ox at market, fattening livestock, selling sand from the river for construction, acting as brokers between farmers and produce buyers, trade of basic commodities and selling local beer
- **Farm size?**
  - Avg. 1.5 ha

### 3. ANNEX 3: FGDs, PALA and PAPOLD in Alem Ber Zuria Kebele

*Coordinates: 11.93243, 37.81105*

*Elevation: 1999m*

#### **FGD 1**

- **What is the ecological and economic importance of the landscape? Qualitative value of natural resources?**
  - ⇒ Goods and services provided by the landscape e.g. wildlife habitat, supporting hydropower, irrigation, food basket, crop value, etc.
  - ⇒ Extent of dependence on wild capture and collection (including fisheries)
  - ⇒ Dependence of individuals on rainfall, i.e. number of stakeholders dependent on rain-fed agriculture
  - ⇒ How many depend on the farm (live, eat, etc.)
- Wildlife habitat. Nearby forest – Alemsaga forest. Provides a valuable food basket, as all people living in the area are subsistence farmers.
- Very dependent on rainfall to water their crops
- Area is a tourist attraction – Simien mountains nearby and the Alemsaga forest → generates income
- Environmental conservation → very much for it as it helps maintain the variable rain season
- 1/3 of the population use irrigation. Make small canals by diverting river. Use of water pumps. And use watering cans → manual
- Almost 100% depend on farm (they live on it and feed themselves from it)
- **What is the state of knowledge and expectations of different stakeholders on landscape functions?**
  - ⇒ Assess stakeholder's expectations on landscape functioning e.g. agricultural productivity and capacity vs. provisioning of environmental services
  - ⇒ Assess Local Environmental Knowledge
  - ⇒ What is the impact of landscape functions?
  - ⇒ Indicators of impact effects?
  - ⇒ Intensity of impacts?
  - ⇒ Risk of impacts?
  - ⇒ Individual sensitivity to impacts?
  - ⇒ Individual knowledge on public policy?
  - ⇒ Assess local ecological knowledge of the landscape
  - ⇒ Assess stakeholder expectations and aspirations of the landscape
- Feel that government land policy doesn't affect their land use practices. And they feel that they and the government both own the land

- **Land classifications, land tenure system, and property rights? Rights of access to water?**
  - ⇒ Who is the owner of the land? Tenure system? Who holds the property rights?
  - ⇒ Area by land classification - versatility
  - ⇒ Access to water
    - ❖ **Human:** tap, well, river, rainwater harvesting, borehole...
    - ❖ **Livestock**
    - ❖ **Agriculture:** rain fed, irrigation
  - ⇒ Who determines the right of access to water resource? Water rights allocation? Sharing?

#### Access to water

- Humans: Use of groundwater. Boreholes shared by the community. Use as much as they want. Government help with their construction
  - Livestock: river
  - Everyone has the right to use water as they wish
- 
- **Conflict/competition between water/resource user groups?**
    - ⇒ What is the level of dependency on the resource?
    - ⇒ Individual and communal rights of the resource?
- 
- Very reliant on water. Need it on a daily basis
  - Conflicts are rare
  - Irrigation conflicts exist e.g. with the use of canals and the canals are not being shared with other plots in the same area
  - Conflicts arise when there is a lack of water
  - Competition due to crop choice e.g. a rice farmer is using more water than a maize farmer
- 
- **Which local institutions are active in the area?**
    - Local agricultural office. Health centre, whose staff participates in planting trees in the area. Farmer's cooperative (offer digging materials for planting at a cost). Education office. Land-use management office
- 
- **How is access to the natural resources of the area controlled?**
    - ⇒ How is this control enforced? By whom?
    - ⇒ Is there a penalty system for overuse or illegal access?
- 
- Community takes responsibility for central NRM. Government take on the role of advisory body → teach conservation methods.
  - Nearby forest is conserved and managed by the Government Forest Authority → penalties exist for intentional degradation and illegal use → Government in the process of creating a bi-law against illegal use. Penalty system = prison, fines and taking cattle away → if cattle are taken due to them grazing on forest land the owner has to pay 20 Birr per cattle head to get them back



- **How do people cope/adapt to the impacts of environmental change?**
  - ⇒ I.e. Food insecurity, climate variability, flooding, drought, any weather changes which aren't considered "normal"
  - ⇒ **Development interventions** – what is happening in the area? Who is driving change/what are they doing? Are the coping mechanisms sustainable?
- They have been having issues with drought in the past as the rivers which are used for irrigation can sometimes run dry, leaving crops to die
- Seasons have become variable and can no longer be predicted
- Issues of food insecurity
- Drought also affects the livestock as they have nothing to feed on and some die
- June, July and August → "normal" rainy season
- Used to start beginning of June but now starts in mid-July
- During droughts they buy cattle feed for the livestock
- Have started to buy crops which can cope with the seasonal variability
- Extension agents assist farmers in the planting of animal feed during drought and also help with the storing of feed in stores
- Crops for human consumption are also stored and extension agents encourage farmers to not consume so extravagantly
- Local agricultural office encourages farmers to celebrate as many local holidays as they consume a lot of food during this time
- Agree that introduced coping mechanisms are sustainable
- **What are considered to be the 3 biggest threats to natural resources in the area?**
  - ⇒ Assess continuing, emerging and future threats to natural resources and livelihoods
    - ❖ New markets and technologies, land grab, population pressure, climate variability/change
- Population pressure (more mouths to feed)
- Soil erosion
- Climate variability
- Access to new farm land is difficult and due to population pressures, people are being forced to look for off-farm work
- Increase in livestock being slaughtered for meat and leather means that there is less livestock residing on farm and being used to plough the land

PaLA

*10 male participants*

### **Stakeholder Interview Questions**

- **What are the key land uses? Land use and water management practices?**
  - ⇒ Comprehensive land use plans

- ⇒ Water sources (surface vs. groundwater); water harvesting practices, soil-water conservation activities and other land management activities
  - ⇒ Area irrigated/nos. and types of livestock
- 
- 2885.3 ha of cultivated land
  - 478 ha of forest
  - 531.25 ha of livestock grazing land
  - 6 ha of gullies
  - Plough land with the assistance of oxen
  - Landscape comprises crop land and grasslands
  - Surface and groundwater for irrigation
  - Terracing and planting of trees for soil conservation
  - Rain water harvesting practised → create pond-like structures to hold water which can be used during the dry season
- 
- **What are the key farming systems and practices? Conservation practices/structures?**
    - ⇒ Crop zoning and cropping patterns, land use plans, farming systems, practices (rain-fed, irrigated, major crops grown, fertilizer use, tillage practices), key products, buffer crops, production input-output
      - ❖ Carry out an assessment between the best and worst field
- 
- Use of organic fertilizer and compost
- 
- **What tree species are planted, maintained, protected and for what purpose (include vegetables)? Current/past?**
    - ⇒ If trees were planted, why? By whom?
    - ⇒ Agroforestry?
- 
- Eucalyptus – grows fast. Use it for firewood and house construction. Also sell it to generate income. Plant it to stop soil erosion
  - Papaya, mango, banana, sugar cane, small amounts of coffee and guava
- 
- **What crops do you plant?**
- 
- Coffee, sugar cane, banana, papaya, mango, maize, teff, sorghum, wheat, millet, nug (inga seed), dagusa (millet), potato, beans, onion, chilli, tomatoes and groundnuts
- 
- **What products are consumed/marketed?**
    - ⇒ Top 3 commercial crops
    - ⇒ Top 3 food crops
    - ⇒ What is the average production per acre?
- 
- Teff, dagusa and maize (consumed)
  - Nug, groundnuts and tomato (marketed)

**Average production yield/product?** (Measured in kg's per unit area (hectare/acre) of a particular crop)

- Teff = 1,200 kg per ha
- Dagusa = 1,800 kg per ha
- Maize = 3,000 kg per ha

○ **How many seasons can they plant in a year?**

- Two times a year:
  - ❖ May-September (rainy season)
  - ❖ October-April (dry season)
- May/June/July (sowing season)
- October (sow again)

**Timeline**

<b>Changes</b> (List predominant crops and highlight any changes over time)				<b>Why?</b> (What was the reason for the change?)
<b>1970-1980</b>	<b>1980-1990</b>	<b>1990-2000</b>	<b>2000-present</b>	
<ul style="list-style-type: none"> <li>▪ Teff</li> <li>▪ Nug</li> <li>▪ Chickpea</li> <li>▪ Dagusa</li> <li>▪ Barley</li> <li>▪ White potato</li> <li>▪ Wheat</li> <li>▪ Maize</li> <li>▪ Chilli</li> <li>▪ Tomato</li> </ul>	<b>Remained the same</b>	<ul style="list-style-type: none"> <li>▪ Red potato</li> <li>▪ Groundnut</li> </ul> <b>Alongside the previously listed</b>	<b>Remained the same</b>	<ul style="list-style-type: none"> <li>▪ New seeds became available at markets (e.g. red potatoes)</li> <li>▪ Government gave out groundnut seeds</li> <li>▪ Driven by market demand</li> </ul>

**PAPOLD**

- **What are the 3 main causes of poverty in the area?**
  - Laziness, climate variability, soil erosion and population pressure
- **What is the education level of the household head?**
  - Primary school
- **What are the greatest needs/priorities?**

- To generate income and get wealthy, also mentioned the importance of gaining knowledge about new land use practices and crop varieties
- **Household size?**
  - Avg. 5.6
- **Health and nutrition status?**
  - Malaria, HIV/AIDS and malnutrition are common health problems
- **Sources of livelihood (both on- and off-farm)**
  - Selling farm products at markets, daily labour in construction, sell sand and stones from the river and trading of livestock
- **Farm size?**
  - Avg. 1 ha

#### 4. ANNEX 4: Key Informant Interview in Alem Ber Woreda with Ateneh Wondimu (Woreda Agricultural Officer)

4<sup>th</sup> August 2011

- **Who is in charge of managing the landscape?**  
**Who makes and implements decisions over NRM?**
  - ⇒ NRM governance structure, both formal (legalised or traditional) and informal (in use and commonly acknowledged even if illegal or not part of traditional customs) involved in NRM and their relationships: governance structure
  - ⇒ NRM institutional capacity (management can be related to non-NRM related organization e.g. urban municipality/department)
- Each individual is responsible for the land they use even though the government technically owns it. But if the government is the one utilizing the land then they are responsible for managing it
- Implementation of NRM done by community → see problems and find viable solutions. Have penalties for those who don't abide by their laws. Traditional laws include forcing farmers to dig 5-10 meters of terraces. If they refuse then they have to pay 30 Birr
- Bi-law of NRM developed by government but won't be implemented at the local level for another 2 years
- Governments also punish farmers who deforest government-managed forests in court
- **How is access to the natural resource controlled?**
  - Forests managed by government
  - Free access to water
  - Access to land and its distribution is controlled by government
  - Kebele government officials first see whether land is available for farming. Then specially selected community groups created due to a lack of land are given land as a group, not individuals, and then the land is split between the individuals who must fit a criteria → fit into the 18-29 age bracket, not have enough land (which means they are poor) and shouldn't have a criminal record
- **NGO activity in the area (both past and ongoing)**
  - ⇒ What actions were/are implemented?
  - ⇒ What planning approaches/tools were used?
  - ⇒ What have been their impacts? Or, expected impacts?
  - ⇒ What worked?
  - ⇒ Did not work?
  - ⇒ Lessons learnt?
  - ⇒ What was the scope (scale of action) of the implemented actions?
  - ⇒ What stakeholder groups and actors were involved?
  - ⇒ How were they involved – in what part of the programme/intervention and how?
- Active NGOs: IPMS, Wetlands International, USAID, IWMI, UNEP, IFAD and ILRI

- **What constrains/hinders successful implementation of INRM options?**
  - ⇒ Past and present
  - ⇒ Top down approach?
  - ⇒ Lack of institutions?
  - ⇒ Poor technical fitness of technologies?
  - ⇒ Poor economic incentive?
  - ⇒ Lack of knowledge?
  - ⇒ Poor capacity?
  
- Lack of awareness in community regarding what NRM was
- Government doesn't see NRM as being a national priority
- But all this is changing and awareness is being generated and the government is attempting to make NRM a priority amongst the farming community

## WORKING PAPERS

### 2011

124. An assessment of farm timber value chains in Mt Kenya area, Kenya
125. A comparative financial analysis of current land use systems and implications for the adoption of improved agroforestry in the East Usambaras, Tanzania
126. Agricultural monitoring and evaluation systems
127. Challenges and opportunities for collaborative landscape governance in the East Usambara Mountains, Tanzania
128. Transforming knowledge to enhance integrated natural resource management, research, development and advocacy in the highlands of Eastern Africa
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