Environmental Policy Review: Key Issues in Ethiopia 2011

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The Environmental Policy Review is a series of reports written and produced by the Colby Environmental Policy Group, senior environmental policy majors at Colby College in Waterville, Maine. This is the first Environmental Policy Review report created by students in ES 493: Environmental Policy Practicum taught by Travis W. Reynolds, Assistant Professor of Environmental Studies at Colby College.


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- **Tedla Haile**  
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<td>AfDB</td>
<td>African Development Bank</td>
</tr>
<tr>
<td>CBO</td>
<td>Community-Based Organization</td>
</tr>
<tr>
<td>CDM</td>
<td>Clean Development Mechanism</td>
</tr>
<tr>
<td>CFE</td>
<td>Concern for Environment</td>
</tr>
<tr>
<td>CGIAR</td>
<td>Consultative Group on International Agricultural Research</td>
</tr>
<tr>
<td>CRDA</td>
<td>Christian Relief and Development Association</td>
</tr>
<tr>
<td>CSO</td>
<td>Civil Society Organization</td>
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<tr>
<td>CSP</td>
<td>Charities and Societies Proclamation</td>
</tr>
<tr>
<td>COP</td>
<td>Conference of the Parties</td>
</tr>
<tr>
<td>DPPC</td>
<td>Disaster Prevention and Preparedness Commission</td>
</tr>
<tr>
<td>EB</td>
<td>Ethiopian birr</td>
</tr>
<tr>
<td>ECSNCC</td>
<td>Ethiopian Civil Society Network on Climate Change</td>
</tr>
<tr>
<td>EEA</td>
<td>Ethiopian Electric Agency</td>
</tr>
<tr>
<td>EPE</td>
<td>Environmental Policy of Ethiopia</td>
</tr>
<tr>
<td>EEPCo</td>
<td>Ethiopian Electric Power Corporation</td>
</tr>
<tr>
<td>EIA</td>
<td>Environmental Impact Assessment</td>
</tr>
<tr>
<td>EIILS</td>
<td>Environmental Implications of Livestock Series</td>
</tr>
<tr>
<td>EPA</td>
<td>Federal Environmental Protection Authority</td>
</tr>
<tr>
<td>EPRDF</td>
<td>Ethiopian People's Revolutionary Democratic Front</td>
</tr>
<tr>
<td>ERDPC</td>
<td>Ethiopian Rural Energy Development Promotion Center</td>
</tr>
<tr>
<td>ERHS</td>
<td>Ethiopian Rural Household Survey</td>
</tr>
<tr>
<td>ERVL</td>
<td>Ethiopian Rift Valley Lake</td>
</tr>
<tr>
<td>ESIA</td>
<td>Environmental and Social Impact Assessment</td>
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<tr>
<td>FAO</td>
<td>Food and Agricultural Organization of the United Nations</td>
</tr>
<tr>
<td>FFE</td>
<td>Forum for Environment</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
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<tr>
<td>GEF</td>
<td>Global Environment Facility</td>
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<tr>
<td>GHG</td>
<td>Greenhouse Gases</td>
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<tr>
<td>GIS</td>
<td>Geographic Information Systems</td>
</tr>
<tr>
<td>HDI</td>
<td>Human Development Index</td>
</tr>
<tr>
<td>HoAREC</td>
<td>Horn of Africa Regional Environmental Center/Network</td>
</tr>
<tr>
<td>IBRD</td>
<td>International Bank for Reconstruction and Development</td>
</tr>
<tr>
<td>ICNL</td>
<td>International Center for Not-for-Profit Law</td>
</tr>
<tr>
<td>IGAD</td>
<td>Intergovernmental Authority on Development</td>
</tr>
<tr>
<td>ILRI</td>
<td>International Livestock Research Institute</td>
</tr>
<tr>
<td>INGO</td>
<td>International Non-Governmental Organization</td>
</tr>
<tr>
<td>IWM</td>
<td>Integrated Watershed Management</td>
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<tr>
<td>LCCS</td>
<td>Land Cover Classification System</td>
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<tr>
<td>LPI</td>
<td>Livestock Policy Initiative</td>
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<tr>
<td>MME</td>
<td>Ministry of Mines and Energy</td>
</tr>
<tr>
<td>MoARD</td>
<td>Federal Ministry of Agriculture and Rural Development</td>
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<tr>
<td>MoFED</td>
<td>Federal Ministry of Finance and Economic Development</td>
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<td>MoJ</td>
<td>Federal Ministry of Justice</td>
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<tr>
<td>MoME</td>
<td>Federal Ministry of Mines and Energy</td>
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<tr>
<td>MoWR</td>
<td>Federal Ministry of Water Resources</td>
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<tr>
<td>NGO</td>
<td>Non-Governmental Organization</td>
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<tr>
<td>Acronym</td>
<td>Full Form</td>
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<tr>
<td>NNGO</td>
<td>National Non-Governmental Organization</td>
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<td>OIE</td>
<td>World Organization for Animal Health</td>
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<tr>
<td>PASDEP</td>
<td>Plan for Accelerated and Sustained Development to End Poverty</td>
</tr>
<tr>
<td>PFM</td>
<td>Participatory Forest Management</td>
</tr>
<tr>
<td>PREEP</td>
<td>Promotion of Renewable Energy and Energy Efficiency Programme</td>
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<tr>
<td>PRSP</td>
<td>Poverty Reduction Strategy Paper</td>
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<tr>
<td>REA</td>
<td>Regional Environmental Protection Agency</td>
</tr>
<tr>
<td>REDD+</td>
<td>Reducing Emissions from Deforestation and Forest Degradation Plus</td>
</tr>
<tr>
<td>SDPRP</td>
<td>Sustainable Development &amp; Poverty Reduction Plan</td>
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<tr>
<td>SLUF</td>
<td>Sustainable Land-Use Forum</td>
</tr>
<tr>
<td>SNNP</td>
<td>Southern Nations, Nationalities, and People Region</td>
</tr>
<tr>
<td>UESSP</td>
<td>Ugandan Energy Saving Stove Project</td>
</tr>
<tr>
<td>UNDP</td>
<td>United Nations Development Programme</td>
</tr>
<tr>
<td>UNFCCC</td>
<td>United Nations Framework Convention on Climate Change</td>
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<tr>
<td>WDI</td>
<td>World Development Indicators</td>
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<tr>
<td>WHO</td>
<td>World Health Organization</td>
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Introduction

Situated in the Horn of Africa, Ethiopia is a geographically diverse developing nation occupying 1.1 million square kilometers of land. Of the nearly 83 million people living in Ethiopia, about 68.3 million people, or 82.4% of the population, live beyond city limits, and about 79% are employed in the agricultural sector. While Ethiopia is undergoing urbanization, the overwhelming majority of people still live in rural areas. Ethiopia’s population is growing with an annual growth rate of 2.1%.

Ethiopia is considered one of the most important biodiversity hotspots of the world, but also one of the most degraded. The country faces many environmental challenges including declines in soil fertility and water quality, loss of biodiversity, deforestation and soil erosion. These issues can cause significant consequences for Ethiopian citizens, since much of Ethiopia’s population is dependent upon the environment as their primary source of income. Additionally, social, political and economic challenges within Ethiopia can contribute to, and be exacerbated by, environmental degradation. Poor infrastructure, recurrent droughts, famines, and periods of political unrest serve as additional challenges for the management of environmental resources within Ethiopia. The way in which environmental issues are addressed in the coming years will have a significant impact on the well-being of the Ethiopian people, as well as surrounding nations whose ecosystems are interconnected with that of Ethiopia.

This report is comprised of six chapters, and begins in the first chapter by exploring the historical and current context of environmentally-focused public institutions and their interactions with environmental non-governmental organizations (NGOs) in Ethiopia. Environmental stakeholders in government, in academia, and in the NGO community all appear to agree that formal environmental policies in Ethiopia are well-written and praiseworthy, but that on-the-ground implementation of policies remains incomplete. In this context, environmental NGOs have demonstrated some capacity to help fill the environmental policy implementation gap. The key informant interviews and reviews of literature, relevant federal institutions, and environmental policy laws presented in this first chapter thus highlight the roles of environmental NGOs in Ethiopia, while also providing a context for the following chapters’ exploration of more specific environmental issues.

The second chapter addresses deforestation, a substantial contributor to economic and environmental concerns ranging from global climate change to local food and energy scarcity. Due to the combined stresses of population pressure and limited access to alternative resources, Ethiopian forests are under significant strain. This chapter draws upon a Geographic Information Systems (GIS) analysis of forest cover within four Regional States of Ethiopia to explore the relationships between governance institutions, access to forests, population pressures, and changes in forest cover over time. Spatial analyses are supplemented by a
quantitative analysis of household tree-planting behavior as reported in the Ethiopian Rural Household Survey (ERHS).

The third chapter examines livestock production systems and their environmental implications. Ethiopia is heavily reliant on agriculture, with livestock estimated to contribute to the livelihoods of 60-70% of the population. The Ethiopian livestock herd is the largest of any African nation. Consequently, livestock help perform a wide variety of functions for Ethiopians and are among the most important commodities of the country. However, livestock also contribute to erosion, soil degradation, greenhouse gas emissions, water pollution, and deforestation. This chapter explores the production systems for livestock in Ethiopia using GIS, a review of literature, and interview data. The value and production of livestock are quantitatively analyzed, as are their environmental effects through quantitative and qualitative data.

The fourth chapter identifies mechanisms involved in lake management and water quality issues in Ethiopia through a literature review, case study comparisons, and interviews. Lakes in Ethiopia are often adjacent to one or more urban areas, as well as agricultural lands, and plots of other resource users who draw their livelihoods from the lake and surrounding land. These anthropogenic forces threaten the water quality of the lakes that they rely on. Lakes are a crucial example of a natural resource upon which humans depend, yet one that may become degraded beyond repair if proper policies are not in place and enforced.

The fifth chapter focuses on waste management in Ethiopia, a sector that is concerned with water quality and health. Ethiopia’s waste management problem is exacerbated by the influx of people moving to urban centers since densely populated areas are more susceptible to health risks and contagious diseases. This chapter focuses primarily on the relationship between disease and the removal and storage of human waste and household waste in the Ethiopian capital, Addis Ababa, and the resort town of Bahir Dar, and the institutions that are involved.

The final chapter of this report explores Ethiopia’s energy sector and the potential for a more sustainable future through rural electrification and renewable energy. The current energy regime in Ethiopia is heavily reliant on traditional biomass fuels, which has resulted in major environmental impacts, including deforestation, land degradation, decreases in agricultural productivity, and greenhouse gas emissions contributing to global climate change. These patterns are further exacerbated by Ethiopia’s growing population’s increased energy demands. Through spatial analysis, a literature review, and case study comparisons this chapter explores Ethiopia’s renewable energy options and examines alternative technologies’ feasibility for increasing access to electricity in rural areas of the country.
Chapter 1 How Environmental Policy Facilitates or Constrains the Activities of Environmental NGOs in Ethiopia

Olivia Kefauver
Research Highlights

Environmental Policy Review 2011: How Environmental Policy Facilitates or Constrains the Activities of Environmental NGOs in Ethiopia

Olivia Kefauver

How do environmental policy facilitate or constrain the activities of environmental NGOs in Ethiopia?

This chapter summarizes the results of a literature review and semi-structured key informant interviews.

Environmental institutions in Ethiopia have become increasingly important.

Environmental policies and institutions are established, but the implementation capacity of government organizations remains weak due to inadequate budgets, lack of expertise, and lack of adequate facilities to test environmental conditions.

Government bodies such as the Ethiopian Environmental Protection Authority collaborate with environmental NGOs for assistance in program and policy implementation.

Environmental NGOs have good working relationships with the government as compared to NGOs working on issues such as human rights, but the political commitment to environmental policies and laws is sometimes unpredictable.

International financial assistance will be critical for improving policy implementation capacity.

Environmental NGOs play a significant role in environmental management in Ethiopia. Efforts should be made to improve government and NGO implementation capacity on all levels by:

- strengthening government-NGO resource exchanges and partnerships, and
- attracting international financial assistance for governmental agencies and NGOs to increase short-term implementation capacity.
Environmental Policy Review 2011: How Environmental Policy Facilitates or Constrains the Activities of Environmental NGOs in Ethiopia

By Olivia Kefauver

Executive Summary

“How Environmental Policy Facilitates or Constrains the Activities of Environmental NGOs in Ethiopia” is the first chapter in Environmental Policy Review 2011, a report produced by the Environmental Policy Group in the Environmental Studies Program at Colby College in Waterville, Maine.

In the 20 years since the overthrow of the Derg regime, new formalized environmental institutions have been established in Ethiopia, including environmental legislation covering an array of environmental issues. This chapter explores the historical and current context of environmental institutions and their interactions with environmental non-governmental organizations (NGOs) in Ethiopia.

Key informant interviews from multiple stakeholders provide different but consistent perspectives on the relationships between environmental NGOs and Ethiopian environmental policy. While environmental policies exist in Ethiopia, problems in implementation are pervasive. This implementation gap has meant that many policies that appear “good on paper” have resulted in few tangible environmental outcomes on the ground. In the face of this problem, environmental NGOs have played a significant role in supporting improved environmental management in Ethiopia. Case studies highlighting two domestic environmental NGOs, Forum for Environment (FFE) and Concern for Environment (CFE), further illustrate the different possible roles of environmental NGOs in Ethiopia and provide insights into the potential of the environmental NGO sector going forward.

Until recently, the Ethiopian government’s relationship with NGOs has been characterized by an aversion to “independent citizen activism,” with the exception of periods of necessity during environmental and human crises. But the strength and diversity of the NGO sector has increased significantly since the 1990s and environmental NGOs are now playing an increasing role. In the context of the government’s limited fiscal and expert resources for environmental management, efforts should be made to improve both government and NGO implementation capacity on all levels. Specific policy recommendations include: (1) strengthening government-NGO partnerships, including locally/regionally-based NGOs in environmental policy dialogue, project implementation and information/resource exchanges; and (2) attracting international financial assistance for government and NGOs to increase short-term implementation capacity.
Environmental Policy Review 2011: How Environmental Policy Facilitates or Constrains the Activities of Environmental NGOs in Ethiopia

By Olivia Kefauver

Introduction

Ethiopia is one of the most important biodiversity hotspots of the world, but also one of the most degraded (FFE, 2011b; Conservation International, 2007; McKee, 2007). The country faces numerous environmental challenges such as deforestation, soil erosion, loss of biodiversity, and declines in soil fertility and water quality (FFE, 2011a; Bekele, 2008; EPE, 1997). These problems pose significant risks for Ethiopian citizens since – as emphasized in the 1997 Environmental Policy of Ethiopia – “natural resources are the foundation of the economy.”

Political, social, and economic challenges can both contribute to and be exacerbated by environmental degradation. Much of Ethiopia’s population is dependent upon the environment as their principal source of income (HoAREC, 2011; US DOS, 2011; McKee, 2007; EPE, 1997). This leads to a cycle of environmental degradation and poverty: to survive, people “are forced to disregard the long-term well-being of the environment and thus degrade it further” (MoFED, 2002, p. 121). Recurrent droughts, famines, poor infrastructure and periods of political unrest serve as additional challenges for environmental management within Ethiopia (Ogbaharya & Tecle, 2010; EPE, 1997).

The Environmental Policy of Ethiopia (EPE) and the 2002 Sustainable Development and Poverty Reduction Program (SDPRP) attribute the prevalence of poverty in part to low growth and low productivity of agriculture and to the populace’s dependence on agriculture and natural resources. The EPE states that agriculture is the main source of variability and stagnation in economic growth (1997). As one of the most dependent countries on foreign aid, limited fiscal resources impact Ethiopia’s ability to address these issues (ICNL, 2011). At the same time, as the current government of Ethiopia has only been in place since 1995, Ethiopia faces not only the economic development challenges of any low-income country, but also the challenge of creating a new government institutional structure so that it can best serve its citizens’ needs.

The manner in which environmental issues are addressed in the coming years will have a significant influence on the well-being of the Ethiopian people, and on surrounding nations whose ecosystems are “dynamically interlinked” with Ethiopia (McKee, 2007). In this context, the development of strong institutions and networks is a necessity to address environmental degradation and management of natural resources. This chapter assesses the strengths and
weaknesses of environmental institutions in Ethiopia and explores how environmental NGOs might help strengthen both written environmental policy and policy implementation.

Theoretical Foundations

Institutions are “humanly devised constraints that structure human interaction” (North, 1994, p. 360). They consist of formal constraints, (rules, laws, constitutions), informal constraints (norms of behavior, conventions, and self-imposed codes of conduct), and their associated enforcement characteristics (North, 1994). The structure of environmental institutions in Ethiopia frames the ways in which environmental problems are approached and in turn, the extent to which tangible results are produced. Although past legislation has addressed natural resource management, formalized environmental institutions such as management bodies and comprehensive environmental policies are relatively new within Ethiopia (FFE, 2010; McKee, 2007).

A key component of environmental management is how policies, once adopted, are carried out. The concept that “policies gain force through implementation” applies directly to environmental policy (Weimer & Vining, 2005). The issuance of a policy establishes the problem at hand, and how it should be addressed. Implementation meanwhile refers to “the efforts made to execute the policies – efforts that don’t always achieve the intended goals” (Weimer & Vining, 2005). Eugene Bardach developed a metaphor for understanding policy implementation that provides a way of conceptualizing the environmental policy process (Figure 1.1). Bardach’s metaphor likens implementation to a machine – in order for it to work all, of the parts must be assembled and kept in place. To begin, a working machine (effective policy) is dependent upon proper design (correct theory); without this, the “machine” will not work, and the desired policy results will not be achieved (Weimer & Vining, 2005). If the correct design (effective policy) is in place, but the necessary parts for policy implementation (essential policy elements) are either lacking or unreliable, then the machine (policy) will be ineffective (Weimer & Vining, 2005).

![Figure 1.1 Bardach’s machine metaphor, based on Weimer & Vining, 2005; Bardach, 1977.](image-url)
The problem of implementation is driven by these essential policy elements, which consist of: (1) the willingness of persons or organizations to comply with the policy; and (2) the ability of persons or organizations to enforce approved policies, dependent upon resources and competence (Weimer & Vining, 2005).

Another aspect of policy implementation concerns cooperation. Cooperation becomes a factor in projects large in scope and scale that can involve many actors (Heikkila & Gerlak, 2005). In short, environmental policy implementation can be extremely complex, often crossing traditional administrative boundaries and requiring a great deal of knowledge and expertise. Actors in environmental policy issues range from government bodies (at federal, regional, and local levels) to civil society organizations (CSOs), academics, scientists, think tanks, corporations, and the general public.

One prominent set of actors in low-income countries is the non-governmental organization (NGO) sector. As described by a World Bank report, “NGOs represent an important element in the political and economic transformation of Ethiopia sought by its people and government” (Clark, 2000, p. 2). Given the relatively recent emergence of formalized environmental institutions in Ethiopia, and considering the capacity of environmental NGOs to address environmental issues on the ground level, it is perhaps no surprise that environmental NGOs appear to play a significant role in the area of environmental management. At the same time, since environmental NGOs must work within the national environmental policy context, they provide a unique perspective into the workings of the Ethiopian environmental policy system.

The environment will continue to be one of the most important determinants of Ethiopia’s welfare in the future (EPE, 1997). Environmental NGOs play an important role in policy development and implementation, acting as instruments of change in improving environmental quality and institutions. Despite this, there has been relatively little research on the roles of environmental NGOs. This analysis represents one of the first efforts to contextualize the work of environmental NGOs in Ethiopia within a policy framework.

Methods

In order to gather background and historical information, an extensive literature review explored the evolution of environmental policy and institutions, and the current state of NGOs in Ethiopia.

Semi-structured interviews and correspondence with environmental and legal experts provided additional insights into environmental institutions in Ethiopia. To gain a comprehensive understanding of my topic, I sought informants from multiple different stakeholder groups. Among those contacted were the Ethiopian Environmental Protection Authority (EPA), the Ministry of Justice (MoJ), Ethiopian national NGOs (NNGOs), international umbrella NGOs
(INGOs), and academics in the fields of geography, environment, development, and law (Table 1.1).

Table 1.1 Summary of informants contacted by type.

<table>
<thead>
<tr>
<th>Type of Contact</th>
<th>No. of Contacts</th>
<th>No. Interviews/Exchanges†</th>
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<td>EPA</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>MoJ</td>
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<td>INGO</td>
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</tr>
<tr>
<td>Local NGO</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Academic</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

Table 1.1 Notes: † indicates that not every contact resulted in an interview/exchange.

I contacted informants by email, telephone, or both, depending on available contact information. I typically sent informants an introductory email (if an email address was available) explaining the purpose and scope of the research project, and requesting information or further contact via email or telephone. A complete list of individuals and organizations contacted can be found under Appendix 1A. Interviews consisted of a series of 5-15 questions that varied based on the expertise and experience of the individual. When applicable, I asked follow-up questions to clarify comments and expand upon issues raised. I took detailed notes during all interviews outlining key points and quotes. When an interview was complete, I immediately compiled these notes and sent them to the interviewee over email for review and revision. The revised notes that I received often brought up new points or clarified previously ambiguous statements. Descriptions of the interviews and communications cited within this report may be found in Appendices 1B, 1C, 1D, 1E and 1F.

To further understand the relationship between environmental NGOs and environmental policy in Ethiopia, two environmental NGOs were selected as case studies: Forum for Environment (FFE) and Concern for Environment (CFE).

Self-described as “sister-organizations,” Forum for Environment and Concern for Environment are broadly representative of two different types of environmental NGOs active in Ethiopia today (CFE, 2010, p. 1). FFE is a large networking organization with an ambitious environmental policy agenda. Based in the capital city of Addis Ababa, in the epicenter of government activity, FFE attempts to strengthen environmental policy and engage government officials in environmental policy implementation in addition to its work in local communities (FFE, 2010). CFE, meanwhile, is a smaller regional NGO with relatively narrower goals, largely limited to improving environmental outcomes in a single watershed (Lake Awassa) in the Great Rift Valley.

While they differ in resources and scope, both organizations work to address environmental issues within the current environmental policy context. As such, they offer valuable insights into
the environmental policies of Ethiopia, as well as into NGO-government relationships and the experience of environmental NGOs working in a developing country.

Results

The Evolution of Environmental Institutions in Ethiopia

Historical evidences indicate that the reasons for century-old lack of sustainable natural resource management and environmental protection tradition are mainly related to the instability of successive governments, their rapidly changing political economy…and non-participatory top-down development programs (Bekele, 2008, p. 337).

Prior to the period of Italian occupation (1936-41), while there were rules that addressed aspects of the environment in Ethiopia, formal environmental decrees were rare (Bekele, 2008). The resource laws during the Italian occupation focused on the economic potential of Ethiopia's natural resources rather than their ecological value. During this period, the Italians issued over twenty forest decrees and implemented destructive forestry programs to fuel infrastructural development (Bekele, 2008).

After the return of the Ethiopian imperial government (1941-1975), government policy focused on the development of the agricultural sector for domestic consumption and export; as a result, national forest land was redistributed for conversion to agricultural land (Bekele, 2008). While the 1955 Constitution introduced the principle of conservation, it took years for forestry policies to develop and even longer for any implementation to take place. The period of 1955-1968 is described by Bekele as “probably one of the most distressing phases in forestry management” in Ethiopia, where the highland forest estimated in 1937 at nearly six million hectares was reduced by almost half to three million hectares in the early 1960s (2008, p. 339).

In 1975, the militaristic Derg regime succeeded the imperial government, drastically changing Ethiopian environmental management. Environmental policies produced during the Derg era (1975-1991) were grounded in the socialist ideologies of the regime (Bekele, 2008). Environmental legislation from this time period “emanated from the socialist principles in which the role of the State as owner of land and manager of related resources was magnified and individual initiative greatly discouraged” (Bekele, 2008, p. 340). The environmental policies of the Derg regime were characterized by top-down management policies which, although they often incorporated extensive conservation and tree-planting initiatives, were accompanied by the disintegration of “customary institutions of natural resource management” (Ogbaharya & Tecle, 2010, pp. 495-496). This resulted in situations where “thousands of hectares of land belonging to communities and individual households came under plantation by force” (Bekele, 2008, p. 339) without regard for local participation or community empowerment. As a result, when the Derg government lost power in 1991, most of the conservation and development activities in the
environmental sector were destroyed in protest against decades of top-down rule (Bekele, 2008; Keeley & Scoones, 2003).

After a brief period of transitional government, the current federal republic system, led by the Ethiopian People's Revolutionary Democratic Front (EPRDF), was instituted in 1995 (Ogbaharya & Tecle, 2010). The violent change in government from the Derg regime to the current EPRDF was accompanied by a drastic ideological shift in environmental management that was manifested in the administrative structure of the government and the development of formal environmental institutions. The EPRDF’s approach to land management, which views land as a common property resource owned by the state and by the people, exemplifies the recent shift towards a more inclusive approach to environmental policy in Ethiopia (Bekele, 2008). The period after the Derg regime can be characterized by a move towards political decentralization, i.e., “a transfer of decision-making power and administrative responsibility from the central government to the periphery” (Wamai, 2008, p. 1). Ethiopia has pursued decentralization as a means of improving service delivery, resource allocation, regional development, and the meaningful participation of the people in decision-making processes (Wamai, 2008; MoFED, 2002). In theory, this administrative and fiscal decentralization was meant to result in more participatory, responsive, government structures and by extension, improved environmental management. The first wave of decentralization policies in 1995 resulted in the establishment of a federal republic government, and in 2002 a further set of decentralization initiatives relegated more fiscal and administrative power to local government administrations (McKee, 2007).

Today, most large-scale environmental administration is dispersed between the federal government, and administrative subdivisions, including nine ethnically based regions and two chartered cities, Addis Ababa and Dire Dawa (US DOS, 2011). In 1995, the Ethiopian Environmental Protection Authority (EPA) was established as a response to the Rio Agenda 21, which emphasized “the necessity of integrating environment and development at policy, planning, and management levels for improved decision making” (Ruffeis et al., 2010, p. 31). The EPA is the primary agency at the federal level responsible for managing environmental issues, and its responsibilities reflect the Rio Agenda 21 goals. The responsibilities of the EPA include the development of environmental legislation and policy, setting of standards, monitoring of environmental policies, implementing Environmental Impact Assessments (EIAs) for proposed development activities, negotiating access & benefit sharing agreements, and undertaking capacity development in relevant agencies to ensure integration of environmental management into policymaking (McKee, 2007).

Regional environmental authorities represent another significant level of environmental management institutions in Ethiopia. In 2002, the establishment of independent environmental agencies at the regional level was codified in the Establishment of Environmental Protection Organs Proclamation (McKee, 2007). Known as Regional Environmental Protection Agencies,
or REAs, these groups were originally responsible for implementation of national and regional environmental policies. The federal EPA has since assisted Regional States in developing their own environmental conservation strategies, through provision of equipment, training and environmental education (MoFED, 2002).

The second stage of decentralization introduced by the federal government in 2002 established the woreda (a local level of government roughly equivalent to a District) as the center of socioeconomic development. The stated goal of this policy was bringing the government closer to the people and increasing responsiveness to local needs (Wamai, 2008; McKee, 2007; MoFED, 2002). The woredas still serve as the base unit for representation in the federal and regional assemblies, representing local communities in national or regional policy debates (McKee, 2007). In terms of environmental management, this power shift has moved responsibilities for environmental service delivery and policy implementation from the regional level to the woreda-level, with the REAs re-focusing their efforts on developing overarching regional environmental legislation and maintaining only a supervisory role in regards to woreda-level environmental management (Wamai, 2008; McKee, 2007).

Environmental Policy in Ethiopia Today

Similar to the development of formal environmental agencies, most of the environmental laws in place today in Ethiopia were developed after a national backlash removed Derg regime policies that were perceived as authoritarian (Bekele, 2008; Keeley & Scoones, 2003). As Damtie notes, within Ethiopia “a separate enactment of environmental laws is a recent phenomenon in the history of making laws,” although some earlier laws had dealt with environmental matters directly or indirectly (Damtie, 2011, p. 1). The majority of the environmental laws in effect today were developed after the transfer of power to the EPRDF in 1995 (Bekele, 2008).

After the Derg regime, a breadth of environmental legislation was written addressing many environmental sectors. Beginning as early as 1994 with the Water Policy Law, until the more recent 2007 Wildlife Policy, a number of sectoral policies were written, covering areas such as forests, conservation, rural land use, and impact assessment, among others. The strength of these policies varies significantly: some, like the Environmental Policy of Ethiopia (EPE) and its predecessor the Conservation Strategy of Ethiopia (CSE), are widely regarded as well-written, comprehensive environmental policies. Others, such as the Rural Development Policy, appear to lack crucial policy elements, or have been criticized for promoting development interests over environmental protection (Bekele, 2008).

Issued in 1997, the current federal environmental policy, the EPE, spans numerous sectoral policies and various cross-sectoral policies (Bekele, 2008). This policy, unlike those of previous regimes, addresses implementation principles, evaluation, and policy review, and explicitly recognizes a role for participatory management. The EPE also addresses the importance of
involving local communities, NGOs and professional associations, indicating in its text the relevance of decentralization of power and collaboration between sectoral interests (Bekele, 2008).

The EPE stresses the importance of sustainable development, stating that its overall goal is

…to improve and enhance the health and quality of life of all Ethiopians and to promote sustainable social and economic development through the sound management and use of natural, human-made and cultural resources and the environment as a whole so as to meet the need of the present generation without compromising the ability of future generations to meet their own needs (1997, p. 3).

To fully understand the implications of this process, one must understand the main objective of the current government that drives it. The thrust of the EPRDF’s sustainable development plan has been motivated by what has been described as Ethiopia’s complex, deep and structural poverty: 44% of the population was living below the poverty line in 2000 (MoFED, 2002). The Plan for Accelerated and Sustained Development to End Poverty (PASDEP) of 2006 and its predecessor, the 2002 Sustainable Development and Poverty Reduction Program (SDPRP) state that the “main development goal” of the Ethiopian government is poverty eradication (MoFED, 2006, 2002). The main mechanisms to achieve this goal are an “overriding and intentional focus on agriculture,” and the strengthening of private sector growth and development of industry (MoFED, 2002, p. i).

The government’s focus on agricultural and industrial development has potentially large implications for Ethiopia’s environment. This potential conflict (and undeniable link) between environmental protection and economic development goals was addressed in a section of the SDPRP entitled “Environment and Development,” which holds accountable the EPA for ensuring “harmonization” of economy and environment through the laws established in the EPE, so neither sector suffers as a result of protection of the other (MoFED, 2002, p. 121). In contrast to the SDPRP, the PASDEP features an expanded section on environmental degradation as a result of development and increased agricultural pressures, addressing explicitly the fact that “reversing environmental degradation and poverty eradication are…mutually reinforcing imperatives and have to be implemented together in Ethiopia’s development initiatives” (MoFED, 2006, p. 187). The SDPRP mentions the potential of Environmental Impact Assessment (EIA) laws to enable integration of environmental consideration into development planning (MoFED, 2002). The extent to which these EIAs have been consistently implemented has been debated, however, and as such, the ability of these laws to prevent environmental degradation is unclear (Ruffeis et al., 2010).
**NGOs in Ethiopia**

Formalized community organizations, such as NGOs, are another relatively recent development in Ethiopia. Several types of indigenous organizations predate the arrival of NGOs in Ethiopia. Common organizations such as “debo,” “idir,” and “iqueb” that served as self-help systems for their members, have defined structures, laws, and procedure of operation (ICNL, 2006). These systems have been in place for centuries, and some eventually were registered as organizations known as Community-Based Organizations (CBOs) (CRDA, 2010). A regulatory framework for the registration and establishment of CBOs and NGOs is embodied in the Civil Code of 1960, Proclamation Number 4/1995 and Regulations Number 321/66 (UN, 2004).

According to the Christian Relief and Development Association (CRDA), two important aspects of the development of the voluntary sector in Ethiopia have “had an enduring impact on the sector: one was that until very recently the sector consisted of a small number of organizations, and the second that they have operated under difficult and sometimes trying circumstances” (CRDA, 2008). The role of formal NGOs began in the 1960s, providing welfare services. As a result of the 1973-1975 and 1984-1985 famines, and subsequent global publicity, the Imperial and Derg regimes reluctantly allowed international and domestic NGOs to engage in relief and humanitarian services, under close observation (ICNL, 2011; CRDA, 2008). Throughout the 1980s and 1990s, the sector remained small and dominated mainly by international NGOs (INGOs) rather than national NGOs (NNGOs) (CRDA, 2008). The post-Derg period saw an accelerated growth in the number and diversity of NGOs (ICNL, 2011) (Figure 1.2).

![Growth of National and International NGOs](image-url)

*Figure 1.2. Growth of national and international NGOs in Ethiopia; CRDA, 2008, based on MoJ, 2007. Note: †=no data for that year.*
As of 2007, the Ministry of Justice reported a total of 2,305 organizations registered at the federal level (CRDA, 2008). Of these 2,305 organizations, 1,976 were NGOs registered at the national level - domestic NGOs accounted for 1,742 organizations, while international NGOs accounted for 234 organizations (Figure 1.3).

Regional States within Ethiopia can also register domestic NGOs, and when included with the federally registered NGOs, the total number of NGOs in Ethiopia exceeds 3,000 (CRDA, 2008).

A gradual shift occurred in the focus of domestic and international NGOs towards rehabilitation efforts, and eventually to the focus on development held by many current NGOs (CRDA, n.d.). The majority of NGOs in Ethiopia today address aspects of human development (education, health, human welfare) and agriculture and food security, but the proportion of NGOs addressing other topics has risen over time, including those integrating components of natural resource management into their activities (Gessesse, 2010).

While on paper NGOs are deemed important partners in project implementation, the relationship between the Ethiopian government and NGOs has historically been characterized by tension as a result of deep mistrust (Wamai, 2008; CCRDA, 2006; MoFED, 2002; EPE, 1997). This mistrust derives from government concerns that relief organizations were perpetuating dependency on relief rather than development, that NGOs were inefficient with funding allocations, that the current influx of foreign financial assistance brought in tow unwanted foreign political influences, and that some NGOs had mandates that it considered questionable, marginal or troublesome (Clark, 2000). This tension has recently manifested itself in what is known as one of the most controversial proclamations in Ethiopia: the Charities and Societies Proclamation (CSP), which came into effect in February 2009. This law concerns the formation and operation of civil society organizations (CSOs), a category which encompasses

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**Figure 1.3 Number and diversity of federally registered NGOs in Ethiopia, CRDA, n.d., based on MoJ, 2007.**

- Federally Registered NGOs
  - National NGOs: 1742
  - International NGOs: 234

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NGOs. The CSP divides CSOs into three types of association: Ethiopian Charities or Societies, Ethiopian Resident Charities or Societies, and Foreign Charities (Hailegebriel, 2010).

Under this law, advocacy activities are considered “political activities,” which are reserved for Ethiopians and the category of Ethiopian Charities – groups that are prohibited from receiving more than 10% of their funds from foreign sources (Hailegebriel, 2010). The following activities are reserved for Ethiopian Charities (and as such are bound by the 10% funding requirement):

- “advancement of human & democratic rights, the promotion of equality of nations, nationalities and people and that of gender and religion;
- the promotion of the rights of the disabled and children’s rights; the promotion of conflict resolution and reconciliation; and
- the promotion of the efficiency of justice and law enforcement services” (Hailegebriel, 2010).

This proclamation bars any NGOs participating in advocacy and human rights activities from receiving more than 10% of their funding from foreign sources (Table 1.2). As described by the International Center for Not-for-Profit Law (ICNL), this proclamation “may effectively silence civil society in Ethiopia by starving NGOs of resources, and thus essentially extinguishing their right to expression” (ICNL, 2011).

Table 1.2 Recognized Civil Society Organization types under the 2009 CSP Proclamation, ICNL, 2010.

<table>
<thead>
<tr>
<th>Type</th>
<th>Place of Registration</th>
<th>Source of Funding</th>
<th>Composition of Members’ Nationality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethiopian Charities/Societies</td>
<td>Ethiopia</td>
<td>May not receive more than 10% of funds from foreign sources</td>
<td>Members are Ethiopian and organization is wholly controlled by Ethiopians</td>
</tr>
<tr>
<td>Ethiopian Resident Charities/Societies</td>
<td>Ethiopia</td>
<td>May receive more than 10% of funds from foreign sources</td>
<td>Members are Ethiopian</td>
</tr>
<tr>
<td>Foreign Charities</td>
<td>Foreign Country</td>
<td>Receives 100% of funds from foreign sources</td>
<td>Members are foreign nationals, or controlled by foreign nationals</td>
</tr>
</tbody>
</table>

Unlike other policies, this proclamation “attempts to make a separation between development and governance/human rights interventions”; by doing so, it limits the ability of many NGOs to engage in governance or policy advocacy (CRDA, 2008, p. 4). As such, laws including the CSP that have the potential to significantly limit the resources of NGOs can by extension impact the sectors in which these NGOs work.
Findings: Key Informant Interviews

Findings from five key informant interviews are summarized below. Respondents’ comments largely centered around the following thematic areas: (1) environmental policy, (2) policy implementation, (3) NGO-government relations, and (4) NGO activism.

Environmental Policy

Overall, as a program manager for the environmental NGO Forum for Environment (FFE) said, Ethiopian environmental policies are “very good and very nice policies on paper” (FFE_1B, 2011). This research found that on the whole, environmental policies in Ethiopia are believed to be well written and fairly comprehensive (HoAREC_1E, 2011; FFE_1B, 2011; CFE_1C, 2011). However, although as one respondent observed “almost all of the necessary policies seem to be in place,” (FFE_1B, 2011) there remained a sense among respondents that not every necessary environmental policy is yet in place in Ethiopia today.

The main environmental law, the EPE, serves as a framework for environmental legislation at lower levels of government, especially regional policies. Regions are permitted to develop their own environmental policy, as long as it meets the standards established by the federal environmental policy (AAU_1D, 2011a). In theory, regional policies may support more stringent environmental standards, but may not set lower standards than the federal law – and indeed in many cases regional policies have been simply “cut and pasted” from the national policy, such that most written environmental policies are similar across regions (AAU_1D, 2011a). In practice, however, some regions are relatively less active than others in terms of environmental law enforcement, particularly with regards to regulating the environmental impacts of development activities (e.g., requiring Environmental Impact Assessments for proposed industrial expansion).

Despite universal recognition that government policies such as the CSP law have hindered NGO activities in Ethiopia (as discussed in greater detail below), when specifically asked how environmental policies affect NGOs, respondents stated that Ethiopian environmental laws themselves have no negative impacts on the work of NGOs. On the contrary, some environmental NGO respondents stated that environmental policy (or the fact that policy exists on some base-level) makes it easier for them to work (FFE_1B, 2011; CFE_1C, 2011) since such laws give additional legitimacy to their conservation and education activities.

Environmental Policy Implementation

“There is no concrete commitment on the ground as you now see in the papers” (AAU_1D, 2011a).

Implementation was identified by respondents as the main challenge for environmental legislation in Ethiopia today (FFE_1B, 2011; AAU_1D, 2011a). As described by a professor at
Addis Ababa University, “we don’t have any problems making laws! But they are not implemented…” (AAU_1D, 2011a). An interviewee from the NGO FFE further explained that the problem of implementation is not unique to the environmental sector, but rather is a problem shared by other sectors (FFE_1B, 2011). Along this line, several respondents emphasized that implementation problems are a common feature of developing nations rather than an issue specific to Ethiopia (FFE_1B, 2011; EPA_1F, 2011). A respondent from the Horn of Africa Regional Environmental Center (HoAREC) remarked that compared to other countries in the Horn of Africa region, Ethiopia’s capacity for implementation wasn’t as strong as that of Kenya, but was stronger than many other countries, including Somalia, Eritrea, Djibouti and Sudan (HoAREC_1E, 2011).

A member of the Environmental Protection Authority (EPA) remarked that Ethiopia’s environmental policies were enacted relatively recently; as a result, Ethiopia is comparatively new to the process of implementing environmental policy (EPA_1F, 2011). Respondents identified several factors responsible for implementation challenges. These included a lack of manpower for enforcement, a lack of expertise in the environmental sector to test and interpret pollution levels in the environment, and a lack of facilities to test environmental quality levels (EPA_1F, 2011; AAU_1D, 2011a). HoAREC attributed implementation problems to inadequate financing, rather than an absence of concern for environmental issues (HoAREC_1E, 2011):

The issue of environment and development, along with climate change are greater here than anywhere else. They do not have strong implementation, not because they don’t want to, but because there is no funding or international assistance for environmental issues.

The HoAREC respondent also mentioned that the Prime Minister of Ethiopia was a leader on climate change issues for the whole of Africa, indicating the importance of environmental issues for the country (HoAREC_1E, 2011). But he also explained that much of the development assistance coming from outside Ethiopia is geared towards sectors such as agriculture, water and energy that have strong government ministries. By comparison, the environmental sector is under the executive branch and as such doesn’t have its own ministerial portfolio, which results in a smaller operating budget, and a potential disadvantage when attracting foreign funds (HoAREC_1E, 2011).

A political focus on economic priorities was also found to play a role in weakening environmental policy implementation in some cases. For instance, respondents noted that the Ethiopian government is actively trying to encourage development and promote investment in the country. A main mechanism through which government is currently seeking to address poverty reduction is through development and commercialization of the agricultural and industrial sectors (PASDEP, 2006). Some investors might not want to do Environmental Impact Assessments (EIAs) even though they are technically required – resulting in a situation where investment might come before the environment: As one respondent summarized: “It may not be
easy to balance environmental interests and development interests, so the priority is often development with a high tolerance for environmental degradation” (AAU_1D, 2011a).

NGO-Government Relationships

Legally, there seems to be no problem working on environmental issues as an NGO in Ethiopia, as long as the organization’s statues are focused solely on environmental issues (FFE_1B, 2011; CFE_1C, 2011; AAU_1D, 2011a, 2011b). Indeed, despite citing the existing implementation problems, the NGO FFE emphasized that it has had no serious problems with government policies in terms of preventing them from implementing their work (FFE_1B, 2011). Both of the NGOs interviewed through this study emphasized that they have good relationships with government officials (FFE_1B, 2011; CFE_1C, 2011).

At times, however, government mistrust of the NGO sector can still be problematic for NGOs. For example, respondents observed that even though it is not the official policy of the government, sometimes a local official will stop the activities of an NGO unexpectedly. Generally speaking, the government is suspicious of NGO activity for several reasons:

- Some NGOs misuse funding that they receive for their organizations’ activities. A small percentage of funds in these cases actually benefits the public, with the remainder benefiting only individuals in the NGO. Since accountability of funds is not very clear, the government feels responsible for monitoring this (AAU_1D, 2011b).
- The Ethiopian government is suspicious that foreign funding is inextricable from foreign influences – the government worries that these influences may be contradictory to government interests, and as such, the government is very wary of foreign funding (AAU_1D, 2011b; CRDA, 2006).

One professor mentioned that recently in the SNNP region, an increase in the amount of environmental legislation led to an increase in the number of environmental NGOs; this quick emergence of NGOs raised concern and confusion among government officials (AAU_1D, 2011a). According to his account, the government was suspicious that the growing NGO sector would become politically active and anti-government, so it banned around 40 groups last year (AAU_1D, 2011a, 2011b). By comparison, the respondent from HoAREC observed that many NGOs, but not environmental NGOs, were shut down across Ethiopia when the Charities and Societies Proclamation (CSP) law came into place (2011). Those NGOs were shut down primarily because they did not meet the new guidelines (HoAREC_1E, 2011).

When asked about the CSP law, NGO respondents suggested there is no legal problem for any environmental NGO in Ethiopia to register as an Ethiopian Resident Charity, which allows it to raise more than 10% of its funds from outside of Ethiopia (Table 1.2). Once legally registered, it is possible to operate in any part of the country. Thus rather than facing registration problems,
the most pressing problem for environmental NGOs lies in securing adequate funding. Most NGOs in Ethiopia receive some form of funding from foreign sources, and even locally based NGOs extend their hand to foreigners (AAU_1D, 2011b). Since the 2009 CSP law, however, NGOs have to be increasingly dependent on domestic sources of funding (AAU_1D, 2011b). HoAREC mentioned a specific exception within the CSP law for environmental NGOs: although foreign-based NGOs registered as international NGOs are prohibited from engaging in policy advocacy, locally-based environmental NGOs are allowed to engage in advocacy so long as such activities focused exclusively on environmental issues (HoAREC_1E, 2011).

Ultimately, environmental NGOs in Ethiopia have good working relationships with the government compared to NGOs working on issues such as human rights. One respondent noted that environmental NGOs are often in agreement with the EPA about environmental issues (HoAREC_1E, 2011), and over the past decade environmental NGOs and the Ethiopian government have known to cooperate extensively (HoAREC_1E, 2011; AAU_1D, 2011b). Such NGO-government collaboration seems to benefit both parties. For instance, the government can assist an environmental NGO by suggesting an environmental sector that needs assistance, and can provide the NGO with information relating to environmental problems (AAU_1D, 2011b). NGOs meanwhile assist the Ethiopian government in project implementation (HoAREC_1E, 2011; AAU_1D, 2011b). Another interviewee recognized environmental protection activities and management (e.g., tree-planting, soil conservation, water harvesting and plant production to fight deforestation), and environmental education and promotion of environmental stewardship as means by which NGOs currently assist the government working to achieve environmental goals (AAU_1D, 2011b).

Lacking a dedicated government ministry and faced with limited resources, the EPA collaborates extensively with NGOs and appreciates NGO partnership in project implementation and environmental education, especially when such activities are completed under the NGOs’ own budgets (HoAREC_1E, 2011; AAU_1D, 2011a, 2011b). The HoAREC respondent mentioned that his organization often steps in where the government can’t allocate funds:

…if the government has to choose between a land use plan or allocating the resources to water and energy they will choose water and energy. So HoAREC provides support in land use planning and secures funding for land use planning programs (HoAREC_1E, 2011).

He further mentioned that while there is still much that the EPA could to do be more inclusive of environmental NGOs, there is a good flow of information between the two groups (HoAREC_1E, 2011).

**NGO Activism**

The ability of NGOs to influence policy in Ethiopia is very limited. According to HoAREC, there aren’t any really large NGOs in Ethiopia; most NGOs being of small or “medium” size
(HoAREC_1E, 2011), and few involved in the policy process. That said, particularly in the environmental policy arena, respondents noted that sometimes small, indigenous NGOs may have the largest impact on environmental policy because they are able to specialize within their field and provide in-depth and credible information to inform policy (HoAREC_1E, 2011). The type of activism for NGOs regarding environmental policy change varies from organization to organization (Betsill and Corell, 2001). One of Forum for Environment’s main goals is to influence federal environmental policy (FFE, 2011a). FFE programs include public meetings and public dialogue forums, research and publications, and capacity building (FFE, 2011a). On the national level, FFE is the secretariat of a civil society network on climate change committee, comprised of 60 member organizations (FFE, 2011b). FFE has also helped to establish and consolidate 12 local FFE groups throughout Ethiopia (FFE, 2011a). As the interviewee explained, “rather than being in Addis and shouting out to the communities,” FFE actively supports local groups that focus on local issues and have a degree of autonomy, translating into a louder voice in their communities (FFE_1B, 2011). Meanwhile, on an international scale, FFE has partnered with the Ethiopian EPA, HoAREC, and Addis Ababa University to promote environmental discourse including a May 2011 workshop entitled “Rio 2012: Ethiopia’s Input to the Sustainability Summit” (HoAREC, 2011). This workshop drew over 60 participants, comprised of “NGO leaders, federal and regional Ethiopian government officials, representatives of academia, research institutions, international organizations and diplomatic community” (FFE, 2011b).

Proceedings of FFE’s public meetings are publicly available, and these public dialogues and meetings have been strong, effective tools in bringing together different stakeholders and helping to influence policy formulation at multiple levels (FFE_1B, 2011). They are mostly organized at the national level in partnership with other like-minded organizations to address key environmental issues (more than ten different topics have been addressed over the last few years). Policy makers and politicians including parliamentarians are regularly invited to these dialogues and meetings (FFE_1B, 2011). FFE believes that its activities have directly contributed to bringing environmental issues into the public consciousness. As the interviewee explained, while a few years ago the issue of the environment was simply not an issue in the eyes of the government or the general public, “at present, one can talk about the environment at all levels, from the woreda-level to the national-level” (FFE_1B, 2011).

By contrast, smaller local NGOs such as Concern for Environment (CFE) work to build capacity and environmental awareness, but make few attempts to influence issues of environmental policy (CFE_1C, 2011). Instead, such organizations’ activities center on the regional and community scale and focus more strongly towards raising awareness and building capacity through skills training seminars and public workshops.

The differences between environmental NGOs in Ethiopia are further explored through the two case studies below.
Findings: Case Studies

Forum for Environment (FFE) and Concern for Environment (CFE) represent two distinct types of environmental NGOs working in Ethiopia today; the first, FFE, is a large networking organization with an ambitious environmental and policy agenda, whereas CFE is a smaller regional organization with relatively narrower goals.

Forum for Environment, Addis Ababa

Based in the capital city, Addis Ababa, in the epicenter of government activity, Forum for Environment (FFE) attempts to influence policy and engage government officials in addition to its work in local communities (FFE, 2011a). FFE engages in a wide variety of activities, including environmental policy advocacy, organization of public meetings, the publication of a printed *Ethiopia Environment Review*, and networking with both governmental and non-governmental organizations on international, national, regional, and local levels. FFE also works with many partner NGOs, serving as the secretariat of the Ethiopian Civil Society Network on Climate Change (ECSNCC), one of the largest and most visible networks on environmental issues in Ethiopia (FFE, 2011b). In addition to these activities, FFE carries out advocacy and lobbying campaigns involving diverse stakeholders, including government officials and civil society groups, to raise awareness among the public on environmental issues. FFE has supported the establishment of 12 local groups across Ethiopia, and in doing so, has helped form a nation-wide network as shown in Figure 1.4 (FFE, 2011a, 2011b).
Figure 1.4 Forum for Environment local groups; Colby GIS, 2011; FFE, 2011b.
Concern for Environment (CFE) represents another type of NGO in Ethiopia – one that may partner with larger organizations like FFE, but largely refrains from policy discourses. Instead, CFE’s stakeholders are largely members of the local community, including local government officials, farmers, and schoolchildren, among others in the Lake Awassa watershed (Figure 1.5).

CFEs activities are at the regional and community level, working with citizens and local government officials to implement environmental programs with the goal of improving environmental quality, and increasing environmental awareness in their program areas (CFE, 2010). CFE focuses primarily on small-scale conservation projects, capacity building through skills training, and public meetings and other activities to raise environmental awareness (CFE, 2010).

In recent years CFE has run skills training sessions for fuel-efficient Mirt stoves with members of the community, and on a separate occasion, a training session on soil conservation techniques (CFE, 2010). CFE produces educational posters and pamphlets written in local languages to promote environmental awareness, and CFE also puts on events, such as their 2009 Earth Day celebration, which drew around 300 youth, as well as other residents of Awassa, including \textit{kebele} administrators (local government leaders), fishermen, and teachers (CFE, 2010).

In June of 2009, CFE was recognized by a regional radio station for their work and were invited to speak (CFE, 2010). In their 2010 annual report, CFE recognized their year’s work within the community, explaining that their organization “is so glad…we bear in mind that the different awareness creation workshops, brochures, posters and stickers that were prepared had done something” (CFE, 2010).
Figure 1.5 Lake Awassa watershed, Graichen, 2011.
The differences between these two organizations illustrate the diversity of environmental activities undertaken by NGOs in Ethiopia today. FFE focuses mainly on the coordination of environmental networks at international, national and regional levels, working to improve policy and implementing on-the-ground environmental programs. Meanwhile CFE focuses on building capacity, teaching environmental management skills, and raising awareness within their local community. The roles played by FFE and CFE in environmental policy are different, yet equally important, and each is based upon a shared vision of environmental improvement and awareness within Ethiopia. The efforts of each group seem to have contributed to change within each of their focus areas (FFE, 2011; CFE, 2010). The impact that groups such as FFE and CFE have on the environment and public awareness is not limited to these two case studies, nor limited to the current level of environmental progress in Ethiopia. There are many other environmental NGOs working to create environmental and behavior change, and as the CFE annual report elegantly states, “advocacy is a slow process, but if it gradually enters into the minds and hearts of the people it will bear fruit” (CFE, 2010).

**Discussion**

The literature review and feedback from key informant interviews suggest that there is a sufficient quantity and range of environmental policies in Ethiopia to cover various environmental sectors (FFE, 2011; AAU_1D, 2011a). The fact that the main environmental policy, the federal Environmental Policy of Ethiopia (EPE), serves as the “cut-and-paste” baseline for regional policies (AAU_1D, 2011a; McKee, 2007) has significant implications regarding potential policy recommendations. When looking to increase pollution standards, or to make adjustments in environmental policy, for example, it would be prudent to look to the federal policy as a means to do so. At least in theory, such a move would have a ripple effect across the standards in regional administration’s environmental policies, since regional laws are held to federal environmental standards.

But while on paper environmental policies may appear well-written and comprehensive, respondents indicated that this legislation has often not been translated into environmental outcomes on the ground. Bardach’s machine metaphor suggests environmental policy may fail due to incomplete or weak policies, or due to an inability to implement existing policies owing to inadequate resources. Collectively, respondents from the NGO Forum for Environment, the EPA, an academic, and the founder of an international environmental organization all suggested that improper implementation of environmental policies may result from combinations of the following reasons: inadequate expertise (i.e. experts who can conduct soil & water quality studies and interpret the results), a lack of facilities, an absence of implementation plans in the environmental policies themselves, inadequate financial resources, and conflicting government policies (HoAREC, 2011; FFE, 2011; EPA, 2011; AAU_1D, 2011a).

The general need to develop implementation capacity has been addressed by a 1998 strategy for
capacity building developed by the Ethiopian government. It implies that external (i.e. foreign) assistance will be necessary in the short term, with the hope of beginning to expand domestic capacity in the medium term (MoFED, 2002). Despite these efforts, it is clear from informants’ responses that the issue of inadequate capacity for implementation remains relevant. Poverty reduction and macroeconomic growth is a legitimate concern for Ethiopia and the health of its citizens, since implementation capacity is hindered by inadequate funds. But a focus on poverty reduction cannot ignore the implications of development for the environment. The link between environmental degradation and negative health and economic impacts is a concept solidified in mandated Environmental Impact Assessments (EIAs), yet often overlooked to make room for development investment (AAU_1D, 2011a & 2011b; Ruffeis et al., 2010; Bekele, 2008). It is reassuring, however, that the PASDEP, Ethiopia’s “guiding strategic framework” for development, makes clear the need to address the link between environmental degradation and poverty (PASDEP, 2006, p. 1). If development is to be sustainable in the long run, policies such as EIAs and development permits should be enforced to dissuade short term interests from undermining the central goal of poverty reduction. Sustainable development in Ethiopia is crucial considering that, as cited previously, “natural resources are the foundation of the economy” and of social and economic development (MoFED, 2006; EPE, 1997).

While sustainable development can address the issue of inadequate capital within Ethiopia in the long run, short term solutions such as financial assistance can serve to address the capacity issues that hinder implementation of environmental policies today. Respondents cited financial assistance and adequate operating budgets as key factors in enabling environmental institutions to implement existing environmental policies (HoAREC_1E, 2011; EPA_1F, 2011). Keeley and Scoones have noted that the establishment of the EPA as a separate government body from other ministries has left it with a limited budget and also weakened the influence of conservationists in the Ministry of Agriculture (2000, p. 105). In the short term, attracting foreign financial assistance for environmental projects could strengthen the EPA’s efforts. In the long term however, in accordance with Ethiopia’s focus on sustainable development and eventual independence from foreign aid, the future of the environmental sector could possibly warrant a ministry similar to the existing Ministry of Agriculture and Rural Development, or the Ministry of Water Resources (MoFED, 2002). Establishment as a ministry would endow the EPA with a budget of its own to build implementation capacity to address the environmental goals outlined in the EPE, and perhaps address environmental issues in other relevant ministries.

For now, faced with a limited budget and weak implementation capacity, the EPA relies on assistance from environmental NGOs for project implementation (HoAREC_1E, 2011; AAU_1D, 2011). Wamai suggests that a decentralized government provides a suitable framework for NGOs to engage in local communities and participate in service delivery – the decentralized nature of Ethiopia’s service sectors may even necessitate the involvement of NGOs to achieve program objectives (Wamai, 2008). Several Ethiopian policies and studies
explicitly cite the importance of encouraging partnerships NGOs in program implementation in Ethiopia (Wamai, 2008; MoFED, 2002; Clark, 2000; EPE, 1997).

While in theory and practice it appears that NGOs are beneficial for service delivery in Ethiopia, laws such as the Charities and Societies Proclamation (CSP) can hinder the environmental management activities of NGOs. On the whole, the government remains very suspicious of the activities of NGOs, and closely monitors their operations through the CSP law (Hailegebriel, 2010). As mentioned before, by limiting international funding for most economic development and humanitarian NGOs to 10% of NGO operating budgets the domestic capacity of such NGOs has been further diminished. Essentially, laws of this type have the potential to remove or limit the benefits that many of these organizations provide to the communities with which they work (assuming that they were indeed non-corrupt organizations). While environmental NGOs have stronger working relationships with the government compared to humanitarian NGOs, the political context in which they work can still impact their ability to engage effectively in their program areas. The mistrust that characterizes the relationship between the government and NGO sector has significant implications for the activities of environmental NGOs going forward, and may restrict the potential of both parties to enact real environmental changes.

For the moment, however, environmental NGOs appear to enjoy a relatively strong collaborative working relationship with the government (as emphasized by the two organizations studied here, FFE and CFE). And across Ethiopia today environmental NGOs play a significant role in environmental management. Sustained cooperation between the Ethiopian government and NGOs can produce mutually beneficial outcomes. As demonstrated by FFE and CFE, NGOs have multiple roles in environmental protection, ranging from education and policy dialogue to on-the-ground environmental works. As suggested by a professor at Addis Ababa University (AAU_1D, 2011b), NGOs in Ethiopia fill environmental management gaps that may result because of limited financial resources in the government sector. Increased collaboration with the Ethiopian government to fill gaps in environmental management and implementation could be a potential goal for NGOs in the future. At present, FFE and CFE both organize workshops that spur collaboration between communities, NGOs and local government officials (HoAREC, 2011; CFE, 2010). It is important to remember that building capacity means building relationships as well.

In the future the fact that humanitarian organizations currently constrained by the CSP law might also contribute to environmental goals (such as providing clean water, food security through sustainable agriculture, and decreased poverty, among others), may be worthy of consideration. If restrictions on humanitarian NGO sources of funding (set in place by the CSP law) were loosened, foreign funding could further facilitate the implementation of environmental programs through humanitarian organizations in addition to through the exclusively “environmental” NGOs partnering with government today – thereby expanding the number of Ethiopian NGOs involved in environmental initiatives.
Questions to explore in future research include:

- To what degree do local environmental NGOs generate improved environmental outcomes relative to other organizations (e.g., public agencies; international NGOs)?
- How will the role of the NGO sector in environmental management and environmental policy discourse evolve in the future?

Environmental NGOs are already in a position to assist the government with the implementation of environmental policies and laws. Ultimately, the Ethiopian government has a clear policy that the public has to get involved with environmental protection and conservation, and NGOs can help make this connection by organizing citizens to be involved in environmental management in their communities. FFE and CFE are two NGOs working actively to accomplish this goal through their activities. As one respondent observed, “there are laws, so there will be a place for [NGOs]” (AAU_1D, 2011b). What remains to be seen is what form this “place” will take.

Limitations

This research was limited by several factors. As per the nature of international research, I was limited to contacting my respondents by phone, Skype, and email. Contact information was difficult to find or not available in many cases, including academic departments at Ethiopian universities, and the Ethiopian EPA. The sparse information provided by government ministries and departments is significant in its own way: availability of contact information in a public space is an indicator of the ability of citizens to access their representatives, and in turn, the ability to make their voices heard.

At times, language barriers presented further difficulties in communication when calling NGOs and the Ministry of Justice within Ethiopia. In future projects, partnering with a native Amharic speaker would prove very helpful.

Finally, the conclusions drawn above are limited by the small sample. While this report might not comprehensively represent the state of this topic within Ethiopia, given the consistency of accounts across respondents, findings are likely indicative of current trends. Further research should investigate the experiences of additional environmental NGOs, and examine both qualitative and quantitative data from relevant federal ministries, regional and woreda-level governments regarding environmental policy and NGOs in Ethiopia.

1 The website of the EPA was new as of 2011, which might explain the relative lack of information available on the website.
Conclusion

The post-Derg period has witnessed the development of many formalized environmental institutions, including environmental laws spanning diverse environmental issues. However, there are significant limitations to environmental policy implementation capacity. Ethiopian environmental NGOs play a significant role in environmental management and are in a position to help address these implementation gaps, but in the past a focus on economic development has caused the political commitment of the government to environmental policies and laws to be unpredictable. Present funding for environmental projects and institutions alike are inadequate to meet the desired environmental outcomes.

Environmental NGOs such as Forum for Environment (FFE) and Concern for Environment (CFE) play a significant role in environmental management in Ethiopia, in sectors that promote long-term environmental sustainability (CRDA, 2008). Looking forward, it is possible that this role will increase in coming years (McKee, 2007). To some extent, the ability of environmental NGOs to engage effectively within their program areas depends on the political context in which they work. As one academic observer mentioned, the relationship between environmental NGOs and the Ethiopian government is good, but there is still work to be done (HoAREC_1E, 2011). FFE and CFE are both examples of organizations working actively to promote NGO-government partnerships, and thereby improve environmental quality within their program areas. In the future the potential for environmental NGOs to affect tangible, positive environmental outcomes will be determined in part by their evolving relationship with the government, their operating budgets, and by the strength of environmental policy within Ethiopia.

Based on key informant interviews and a review of literature, policy recommendations include:

- in looking to adjust or improve existing environmental policies, one should start with the federal policy, since regional policies are held to federal standards;
- there should be a continued and intensified focus on improving government environmental policy implementation capacity at all levels; and
- this improvement in implementation capacity can be achieved in part by:
  - strengthening government-NGO resource exchanges and partnerships, with attention paid to including locally/regionally-based NGOs in policy dialogue, project implementation and information/resource exchange; and
  - attracting international financial assistance for governmental agencies and NGOs to increase short-term implementation capacity.
Works Cited


**Additional References**


Environmental Policy Review 2011: Key Issues in Ethiopia

Chapter 2 Evaluation of Forest Cover Change between 2005 and 2009 in four Regional States of Ethiopia

Daniel Homeier
Research Highlights


Daniel Homeier

This chapter examines relationships between governance institutions, access to forests, population pressures, and changes in forest cover in Ethiopia.

Qualitative (literature review) and quantitative (spatial and statistical) data were analyzed for four Regional States: Tigray, Amhara, Oromia and the Southern Nations, Nationalities and Peoples region (SNNP).

Additional data on household tree planting were obtained from the 2009 Ethiopian Rural Household Survey.

Governance institutions at the regional level vary substantially. This is reflected in the observed differences in distribution of forest cover across regions.

Areas farther from roads, which consequently may have less access to financial resources, experienced greater forest loss than areas closer to roads.

Although deforested areas tend to be relatively densely populated, afforestation can occur in population dense areas.

Despite observed declines in closed forest cover, tree planting has likely increased thin forest cover.

International carbon markets may be able to also play a role in increasing forest cover, especially if regionally focused.

By Daniel Homeier

Executive Summary

“Evaluation of Forest Cover Change between 2005 and 2009 in four Regional States of Ethiopia” is the second chapter in Environmental Policy Review 2011, a report produced by the Environmental Policy Group in the Environmental Studies Program at Colby College in Waterville, Maine.

Forests are globally threatened, especially in Ethiopia where 12% or less of land area is forested. Loss of forest cover may be due to a number of factors, such as the cutting of timber for fuel wood and the expansion of agriculture. At the same time, changes in household tree planting practices, among other things, may be increasing forest cover in some degraded areas. By drawing upon a Geographic Information Systems (GIS) analysis of forest cover within four Regional States - Tigray, Amhara, Oromia and the Southern Nations, Nationalities, and Peoples region (SNNP) - this study aims to explore the relationships between governance institutions, access to forests, and population pressures, and changes in forest cover in Ethiopia.

A review of literature suggests regional governance institutions across Ethiopia are distinct from one another. GIS analyses of forest cover changes from 2005 to 2009 reveal that this distinction is reflected in the distribution of forests within and across regions. More specifically, forests vary in relation to regional boundaries, roads and railroads, cities, and population density from region to region. Generally speaking, densely populated areas are more deforested than less populated areas. Surprisingly, some areas closer to roads are less deforested than areas farther from roads.

Analyses of household-level survey data from 2004 to 2009 show that household tree planting increased substantially in all regions over the past decade, especially in the Tigray and Amhara regions. During the same time period the area of thin forest (forest in which trees and vegetation are sparse) increased most in Tigray and Amhara. The reflection of household tree planting practices in national forest cover data highlights the potential importance of household tree planting in a country facing threatened forest resources.

Differences in regional governance institutions suggest efforts to increase forest cover in Ethiopia must be regionally focused to fit regional conditions, including road access and population density. Efforts seeking to utilize global carbon markets such as REDD+ may more effectively increase forest cover if regionally focused. Finally, household tree-planting, a tool for increasing forest cover while addressing social concerns such as poverty, should be part of any regional development efforts.

By Daniel Homeier

Introduction

Due to the combined stresses of population pressure and limited access to alternative resources, Ethiopian forests are under significant strain. According to the Food and Agriculture Organization of the United Nations (FAO), forest area accounted for approximately 12% of Ethiopia’s total land area in 2005 (FAO, 2010). EarthTrends (2003) suggests forest cover in Ethiopia may be substantially less, as little as 5%. By any measure forest cover in Ethiopia is low compared to the 20.8% average for East Africa; and Ethiopia’s forest cover is expected to continue decreasing in coming years (Mekonnen, 2009; European Commission et al., 2003).

Deforestation, along with other forms of land use change, is a substantial contributor to economic and environmental problems, ranging from global climate change to local food and energy scarcity. Forests provide numerous ecosystem services, or benefits provided by proper ecosystem functioning. Some ecosystem services provided by forests include erosion control, nutrient cycling, maintenance of biodiversity, water purification, control of desertification, carbon sequestration, and climate stabilization (Nair & Tieguhong, 2004). Deforestation alone was responsible for nearly 25% of worldwide anthropogenic CO$_2$ emissions during the 1990s (Houghton, 2003). Improvement of forest management practices are estimated to be capable of reducing worldwide CO$_2$ emissions substantially (Sohngen, 2009). Inextricably linked to ecosystem services, deforestation plays a role in a variety of social concerns, such as poverty and energy availability (Alem et al., 2010; Burgess et al., 2010). Rural and poor communities internationally, including those in Ethiopia, depend on forests for sources of energy, food, timber and income (Burgess et al., 2010; Scherr et al., 2005). Even urban areas depend heavily on forest resources: Alem et al. (2010) found that nearly one million trees must be cut annually to account solely for the amount of charcoal that is brought to Addis Ababa, the capital city of Ethiopia.

By drawing upon Geographic Information Systems (GIS) analyses of forest cover within four Regional States: Tigray, Amhara, Oromia and the Southern Nations, Nationalities, and Peoples region (SNNP), this study aims to investigate the influence of governance institutions, access to forests, and population pressures on changes in forest cover in Ethiopia. These three variables were chosen because of their theoretical importance to forests as suggested by the literature (Mena et al., 2006; Berry, 2003; European Commission et al., 2003; Rudel et al., 1998). For example, in their 2003 report, the European Commission et al. identified institutions and

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2 For more on fuel wood, charcoal and energy sources in Ethiopia see chapter six in Environmental Policy Review 2011.
population pressure as “driving forces” impacting Africa’s forests. They also identified increased access to forest via roads as a serious concern. Berry (2003) similarly identified institutional issues and population growth as root causes of land degradation in Ethiopia, while other researchers beyond Africa, such as Mena et al. (2006) and Rudel et al. (1998), have found that road access is significantly related to deforestation.

This chapter proceeds as follows. The methods section outlines the methodology followed for data collection and analysis, while a brief history of land use and institutions pertaining to forests in Ethiopia is provided in the historical context and institutions section. The results section contains the quantitative section of this chapter, providing land cover findings produced by spatial analysis. The discussion section then explores the relationship between the land cover findings and the history of land use and institutions to further develop our understanding of declining forest cover in Ethiopia, and the conclusions section summarizes the primary findings of this chapter and provides policy recommendations.

Methods

I collected three primary types of data; preexisting literature and interview data, spatial data, and survey data (containing household tree planting information) to evaluate how governance institutions, access to forests, and population pressures influence patterns of forest cover change in four Regional States: Tigray, Amhara, Oromia, and SNNP (Figure 2.1).
Figure 2.1 Study regions and national and provincial capitals of Ethiopia, GADM, 2011.
Literature Review and Interview Data

I used Web of Knowledge, Environment Complete, and Google Scholar to find peer reviewed journal articles pertaining to forest related institutions globally and in Ethiopia. In addition to an online literature search, I collected anecdotal information pertaining to forest cover and regional governance institutions through phone and email conservations with individuals involved in forests in a few of the study regions (for a complete list of interviews and attempted interviews see the Works Cited section). While I was not able to create a complete data set of regional institutions due to a lack of readily available institutional information at a regional level, I was able to make preliminary conclusions based on available sources.

Spatial Analysis

Spatial analyses sought to evaluate how (1) governance institutions, (2) access to forests, and (3) population pressures might influence forest cover. These three sets of variables are used to explain patterns of forest cover change in Ethiopia, and specifically whether a given parcel experienced reforestation, no change in forest, or deforestation between 2005 and 2009. Governance institutions are represented by region and proximity to regional borders. Access to forests is represented by spatial and quantitative analysis of forest cover as a function of distance from roads and railroads. Population pressures are represented by spatial and quantitative analysis of forest cover as a function of distance from cities and of the surrounding population density.

I collected GIS data primarily from ESRI, a popular source of GIS software (ArcGIS) and other online resources, including Ionia, the European Space Agency’s global land cover organization, and DIVA-GIS, a web portal for online GIS resources supported by the Consultative Group on International Agricultural Research (CGIAR). For a complete list of GIS data sources (many of which are freely and publicly available through DIVA-GIS) see Table 2.1. For a depiction of variables used to represent governance institutions, access to forests, and population pressures in relation to forest cover change from 2005 to 2009, see Appendix 2F Figure 2.12.

Based on the availability of land cover data, I broke down spatial and statistical analysis into two main time periods, 2005 and 2009, for temporal comparison. It is important to note that 2005 spatial data is an amalgamation of data from 2005 to 2006, while 2009 data is strictly from 2009. I performed analyses of change in forest cover and visual representation of spatial data using ArcGIS 10 (for a more detailed explanation of my GIS analyses see Appendix 2E).
Table 2.1 GIS data sources, description and URL.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Description</th>
<th>Type</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administrative</td>
<td>Country boundary and administrative subdivisions</td>
<td>Spatial</td>
<td>GADM (<a href="http://www.gadm.org/">http://www.gadm.org/</a>)</td>
</tr>
<tr>
<td>Boundaries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roads</td>
<td>Roads (year unknown)</td>
<td>Spatial</td>
<td>Digital Chart of the World</td>
</tr>
<tr>
<td>Land Cover</td>
<td>Global land cover raster data for 2004-2006 and 2009</td>
<td>Spatial</td>
<td>Ionia GlobCover (<a href="http://ionia1.esrin.esa.int/">http://ionia1.esrin.esa.int/</a>)</td>
</tr>
<tr>
<td>Elevation</td>
<td>SRTM 30</td>
<td>Spatial</td>
<td>USGS (<a href="http://eros.usgs.gov/#/Find_Data/Products_and_Data_Available/SRTM">http://eros.usgs.gov/#/Find_Data/Products_and_Data_Available/SRTM</a>)</td>
</tr>
<tr>
<td>Mean Precipitation</td>
<td>1950-2000 2.5 arc-minutes</td>
<td>Spatial</td>
<td>WorldClim (<a href="http://www.worldclim.org/">http://www.worldclim.org/</a>)</td>
</tr>
<tr>
<td>Mean Temperature</td>
<td>1950-2000 2.5 arc-minutes</td>
<td>Spatial</td>
<td>WorldClim (<a href="http://www.worldclim.org/">http://www.worldclim.org/</a>)</td>
</tr>
<tr>
<td>Inland Water</td>
<td>Significant water bodies (rivers, canals, lakes)</td>
<td>Spatial</td>
<td>Digital Chart of the World</td>
</tr>
</tbody>
</table>

In regards to forest cover classifications, I considered the closed to open (>15%) broadleaved evergreen and/or semi-deciduous forest (>5m in height) land use classification the least thin forest cover (henceforth “closed forest cover”). I considered the open (15-40%) broadleaved deciduous forest (>5m) land use classification to be a thinner forest cover (henceforth “open forest cover”). Lastly, I considered the mosaic forest/shrubland (50-70%)/grassland (20-50%) land use category to be the thinnest forest cover (henceforth “mosaic forest cover”).

Survey Data Analysis

Finally, in order to investigate household tree planting practices, I used tree planting data from the 2004 and 2009 versions of the International Food Policy Research Institute’s Ethiopian Rural Household Survey (ERHS). The ERHS is an extensive questionnaire that began in 1989.

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Footnote 3: The FAO broadly defines forest as “land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10%, or trees able to reach these thresholds in situ. “It does not include land that is predominantly under agricultural or urban land use” (FAO, 2010, p. 5). Unfortunately, no such broad classification exists in LCCS, or consequently in the GlobCover classification of Ethiopian land cover (FAO, 2010). Therefore, the categories closest to representing forest cover in the four study regions are closed to open (>15%) broadleaved evergreen and/or semi-deciduous forest (>5m), open (15-40%) broadleaved deciduous forest (>5m), and mosaic forest/shrubland (50-70%)/grassland (20-50%) (GlobCover, 2009).
and is administered approximately every five years to households within 15 villages in Tigray, Amhara, Oromia, and SNNP. The ERHS villages were chosen so that one to three villages per agro-ecological zones and sub-zones were represented. Within each village, households were selected randomly. While not representative of the entire country, the ERHS can be “considered broadly representative of households in non-pastoralist farming systems as of 1994” (Dercon & Hoddinott, 2011). I performed statistical analysis of the ERHS data to evaluate tree planting practices data using STATA SE 12.0. More specifically, I used bivariate analyses to explore the relationship between region and forest cover change, and a probit regression to explore the relationship between the number of trees planted and the regional location of tree planting. I also used Ordinary Least Squares (OLS) regression to explore the relationship between tree planting and education attained by household heads.

**Historical Context and Institutions**

In order to fully understand why forest cover in Ethiopia is sparse and threatened, a brief overview of the laws and institutions that shape forest use and protection is necessary. The Ethiopian historical context most relevant to forest cover is marked by three periods defined by the evolution in land rights systems: pre-1975 land reform, land reform under the Derg regime, and the post-Derg era up to today.

**Pre-1975 Land Reform**

Before 1975, Haile Selassie maintained a monarchy, controlling Ethiopia as an emperor. As Gebreegziabher (2009) notes, three land rights systems existed prior to and during Selassie’s regime: the *risti* system; the *gulti* system; and church holdings. The *gulti* system of land rights is analogous to feudalism; *gulti* holdings were those held by royal individuals. Because of a lack of information regarding church land holdings and the relative rarity of the *gulti*, the most well-known and common historical Ethiopian land rights system is the *risti* system.

The *risti* system, like many traditional African land rights systems, was one in which land was communally held (Besley, 1995). Although individuals could claim the legal right to use land through proof of relation to the original landholder, they could not transfer rights to family members or to others by way of sale. To meet the needs of new individuals, land was redistributed; further weakening individual rights to a particular area and solidifying the reality that no one had rights to any one parcel of land. The system was considered relatively egalitarian in that equal distribution of land was ensured through a lottery system based on land quality (Gebreegziabher, 2009). But by weakening individual user rights, the *risti* system essentially deincentivized investment by land users (i.e., farmers) in the land they were using, often resulting in land degradation (Gebreegziabher, 2009).
Land Reform and the Derg Regime

Ethiopian land rights changed drastically during the mid-1970s. The historical system of decentralized land rights ended in 1974 when the Derg, a Marxist military junta, pushed Emperor Haile Selassie from power. The Derg installed a government backed by the Soviets, led by Mengistu Haile Mariam, and promptly initiated nationwide land reform (Keeley & Scoones, 2000). The military regime seized all land, eliminating any existing rights, and redistributed land on a household basis. Through redistributions of land, nationalization of farms, abolishment of tenant farming and hired labor and control of prices, supplies, and markets, the government maintained centralized control over land distribution (Jagger et al., 2005; Holden, 2002; Keeley & Scoones, 2000). Because there was not enough land to redistribute evenly among all individuals within Ethiopia, and because hired labor was outlawed, a group of landless households was created. In recognition of widespread unemployment coupled with growing national environmental threats, the Derg initiated extensive conservation measures countrywide. The rural landless were thus put to work implementing vast state-run conservation projects, including tree planting.

In the long-run, however, the Derg forestry initiatives had little positive effect on forest cover (Jagger et al., 2005; Hoben, 1995). The conservation measures practiced by the Derg were recognized as byproducts of centralized, top-down rule. This often resulted in the destruction of tree planting efforts once the Derg regime fell, satisfying the desire of the people to revolt against the centralized regime, but environmentally only serving to further degrade the land (Keeley & Scoones, 2000). The Director of Concern for Environment, an Ethiopian NGO, asserted that even today some reforestation programs are criticized by local communities for being too top down in nature (CFE_2A, 2011).

Although the Derg’s state-run land reform and centralized conservation projects were, for the most part, ineffective, elements of the Derg regime have shaped the contemporary resource management landscape in Ethiopia (Bewket, 2002). The Derg regime directly influenced Ethiopian forests by the fact that seedling or sapling trees planted during the Derg regime would have developed into a mature forest by the 21st century (Bewket, 2002). In other words, any evaluation of forests today must consider the actions that may have influenced forests decades prior.

Post Derg – Today

The decline of the Derg paralleled that of the Soviet Union. By 1991 the Derg was ousted and replaced by a transitional government. The Ethiopian People’s Revolutionary Democratic Front (EPRDF) was elected to power. With the new government came a new democratic constitution. Governance was shaped around ethnic divisions within the country in an effort to move away from centralized government (Keeley & Scoones, 2000). For a variety of reasons, including the
ethnic complexity of Ethiopia and its historical ethnic tensions, ethnic division of the country has proved to be challenging (Abraham, 2005). For example, the Abyssinian part of the country (located in the northern part of Ethiopia, now the Tigray and Amhara regions) has historically dominated the southern regions, resulting in fewer resources and less governing power in the south (Keeley & Scoones, 2000).

In addition to a new ethnically based governance scheme, woodlot management was decentralized and community management was reinstated (Jagger et al., 2005). Some lots of land were even privatized in forest re-planting efforts. However, land in Ethiopia is still state-owned, as Article 40 of the Constitution states: “the right to ownership of rural and urban land is exclusively vested in the state... and shall not be subject to sale or exchange” (FDRE, 1995).

Although EPRDF policies were a step away from the centralized control put in place by the Derg, land tenure has remained a heated political issue due to uncertainty created by the lack of a well-designed and enforced policy (Holden & Yohannes, 2002). Continuing land redistributions, such as those in 1992, 1993, and 1997, have not helped to reduce uncertainty amongst land-users. It is entirely feasible that such uncertainty can act as the lack of transferable land rights did during the pre-1975 period of Ethiopian history by weakening incentives to improve land, resulting in degradation. Ironically, protected National Forest Priority Areas were some of the areas hardest hit by failure of centralized control (Melaku, 2003). In light of this, localized (or decentralized) management of forests based on community based forest management is touted as one potential solution to deforestation (Environmental Economics Policy Forum for Ethiopia and Ethiopian Development Research Institute, 2007).⁴

**Current Institutional Context**

Today, there are at least two levels of institutional context pertinent for the study of forest management in Ethiopia: federal and regional.⁵

**Federal Institutions**

The government bodies that oversee forestry issues (to varying degrees) are: the Federal Ministry of Agriculture and Rural Development (MoARD), the Federal Environmental Protection Authority (EPA), the Federal Ministry of Water Resources (MoWR), and the Federal Ministry of Mines and Energy (MoME). While all of these government bodies have specific roles regarding forestry, MoARD has the most significant role, which includes the listing of endangered native tree species and the coordinating of relevant federal and regional bodies (Environmental Economics Policy Forum for Ethiopia and Ethiopian Development Research Institute, 2007).

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⁴ For a more nuanced explanation of community forest management, see Agrawal and Ostrom, 2001.
⁵ Although not entirely relevant for a regional level analysis of forest cover, the international institutions outlined in Appendix A Table 2.11 are those most likely to influence forest cover in Ethiopia.
For a detailed list of federal institutions relevant to forests in Ethiopia see Table 2.3.

These combined institutions, along with other lesser federal institutions concerned with forest policy, have had little success in conserving forests or increasing forest cover in Ethiopia, in large part due to poor funding and low priority within the government (Environmental Economics Policy Forum for Ethiopia and Ethiopian Development Research Institute, 2007; Million, 2004 & 2001). Because of such relatively weak federal institutions, authors such as Keeley and Scoones (2000, p. 110) have observed that “the federal level has become less important, and it is in the regions that policy agendas are set, decisions taken and projects implemented.”

**Regional Institutions**

As mentioned above, regional-level institutional power is effectively greater than national power in Ethiopia today (Keeley & Scoones, 2000). Regions, however, differ from one another in terms of both institutional strength and local participation in government. In their comparison of the Tigray and SNNP regions Keeley and Scoones (2000) found that in SNNP, there is little evidence of local participation, while in Tigray, there is a rich history of local participation in government. This seemed to affect citizens’ confidence in the policy process. The distinction between Tigray and SNNP is not surprising considering the historical influence of the north: Tigray regional council members, for example, were closely involved with the EPRDF (Keeley & Scoones, 2000). Further emphasizing the disparity in power between administrative levels within Ethiopia, institutions at the *woreda* level (an administrative level a step smaller than regions) have been identified as too weak even to provide simple evaluation of tea plantation impacts on forests (Environmental Economics Policy Forum on Policies to Increase Forest Cover, 2007). For a brief outline of each study region and its respective forest policy landscape, see Table 2.3.

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6 During the pre-1975 and Derg period, various institutions influenced forests and forest policy in Ethiopia, such as Public Ownership of Rural Land Proclamation No. 31/1975 (Environmental Economics Policy Forum for Ethiopia and Ethiopian Development Research Institute, 2007). For the sake of simplifying analysis, this review focuses on the post-Derg institutions.
<table>
<thead>
<tr>
<th>Institution</th>
<th>Year</th>
<th>Description</th>
<th>Institution Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Forest Conservation, Development and Utilization: Proclamation No. 94</td>
<td>1994</td>
<td>Classified three forest types: state, regional, and private forests. Expanded the role of private entities; required permits for forest use; established that violation of the proclamation would result in imprisonment and/or fine</td>
<td>No information</td>
</tr>
<tr>
<td>Ethiopian Forestry Action Program</td>
<td>1994</td>
<td>Created eight forestry development programs: Tree and Forest Reduction Program, Forest Resource and Ecosystem Management Program, Forest Industries Development Program, Wood fuel Energy Efficiency Development Program, Technology Development, Dissemination Program, Sectoral Integration Program, Planning, Monitoring and Evaluation Program, and Human Resources Development Program</td>
<td>Due to funding issues the effectiveness of these programs is questionable</td>
</tr>
<tr>
<td>Ethiopian Constitution: Proclamation No. 1</td>
<td>1995</td>
<td>Created Ethiopian government, FDRE; constructed the building blocks for environmental protection; maintained state ownership of land</td>
<td>No information</td>
</tr>
<tr>
<td>Conservation Strategy of Ethiopia and Environmental Policy of Ethiopia</td>
<td>1997</td>
<td>Highlighted the importance of sustainably conserving, developing, and utilizing forests and their resources</td>
<td>No information</td>
</tr>
<tr>
<td>Policy and Strategy on Forest Development, Conservation and Utilization</td>
<td>1997</td>
<td>Highlights state, private and community roles in forest management, forestry in regard to other resources (i.e. water), suitable afforestation/reforestation species, environmental impact assessments, and sustainable management of forests</td>
<td>Evidence suggests that the areas of concern were poorly addressed or enforced</td>
</tr>
<tr>
<td>Woody Biomass Inventory and Strategic Planning Project</td>
<td>2001-2004</td>
<td>Produced reports and strategic plans at both a federal and regional scale</td>
<td>No information</td>
</tr>
<tr>
<td>Forest Development, Conservation and Utilization: Proclamation No. 542</td>
<td>2007</td>
<td>Replaces the Policy and Strategy on Forest Development, Conservation and Utilization (1997); defined the types of forest ownership recognized at federal, private and state levels; grants MoARD forest management powers</td>
<td>Contains unclear provisions and does not account for community forests adequately</td>
</tr>
<tr>
<td>Ethiopian Wildlife Development and Conservation Authority Establishment: Proclamation No. 575</td>
<td>2008</td>
<td>The proclamation created the Ethiopian Wildlife Development and Conservation Authority and endowed it with various powers regarding wildlife; the Authority was not given the ability to regulate forests</td>
<td>Requires cooperation between the Authority and MoARD due to ecological links between forests and wildlife</td>
</tr>
</tbody>
</table>

Table 2.3 Regional comparisons of factors relevant to forests, see notes for source.

<table>
<thead>
<tr>
<th>Region</th>
<th>Policies</th>
<th>Identified Problems</th>
<th>NGO Activity</th>
<th>Protected Areas</th>
<th>Reforestation Projects</th>
<th>Localized Forest Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tigray</td>
<td>Yes</td>
<td>No information</td>
<td>Yes</td>
<td>Enclosures</td>
<td>No information</td>
<td>No information</td>
</tr>
<tr>
<td>Amhara</td>
<td>Yes, weak institutional capacity (budget, skills)</td>
<td>Unsustainable resource development/utilization, illegal logging, budget constraints, and poor infrastructure</td>
<td>No information</td>
<td>No information</td>
<td>No information</td>
<td>Yes (community management)</td>
</tr>
<tr>
<td>Oromia</td>
<td>Yes, poorly implemented due to budget constraints</td>
<td>Agricultural expansion, grazing, and timber/fuel wood/charcoal extraction</td>
<td>No information</td>
<td>Yes but either failed or narrowly implemented (forest priority areas)</td>
<td>Tree development program in development</td>
<td>No information</td>
</tr>
<tr>
<td>SNNP</td>
<td>Yes, poorly implemented</td>
<td>Agricultural and settlement expansion, energy demands, and construction</td>
<td>No information</td>
<td>Demarcation and protection of forest</td>
<td>Demarcation and protection of forest, tree planting, enrichment plantation and water diversion (soil recovery)</td>
<td>Yes (PFM), not well supported</td>
</tr>
</tbody>
</table>

Table 2.3 Notes: Source for all four regions: Environmental Economics Policy Forum for Ethiopia and Ethiopian Development Research Institute, 2007, p. 73-103. Information from region to region was inconsistent, as a result “no information” does not necessarily preclude that feature from a region, it simply means that Environmental Economics Policy Forum for Ethiopia and Ethiopian Development Research Institute either did not find the information or include it.
Results

Land Cover

Figure 2.2 depicts the change in forest types between 2005 and 2009. For visual purposes, the legend was simplified so that forest (dark green) represents closed forest cover that did not change between 2005 and 2009, thin forest (beige) represents open and mosaic forest cover that did not change between 2005 and 2009, forest growth (bright green) represents open and mosaic forest cover that changed to closed forest cover between 2005 and 2009, and thin forest growth (red) represents closed forest that changed to open and mosaic forest cover between 2005 and 2009 (i.e., loss of closed forest).

Two things stand out in this figure of forest change. First, there is very little closed forest in Ethiopia and it is primarily located in the SNNP and Oromia regions. Second, much of the little closed forest that did exist in 2005 was converted to mosaic or open forest by 2009. For a more detailed analysis of land use change, see the explanation of Figures 2.4 and 2.5 below.
Figure 2.2 Growth and loss of closed forest and thin forest cover in study regions, GlobCover, 2011.
Figure 2.3 depicts change in all three forest cover types clumped into a closed/open/mosaic forest classification, between 2005 and 2009. Compared to Figure 2.2, Figure 2.3 uses a more inclusive definition of forest, including closed to open (>15%) broadleaved evergreen and/or semi-deciduous forest (>5m), open (15-40%) broadleaved deciduous forest (>5m), and mosaic forest/shrubland (50-70%)/grassland (20-50%). The legend was again simplified for visual purposes so that forest (dark green) represents land falling in the general forest cover classification in both 2005 and 2009. Forest loss (red) represents change from the general forest cover classification to all other land cover types (such as agriculture). Forest growth (bright green) represents change from all other land cover types to the general forest cover classification. Other (beige) represents land classified as non-forest in both 2005 and 2009.

Unlike the previous figure, this figure depicts a larger coverage of general forest cover and a great deal of growth in the general forest cover classification. This figure also depicts the distribution of general forest cover along the eastern border of the Amhara and Oromia regions and more generally in the southeastern part of the country.
Figure 2.3 Growth and loss of closed/open/mosaic forest land cover and other land cover types (i.e., agriculture) in study regions, GlobCover, 2011.
Comparing mean Euclidean distances between features and areas of afforestation, unchanged forest, and deforestation within regions reveals a few things regarding the distribution of forests relative to features. Predictably roads, compared to boundaries, cities, and railroads (when applicable), tend to be closer to afforestation, unchanged forest, and deforestation (Table 2.4). For the most part, deforestation areas tend to be closer to boundaries, cities, railroads, and roads than afforestation areas. Roads in the Amhara and Oromia regions are exceptions, as is the SNNP boundary.

Boundaries, cities, railroads, and roads tend to be nearly the same distance from afforestation (~.30km) and deforestation areas (~.28km) from region to region. The administrative boundary of SNNP, however, is an exception, the mean distance to afforested parcels in SNNP is triple (91km) the distance to boundaries in the other three regions, and the mean distance to deforested parcels is five times as great (1.40km).

Unchanged forest – that is, forested area that remains forested over time – tends to be closer to roads than afforestation and deforestation areas, with the exception of in Oromia. Unchanged forest does not seem to be consistently near or far, compared to afforestation and deforestation areas, to boundaries or cities. Railroads, due to their presence in only two regions, are impossible to compare across all four regions. That said, they tend to be relatively far from all three forest change types compared to other features.

Table 2.4 Mean Euclidean distances between feature and areas of afforestation, deforestation, and unchanged forest normalized by maximum Euclidean distance from feature within region, GlobCover, 2011.

<table>
<thead>
<tr>
<th>Region</th>
<th>Feature</th>
<th>Afforestation Mean Distance Standardized</th>
<th>Unchanged Forest Mean Distance Standardized</th>
<th>Deforestation Mean Distance Standardized</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tigray</td>
<td>Boundary</td>
<td>0.29</td>
<td>0.25</td>
<td>0.28</td>
</tr>
<tr>
<td></td>
<td>Cities</td>
<td>0.51</td>
<td>0.37</td>
<td>0.37</td>
</tr>
<tr>
<td></td>
<td>Railroads</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Roads</td>
<td>0.16</td>
<td>0.13</td>
<td>0.14</td>
</tr>
<tr>
<td>Amhara</td>
<td>Boundary</td>
<td>0.32</td>
<td>0.33</td>
<td>0.28</td>
</tr>
<tr>
<td></td>
<td>Cities</td>
<td>0.45</td>
<td>0.43</td>
<td>0.40</td>
</tr>
<tr>
<td></td>
<td>Railroads</td>
<td>0.56</td>
<td>0.53</td>
<td>0.60</td>
</tr>
<tr>
<td></td>
<td>Roads</td>
<td>0.18</td>
<td>0.17</td>
<td>0.25</td>
</tr>
<tr>
<td>Oromia</td>
<td>Boundary</td>
<td>0.30</td>
<td>0.29</td>
<td>0.26</td>
</tr>
<tr>
<td></td>
<td>Cities</td>
<td>0.45</td>
<td>0.48</td>
<td>0.35</td>
</tr>
<tr>
<td></td>
<td>Railroads</td>
<td>0.52</td>
<td>0.53</td>
<td>0.45</td>
</tr>
<tr>
<td></td>
<td>Roads</td>
<td>0.13</td>
<td>0.15</td>
<td>0.20</td>
</tr>
<tr>
<td>SNNP</td>
<td>Boundary</td>
<td>0.91</td>
<td>1.04</td>
<td>1.40</td>
</tr>
<tr>
<td></td>
<td>Cities</td>
<td>0.44</td>
<td>0.41</td>
<td>0.39</td>
</tr>
<tr>
<td></td>
<td>Railroads</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Roads</td>
<td>0.22</td>
<td>0.18</td>
<td>0.21</td>
</tr>
</tbody>
</table>

7 Euclidean distance is the distance from a pixel representing a forest parcel to the closest feature of interest pixel.
A comparison of the mean population density of afforestation, unchanged forest, and deforestation areas reveals distinct trends from region to region (Table 2.5). For example, in Tigray afforestation and unchanged forest occur in less densely populated areas than deforestation. The same is true for Oromia. The opposite, however, is true for SNNP, where deforestation occurs in less densely populated areas than afforestation. Compared to the other three regions, Amhara is an outlier in that deforestation occurs in areas less densely populated than both unchanged forest and afforested areas. Notably, overall density in Amhara is high relative compared to the other regions. Generally, unchanged forest tends to be in less densely populated areas than deforestation areas.

Table 2.5 Mean population density (people/km²) for areas of afforestation, unchanged forest, and deforestation, GlobCover, 2011.

<table>
<thead>
<tr>
<th>Region</th>
<th>Afforestation Mean Population Density (km²)</th>
<th>Unchanged Forest Mean Population Density (km²)</th>
<th>Deforestation Mean Population Density (km²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tigray</td>
<td>45.7</td>
<td>58.9</td>
<td>76.1</td>
</tr>
<tr>
<td>Amhara</td>
<td>81.6</td>
<td>82.5</td>
<td>77.7</td>
</tr>
<tr>
<td>Oromia</td>
<td>41.4</td>
<td>27.2</td>
<td>51.8</td>
</tr>
<tr>
<td>SNNP</td>
<td>55.2</td>
<td>36.1</td>
<td>49.5</td>
</tr>
</tbody>
</table>

In the figures below the analysis of land cover from 2005 to 2009 is broken down into two comparisons for easy interpretation. The first is a percentage of the study regions’ total land area, represented by four forest cover types in 2005 and 2009. This is designed to depict differences in distribution of land cover between regions. The second is a comparison of forest cover types within each region to illustrate changes in land cover distribution between 2005 and 2009. Figures 2.4 and 2.5 depict the first comparison while Appendix 2B shows the second comparison. All depictions contain three forest cover types: mosaic forest-shrubland/grassland, open broadleaved deciduous forest, and closed to open broadleaved evergreen or semi-deciduous forest.

In 2005, closed forest cover represented a relatively small percentage of all four study areas’ total land area (see Figure 2.4). Tigray and Amhara contained the lowest percentages, with .01% and .10%, respectively. Oromia and SNNP had greater percentages of closed forest cover, with 3% and 2% respectively. Oromia and SNNP had greater percentages of open broadleaved forest, both being 6%, than Tigray and Amhara, 1% and 3% respectively. Conversely, Tigray and Amhara had greater percentages of mosaic forest, with 18% and 22% respectively, compared to 17% and 11% for Oromia and SNNP.
The land cover distribution across regions in 2009 was similar to that of 2005 (see Figure 2.5). Oromia and SNNP regions again contained more closed forest cover. However, from 2005 to 2009, closed forest cover in both regions declined while mosaic and open forest increased across all four regions (for a more detailed depiction of temporal change within each region see Appendix 2B). Mosaic forest cover increased, especially in the Amhara and Tigray regions considering both had 32% mosaic forest cover in 2009. SNNP and Oromia still have relatively less mosaic forest cover with 14% and 25%, respectively. Within SNNP and Oromia, however, open forest cover increased to a greater degree and continued to maintain a larger percent coverage with 8% and 10%, respectively.

Across all four study regions, closed forest decreased from 1,224,953 ha to 1,046,666 ha from 2005 to 2009, resulting in a 44,000 hectare per year decrease (or a 14.6% change).
Household Tree Planting

Although not representative of tree cover, the Ethiopian Rural Household Survey (ERHS) tree planting data can inform the forest cover data results. For example, regional increases or decreases in forest cover may be explained by corresponding changes in household tree planting practices within the same region. More specifically, the ERHS planting data suggest that in 2009, in comparison to 2005, across all four regions the average household planted a greater number of trees. Increases were proportionally greatest in the Tigray region, followed by Amhara, SNNP and Oromia (see Table 2.6).

Table 2.6 Mean number of trees planted per household in 2004 and 2009, ERHS 2011.

<table>
<thead>
<tr>
<th>Region</th>
<th>Mean number of trees per household 2004</th>
<th>Mean number of trees per household 2009</th>
<th>Percent Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tigray</td>
<td>23</td>
<td>417</td>
<td>1713%</td>
</tr>
<tr>
<td>Amhara</td>
<td>172</td>
<td>512</td>
<td>198%</td>
</tr>
<tr>
<td>Oromia</td>
<td>558</td>
<td>712</td>
<td>28%</td>
</tr>
<tr>
<td>SNNP</td>
<td>721</td>
<td>1196</td>
<td>66%</td>
</tr>
<tr>
<td>Total</td>
<td>297</td>
<td>761</td>
<td>156%</td>
</tr>
</tbody>
</table>

Table 2.6 Notes: Mean number of trees is based on the total trees planted per household in 2004 and in 2009.

A probit regression evaluating the decision to plant any tree (yes/no) as a function of the region in which the planting household was located found that the Amhara, Oromia, and SNNP regions were all significantly different (at a greater than 95% confidence level) from Tigray in their decision to plant in 2009 (See Table 2.7). Due to the complexity in interpreting probit regression coefficients, it is only reasonable to conclude that being in Amhara or Oromia reduces the odds of planting trees, while being in SNNP positively influences the odds of planting (based on the coefficient sign).

Table 2.7 Probit regression for tree planting as a function of household location by region in 2009, ERHS, 2011.

| Variable | Odds Ratio | Coefficient | Standard error | z     | P>|z| |
|----------|------------|-------------|----------------|-------|-------|
| Education| 1.378      | 0.186       | 0.031          | 5.82  | <0.001***|
| Farmer   | 1.111      | 0.075       | 0.082          | 0.92  | 0.358 |
| Region   |            |             |                |       |       |
| Amhara   | 0.148      | -1.110      | 0.148          | -7.50 | <0.001***|
| Oromia   | 0.382      | -0.550      | 0.143          | -3.87 | <0.001***|
| SNNP     | 2.980      | 0.530       | 0.166          | 3.23  | 0.001**|
| Constant | 5.018      | 0.952       | 0.136          | 7.01  | <0.001 |
| N        | 1564       |             |                |       |       |
| LR $\chi^2(5)$ | 230.39   |             |                |       |       |
| Prob $\chi^2$  | 0.000     |             |                |       |       |
| Psuedo $R^2$   | 0.1352    |             |                |       |       |
| Log likelihood| -736.933 |             |                |       |       |

Table 2.7 Notes: *, **, and *** indicates statistically significant at a 5%, 1% and .1% level (respectively). For the Region variable, the category Tigray was omitted to avoid collinearity.
Evaluating the number of trees to plant and the level of education held by the household head with an OLS regression found that relative to having no education, having one to six and six to twelve years of education has a significant (at a slightly greater than 95% confidence level for both) effect on the number of trees planted in 2009 (see Table 2.8). Based on the coefficient, this impact is substantial; households in which the household head had some education on average planted over 300 more trees than those with no education. University level education, however, was not found to have a significant influence on planting behavior.

Table 2.8 An Ordinary Least Squares regression evaluating the number of trees planted and level of education of head of household in 2009, ERHS, 2011.

| Variable       | Coefficient | Standard error | t     | P>|t| |
|----------------|-------------|----------------|-------|---------|
| Level of Education |             |                |       |         |
| 1-6 years      | 334.62      | 115.68         | 2.89  | 0.004** |
| 6-12 years     | 336.75      | 160.33         | 2.10  | 0.036*  |
| University     | 82.66       | 108.95         | 0.76  | 0.488   |
| Constant       | 643.09      | 64.33          | 9.98  | <0.001  |
| Number of observations | 1564 |   |       |         |
| Prob>F         | 0.012       |                |       |         |
| R-squared      | 0.006       |                |       |         |
| Adj R-squared  | 0.005       |                |       |         |
| Root MSE       | 1725.2      |                |       |         |

Table 2.8 Notes: *, **, and *** indicate statistically significant at a 5%, 1% and .1% level (respectively).

Discussion

The evolution of Ethiopian governance institutions provides a valuable context for understanding forest cover in Ethiopia. For example, changes in property regime types, which occurred as governments changed during the 20th century, has had little positive influence on forests in Ethiopia (Melaku, 2003). In response to the widespread failure of highly centralized governments such as the Derg, communal management is an option considered today for improved resource management (WRI, 2003). This is, unfortunately, based on the assumption that because of the widespread use of the risti system, communal land ownership defined pre-1975 Ethiopian land regimes. Such an assumption is based on a generalized notion of pre-1975 Ethiopia and results in the loss of details regarding diverse situations and potentially inaccurate perceptions of power structures and their effects (Rahmato, 1990). Therefore, when communal management is implemented as a solution, it does not always solve the environmental and social issues that many hope it will (Crook, 2003). Changes in the structure of governance institutions, such as implementing communal resource management, must consider all aspects of the institutional landscape.
In the case of Ethiopia, the relationship between national and regional administrative power is an aspect of governance institutions that must be considered. Kefauver, in the first chapter of *Environmental Policy Review 2011*, found that regions generally adopt national level policy. Therefore, while national institutions may be poorly enforced, it is still important that policy is created at a national level. For example, the recent creation of The Reducing Emissions from Deforestation and Forest Degradation Readiness Preparedness Proposal at a national level means that the policy may be implemented at a regional level to improve foreign investment in Ethiopian forests (EPA, 2011). However, a lack of strong national level policy means that regional policies may be an unorganized patchwork of forest policies that do not address the cross boundary nature of environmental problems, such as forest degradation and loss. The analysis of forest cover presented here, especially when measured in relation to regional boundaries, population density of forest areas, and in terms of changes in forest cover across boundaries, supports the conclusion that differences in regional governance institutions are reflected in forest cover. Differences in tree planting practices, as measured by the ERHS, also provide support for this conclusion.

The variation in distance of regional boundaries from forest parcels suggests that regional boundaries, and the regions they enclose, are distinct from one another. For example, forest change tends to be relatively far from SNNP’s boundaries compared to other regions, suggesting that SNNP’s regulation of forest use along its boundaries may be weaker than other regions’. That said, it is important to note that administrative boundaries tend to follow natural features, such as mountain ranges, and therefore cannot be used with great confidence to describe forest cover characteristics. But comparing the changes in forest cover across regions may be a more reliable way of showing that regions are distinct from one another. For example, the sizeable increase observed in mosaic forest within the Tigray and Amhara regions compared to the Oromia and SNNP regions suggests that the two northern regions may differ in regards to tree planting or deforestation institutions.8

The differences in regional scale policy are exacerbated by a lack of regional scale information, such as whether or not NGOs are involved in preventing deforestation or the extent of protected forest areas. Robert Sturtevant, a Peace Corps volunteer working at the Wondo Genet College of Forestry (and a Natural Resources and Extension Forestry Specialist at the Colorado State Forest Service), expressed also having a difficult time finding forestry information (2011). Regardless, federal creation of institutions, strengthening of property rights throughout Ethiopia,

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8 The increase in mosaic forest cover in the Amhara and Tigray regions in conjunction with the relatively small decrease in open and closed forest and a decrease in other land uses suggests that other land uses are possibly transitioning from very thin forest to less thin forest. This makes sense considering mosaic and open forest cover are likely the result of either one of two things, the degradation of closed forest or the forestation of non-forested land. A similar difference exists between open and mosaic forest. Forested mosaic cover may result in open forest while degraded open forest may result in mosaic forest.
and encouraging local management may be vital to growth of forest cover (Environmental Economics Policy Forum for Ethiopia and Ethiopian Development Research Institute, 2007). Considering the disparity in national and regional power and inconsistencies in governance institutions across regions, international institutions are unlikely to have a major role in shaping forest cover in Ethiopia. That said, REDD+, a mechanism with which wealthy nations pay developing nations to reduce deforestation and degradation utilizing a carbon market, is an example of an international funding institution that could be implemented in Ethiopia (Parker et al., 2008; Peskett et al., 2008). In addition to REDD+, two financing mechanisms and programs, the Global Environmental Fund and the World Bank BioCarbon Fund, have already managed to support beneficial programs for forests in Ethiopia despite the challenging institutional landscape. Both the Humbo Regeneration Project and the Sodo Reforestation Project are supported through World Vision, suggesting such an organization has potential for providing future benefits to Ethiopian people and forests. For a brief outline of international institutions supporting a carbon market that may benefit forests in Ethiopia, see Table 2.9.

Table 2.9 International institutions relevant to carbon markets and Ethiopian forests, see notes for sources.

<table>
<thead>
<tr>
<th>Institution</th>
<th>Date</th>
<th>Description</th>
<th>Institution Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>World Bank BioCarbon Fund</td>
<td>2004-2007</td>
<td>World bank administered fund to support carbon sequestration and conservation, including afforestation and reforestation, and REDD</td>
<td>Supports Humbo Community-based Natural Regeneration Project</td>
</tr>
<tr>
<td>World Vision</td>
<td>2006</td>
<td>Christian relief organization working to stem the causes of poverty and injustice, supports global carbon sequestration schemes</td>
<td>Supports Sodo Reforestation Project and Humbo Community-based Natural Regeneration Project</td>
</tr>
<tr>
<td>REDD+</td>
<td>2005-2009</td>
<td>Reducing Emissions from Deforestation and Forest Degradation may promote sequestration of atmospheric CO2 while creating benefits for communities with potential annual payments greater than $30 billion</td>
<td>The continuing issue of insecure land tenure that has historically caused land degradation in Ethiopia may make the successful application of REDD+ difficult; in order for distribution of payments to work effectively, tenure must be well defined and secure; the lack of support and funding that has prevented many of the federal level institutions from helping Ethiopian forests may also negatively affect the application of REDD+</td>
</tr>
</tbody>
</table>

Table 2.9 Notes: World Bank BioCarbon Fund, source: The World Bank Carbon Finance Unit (http://wbcarbonfinance.org/Router.cfm?Page=BioCF); World Vision, source: World Vision (http://www.worldvision.org/content.nsf/about/who-we-are?open&ipos=top_drp_AboutUs_WhoWeAre); REDD+, source: Slunge, 2011 and Peskett et al., 2008.

How access to forests by way of roads influences forest cover may inform the way in which international efforts, using institutions such as REDD+, may best focus their efforts. Based on the distribution of forest change relative to roads, forests tend to be deforested in areas farther from roads and remain unchanged (or in some instances become afforested) in areas closer to roads. This somewhat counterintuitive finding – that access to forests via roads decreases the
likelihood of deforestation – may suggest that the wealth, development, and increased ease of enforcement that come as a result of roads may be beneficial for maintaining and increasing forest cover. In other words, the additional economic opportunities provided by roads may effectively remove the resource strain on forests while increasing their intact value. While this supports the general theory of the environmental Kuznets curve, in which “there is an inverted U-shape relation between environmental degradation and income per capita,” it suggests that the tipping point after which environmental degradation decreases, at least in Ethiopia, may be relatively low in terms of GDP, perhaps requiring rural households have access to only a few vital, but relatively inexpensive, resources (Stern et al., 1999).

The role of population pressure, in terms of distance from cities and population density of forest areas, in influencing forest cover further supports the conclusion that economic development may decrease deforestation and increase afforestation. Generally, forested parcels that remain forests appear in less population-dense areas than deforested areas. Similarly, standing forests tend to be farther from cities, and thus the populations they contain. Both of these findings are consistent with the notion that population pressures result in resource pressure (European Commission, 2003). But at the same time, based on the findings from Amhara and SNNP, it seems afforestation often also occurs in relatively densely populated areas. This implies that while population pressure often threatens forest, it does not necessarily have to.

How governance institutions, access to forests, and population pressures work together to influence forest cover across all four study regions within Ethiopia reveals inconsistencies with the literature. As FAO (2010) and estimates cited by Mekonnen (2009) suggest, forest cover in Ethiopia is low, ranging from 5% to 12%. Across all four study regions, the loss of approximately 44,000 hectares of closed forest per year between 2005 and 2009 seems high based on the EarthTrends 2003 estimate of 40,000 hectares of forest loss per year between 1990 and 2000. Conversely, compared to estimates by FAO in 2010, based on a WBISPP 2000 report, of approximately 60,000 hectares of forest loss per year between 2000 and 2005, the findings seem low.

Although any measure of forest cover in Ethiopia is low, the country seems to fare slightly better than surrounding countries. Ethiopia lost slightly less forest from 1990 to 2000 than Sub-Saharan Africa overall (EarthTrends, 2003). Furthermore, East Africa generally fares better in terms of forest loss than other regions within Africa: Africa as a continent accounted for more than half of the world’s forest loss between 1990 and 2000 and most of that forest loss was concentrated in Southern and West Africa (European Commission et al., 2003). This may be in part explained by tree planting efforts, as measured by the ERHS, in Ethiopia.

Not only do the ERHS tree planting figures suggest that the Tigray and Amhara regions increased tree planting substantially, but also the Environmental Economics Policy Forum for Ethiopia and Ethiopian Development Research Institute noted substantial tree planting practices.
in the same regions (2007). Furthermore, the observed increase in tree planting coincides with a sizeable increase in mosaic forest cover and decrease in other land uses in the same regions. Tree planting is, therefore, a likely cause of the increase in mosaic forest cover. Based on the positive impact tree planting has had in Tigray and Amhara, Bishaw’s suggestion that initiatives to incentivize tree planting should be incorporated into afforestation and reforestation projects seems like a worthy one (2001). Considering one to twelve years of education positively increases the number of trees planted per household, marrying tree planting efforts with educational efforts will likely improve tree planting outcomes. Such a union further emphasizes that regardless of their effect on forests, tree planting programs are valuable in that they support local communities with food, fuel wood, income and ecosystem services (Bishaw, 2001; Hagos et al., 1999).

**Conclusion**

In evaluating governance institutions, access to forests, and population pressures within the Regional States of Tigray, Amhara, Oromia, and SNNP, it is clear that regions within Ethiopia are distinct from one another in regard to all three variables. Any future efforts to increase forest cover in Ethiopia therefore must consider regional context. International carbon finance institutions, such as REDD+, will likely be more successful if they are implemented at a regional scale and are not exclusively reliant on strong national institutions (as such institutions may not be present or, if present, may not be locally enforced or contextually appropriate). National-level efforts to improve forest policy, such as implementing carbon finance, are still vitally important but must be recognized as a foundation upon which regional administrations can build their own policy, allowing them to adapt policy to meet regional needs. With this in mind, a well-organized and comprehensive dataset of forest information on a regional scale is needed. Such a dataset is especially valuable considering the variety of roles regional boundaries, roads, cities and population density play in shaping forest cover within regions. These factors ought to be considered when locating projects that aim to improve forest cover. Such projects would be wise to incorporate tree planting, as it seems to have significant potential to increase forest cover.

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9 The probit regression of ERHS tree planting as a function of household location further supports the conclusion that regions are different from one another in terms of forest cover, in this case by number of trees planted per household.
Works Cited


Environmental Policy Review 2011: Key Issues in Ethiopia

Chapter 3 Livestock Production Systems and their Environmental Implications in Ethiopia

Tom Kimball
Research Highlights

Environmental Policy Review 2011: Livestock Production Systems and their Environmental Implications in Ethiopia

Tom Kimball

- How do expanding livestock production systems and increasing numbers of cattle impact the quantity and quality of rangeland and forest cover in Ethiopia?
- Spatial, qualitative and quantitative data were used to frame and analyze livestock production and impacts.
- Livestock production is underestimated in its contribution to GDP and undervalued in its benefits and worth to rural Ethiopians.
- Ethiopia is highly dependent on livestock: as its population grows, so does its livestock production.
- Substantial increases in livestock production have negative externalities on the environment including erosion, soil degradation, GHG emissions, deforestation, and water pollution.
- Livestock is underestimated both as an asset and as a potential threat to Ethiopia.
- With support from research institutes, NGOs and international development partners, Ethiopia should increase productivity per animal through improved genetics, feed, and services and minimize negative environmental externalities by engaging in nutrient management strategies, selective grazing patterns, and carbon sequestration efforts.
Environmental Policy Review 2011: Livestock Production Systems and their Environmental Implications in Ethiopia

By Tom Kimball

Executive Summary

“Livestock Production Systems and their Environmental Implications in Ethiopia” is the third chapter in *Environmental Policy Review 2011*, a report produced by the Environmental Policy Group in the Environmental Studies Program at Colby College in Waterville, Maine.

As an agricultural country with a low level of economic development, livestock are estimated to contribute to the livelihoods of 60-70% of the population of Ethiopia. Subsequently, the Ethiopian livestock herd is the largest of any African nation. Livestock help perform a wide variety of functions for Ethiopians and are among the most important commodities of the country.

This chapter uses spatial, qualitative and quantitative data to explore the current trends of livestock production and their environmental externalities. The production systems for livestock are framed with GIS mapping and literature review. The value and production of livestock are quantitatively analyzed, as are their effects through quantitative data and meta-analysis. Policy recommendations are informed via interviews and literature review.

Just as Ethiopia’s population is growing at a rapid rate, so too is the country’s total number of livestock. The environmental impacts of livestock production in Ethiopia include but are not limited to erosion, soil degradation, GHG emissions, water pollution, and deforestation. These impacts have inherent feedback loops which compound one another’s effects.

Current trends related to expanding agriculture and livestock in Ethiopia, such as deforestation and other forms of land degradation, are a high level risk to the improvement living standards within the country. In order to combat these trends of environmental degradation, Ethiopia must create a comprehensive, feasible livestock production policy promoting efficiency and reducing the environmental impact of livestock production in order to successfully handle the growing numbers of the livestock population.
Environmental Policy Review 2011: Livestock Production Systems and their Environmental Implications in Ethiopia

By Tom Kimball

Introduction

Environmental degradation from human pressures and land use has become a major worldwide problem, though the effects are felt more in developing countries due to the high population growth rate and the associated rapid depletion of natural resources (Ehrlich, 1988). Ethiopia is a largely agricultural country whose economy is based on renewable resources in rural areas. Given the low level of economic development in the country, the pressure exerted on the environment by growing human and livestock populations has exacerbated the rapid depletion of the natural resource base (Feoli, et al. 2002). The issue of livestock and the production systems that support them is of the utmost significance if Ethiopia is to improve its social and economic stability.

The Scope of Livestock

Throughout their long history, Ethiopians have constantly relied on livestock in order to survive. Livestock in Ethiopia are extremely important as they serve a wide variety of functions in society from social to subsistence purposes (Behnke, 2010; Kassahun, 2008; Halderman, 2004). Livestock in Sub-Saharan Africa and in Ethiopia are often undervalued in terms of their potential for supporting overall economic development, poverty alleviation, and the general well-being of an immense proportion of the population. In spite of the relatively low notice they are afforded, livestock are estimated to contribute to the livelihoods of 60-70% of the Ethiopian population (Halderman, 2004). They can contribute in a myriad of different forms from traditional security systems to cash to transportation for many Ethiopians. As the oldest form of assets in Ethiopia, cattle and other types of livestock have traditionally and still today serve as a significant indicator of wealth. Even today, Ethiopia is generally recognized to have the largest population of livestock of any other African nation (Halderman, 2004). The immense scope of dependence on livestock is not without reason; Ethiopia’s population is growing at a tremendous rate of 2.56% as of 2010 (World Bank, 2011). As rural Ethiopians, generally speaking, live in a subsistence economy, the immense pressure of that population growth has exacerbated poverty, leaving the population more vulnerable to hunger, disease, and famine. Ethiopia’s dependency on livestock has in turn created a need to expand livestock production, to help feed and support the growing population. The environmental burden that comes with this intensive increase in livestock production is substantial. The conversion of woodlands and shrublands into croplands has resulted in the loss of the natural vegetation cover and has caused serious erosion (Feoli et al., 2002).
Livestock and Deforestation

Environmental degradation as a result of agricultural development occurs in a numerous forms. One of the most devastating and widespread is deforestation. Removing forest and crop residues adversely affects the continued productivity in both forest and agricultural systems. It is important to note the scale of deforestation in Ethiopia to date. Forest areas have been reduced from 40% of land cover a century ago to an estimated less than 3% (Bishaw, 2001). A major issue within forestry throughout Ethiopia’s history has been property rights. From the 1950s until 1974, private land ownership was promoted through land grants given by the federal government. As a result, mechanized farming became increasingly attractive, and large numbers of Ethiopians were relocated to forest areas, where recent pressures have forced unsustainable harvest of timber and other forest products. The Derg regime, which took power after the Ethiopian Revolution in 1974, worsened the situation by promoting relocation programs known as “villagization”. Deforestation and the resulting environmental degradation has remained a major problem in Ethiopia and a key challenge to food security, community livelihood and sustainable development. Between 1955 and 1979, over 77% of the country’s forested area disappeared, and Ethiopia continues to lose 140,000 hectares of its remaining forests annually (Winberg, 2010).

There is no doubt of the interdependency of agriculture and healthy woodlands. Tree and crop residues contain valuable nutrients that are lost to the soils once they are removed. The removal of trees and other land cover also exposes soil to the consequences of water and wind erosion (Pimentel et al., 1986). For a country that has only 3% of its original forests still standing, and where 80% of people depend on wood fuel for all of their energy needs, continued deforestation is a serious issue. Losing forest cover as a result of agricultural expansion is a severe risk for Ethiopia in both sustaining its main energy source as well as its environmental health.

Objectives

This report asks the question:

How do expanding livestock production systems and increasing numbers of cattle impact the quantity and quality of rangeland and forest cover in Ethiopia?

In addressing this question, this report seeks to:

- understand the importance of livestock production systems and their impact on pastoral communities in Ethiopia;
- assess the trends and extent of degradation to the environment in Ethiopia as a result of livestock production systems; and
- document constraints, coping methods, and policy recommendations for the future of livestock production in Ethiopia.
Methods

In order to assess livestock production systems and their effects on rangeland and forest ecosystems, I began with an extensive literature review of scientific reports conducted on livestock production systems within Sub-Saharan Africa and, more specifically, Ethiopia. The initial review served to introduce and frame the issue of environmental degradation caused by livestock in Ethiopia. I then used spatial, qualitative and quantitative data to explore the importance of livestock production systems, the environmental degradation these systems cause, and policy measures that could alleviate the pressures of livestock on the Ethiopian environment.

Spatial Data

Using Geographic Information Systems (GIS) analysis with ArcMap 10, I generated a land-use cover map to see how agricultural development has affected forest areas across Ethiopia. The GIS map used in this report was generated using GlobCover 2009 land cover data, which was derived from a time series of global MERIS FR mosaics for the year 2009. A layer displaying elevation within Ethiopia was then added onto the land cover map to illustrate the relationships between land use and topography. Scientific literature on land cover and use in Ethiopia was used to further clarify how livestock production and grazing might affect the different land cover patterns observed through GIS mapping.

Qualitative Data

Due to resource and time constraints, conducting a survey of livestock herders in Ethiopia specific to this report was not possible. There is, however, extensive scientific literature discussing local perceptions of expanding livestock production and environmental degradation (see, e.g., Ayantunde, 2011; Agassa et al., 2008; Kassahun, 2008 among others). A large amount of qualitative data concerning Ethiopian livestock was derived from FAO and IGAD Working Papers (PPLPI Working Paper No. 19 & IGAD LPI Working Paper No. 07-08). These papers focused on regulatory frameworks, economic issues, and policy recommendations for livestock production systems in Ethiopia. Other important qualitative data gathered were interviews with representatives of ILRI and correspondence with MoARD and FAO representatives.

Quantitative Data

A primary source for quantitative data in this report was the FAOSTAT database, which provides time-series and cross sectional data relating to food and agriculture for over 200 countries, including Ethiopia. The data on livestock were reported in ‘live head,’ referring to an estimation of grazing livestock not yet slaughtered for meat or other processing. Data were selected for analysis, transferred to Microsoft Excel, and presented in appropriate figures.
Bivariate analysis and linear regression were then used to look for significant predictors of livestock increases and dependency. A series of IGAD Working Papers provided estimates of the contribution of livestock to the Ethiopian economy (IGAD LPI Working Paper No. 02-11, 2010), while measures of environmental impacts of livestock in broader terms were obtained from the Evans School Environmental Implications of Livestock Series, published in 2011.

The study findings presented below are organized as follows:

- Laws, Institutions, and Stakeholders
- Geographic Distribution of Livestock
- Growing Numbers of Livestock
- Economic Importance of Livestock
- Environmental Implications of Livestock
- Long-Term Impacts and Interview Findings

**Laws, Institutions, and Stakeholders**

Ethiopia has a number of laws providing for sanitary and food safety standards, as well as the prevention of animal diseases that affect livestock production. Whether these laws are enforced is questionable. Government policies have been unable to provide relevant infrastructure and market development to enforce administration policies (Forum for Environment, 2011).

Table 3.1 Livestock-related laws, MoARD, 2011.

<table>
<thead>
<tr>
<th>Law</th>
<th>Year</th>
<th>Description</th>
<th>Location of Law</th>
</tr>
</thead>
<tbody>
<tr>
<td>Livestock and Meat Board Order No. 34/1964</td>
<td>1964</td>
<td>Set up Livestock and Meat Board and the establishment of a National Veterinary Institute</td>
<td>N/A</td>
</tr>
<tr>
<td>Meat Inspection Proclamation No. 274</td>
<td>1970</td>
<td>Set up formal specifications for slaughterhouses and other processing facilities</td>
<td>Federal Negarit Gazeta, 29th Year, No. 15, 6th April 1970</td>
</tr>
<tr>
<td>Reorganization of the Executive Organs of the Federal Democratic Republic of Ethiopia (Amendment) Proclamation No. 380</td>
<td>2004</td>
<td>Dissolved the Livestock Marketing Authority (1998) and all duties into MoARD. MoARD as it exists today is created, merging the Ministry of Agriculture with Rural Development</td>
<td>Federal Negarit Gazeta, 10th Year No. 15, 13th January 2004</td>
</tr>
</tbody>
</table>
Federal Institutions

The key national institution for livestock production systems in Ethiopia as well as forest management is the Ministry of Agriculture and Rural Development (MoARD). MoARD is the government ministry charged with overseeing agricultural and rural development policies in Ethiopia. Within the many varied responsibilities of MoARD are the following two duties: supervising use and conservation of forest resources, as well as monitoring and promoting agricultural development.

MoARD was originally the Ministry of Agriculture, which was established by the Federal Government of Ethiopia with the passing of Proclamation 4-1995. This Proclamation also established the other 14 original Ministries of the Federal Democratic Republic of Ethiopia. On January 13, 2004, Proclamation No. 300/2004 merged the Ministry of Agriculture with the Ministry of Rural Development, which today comprises MoARD.

As it pertains to forestry, MoARD operates under the Forest Development, Conservation and Utilization Proclamation No. 542/2007. The Proclamation recognizes two forest types: private and state owned. The Proclamation also bequeaths MoARD with various powers and duties. They include: differentiating trees vs. plants, identifying endangered indigenous tree species, coordinating relevant federal and regional bodies, and enacting policies, laws and strategies to effectively utilize and conserve Ethiopian forests. MoARD also provides technical support to all relevant federal and regional bodies. In forestry today, MoARD acts upon Proclamation No. 542/2007: Forest Development, Conservation and Utilization. This Proclamation replaces the Policy and Strategy on Forest Development, Conservation and Utilization issued by Ministry of Agriculture and Rural Development, which was adopted by the Council of Ministers in 1997.

The Ministry of Finance and Economic Development (MoFED) is another institution with ties to the livestock sector in Ethiopia. It was established to initiate policies that ensure sustainable and equitable macroeconomic stability in Ethiopia. As it relates to livestock, MoFED is responsible for generating GDP estimates for all sectors of the Ethiopian economy. The reports generated by MoFED are thus critical in understanding livestock’s role within the economy of Ethiopia. By the same token, if GDP estimates are incorrect (as some authors have argued (IGAD, 2010)) the valuation and subsequently the prioritization of livestock within the Ethiopian economy may be erroneous.

The Ministry of Health is the other important player in the livestock sector, especially as related to any food products derived from livestock. Within the Ministry laws, Article 22 requires the Ministry of Health to devise plans and follow up on their implementation in eradicating communicable diseases, undertaking the necessary quarantine controls to protect public health, and conducting studies with a view to determining the nutritional value of foods.
Finally, the Environmental Protection Authority is the primary regulatory agency for environmental protection in Ethiopia. At the regional and lower levels, the Environmental Protection and Land Administration Authorities act as regulatory agencies for environmental regulation. One of the most important is the Environmental Policy of Ethiopia (Forum for Environment, 2011). This policy addresses a wide range of environmental concerns. The major aim of the policy is to ensure the sustainable use and management of natural, human made and cultural resources, and the environment. The specific land use and administration policies and strategies have been developed by the different Regional States with autonomous organizations established for implementation (Forum for the Environment, 2011).

International Projects, Stakeholders, and NGOs

There are a variety of institutions invested in Ethiopian livestock production in some way. The Intergovernmental Authority on Development (IGAD), comprised of Djibouti, Eritrea, Ethiopia, Kenya, Somalia, Sudan and Uganda, has implemented the IGAD Livestock Policy Initiative (LPI). The LPI’s purpose is to promote sustainable and effective livestock practices within IGAD countries. To this end, the initiative has created a number of IGAD Working Papers, designed to explore issues related to livestock development in the context of poverty alleviation.

Pastoralists Forum Ethiopia (PFE) is comprised of 20 members, including: Panos Ethiopia, Pastoralist Concern Association Ethiopia, Farm Africa, Hope for the Horn, Oxfam GB, SOS Sahel, UN-EUE. NGOs such as PFE campaigned to have pastoralists’ ties included in documents such as the PRSP. From these efforts, the PRSP, published in 2002, contains a section on development approaches and interventions in pastoral areas. However, the document does not include the first and most basic recommendations from PFE, which was that pastoralism be recognized as a way of life and as a production system in the same way that traditional peasant cropping systems are recognized by the federal government (Halderman, 2004).

With 60-70% of the population’s livelihoods dependent on livestock in one way or another, the majority of Ethiopians are stakeholders in the success of the livestock sector, and in the environmental systems that support livestock production (Behnke, 2010; Halderman, 2004). The most reliant on livestock can be classified into two groups; those living in the rural highland areas, and those in the pastoral lowland communities. While the majority of people and livestock live in the rural highlands, pastoralists rely more on livestock than any other population category (Ayantunde et al., 2011; Halderman, 2004). The vast majority of land users and managers in Ethiopia, whether in the highlands or pasturelands, also have a stake in any land management practices that affect livestock. The farmers and local communities are the direct beneficiaries, and ultimately the enforcers, of the environmental policies seeking to mitigate the environmental impacts of livestock management in Ethiopia.
Study Findings

Geographic Distribution of Livestock

Land use displayed by GIS mapping in Figure 3.3 show different applications of livestock within Ethiopia. The GIS map was derived from the GlobCover 2009 land use data. Classifications 11-30 (irrigated croplands, rainfed croplands, mosaic croplands/vegetation, mosaic vegetation/croplands) are all considered cultivated areas or managed lands (see Appendix 3A for details). The elevation layer shows that the Ethiopian rural highlands (classified as >1500m) contain nearly all cultivated or managed areas, classified as land use 20 and 30. These areas show livestock use in order to aid in plowing and cultivating cereal crops for Ethiopia. As elevation drops around the cultivated areas, much of the land classification turns to mosaic forest shrubland and grassland, which is where livestock are connected within the pastoral production system.

The figure emphasizes in particular those agricultural areas that are bordering forests, as indicated by the shift in red and orange, which represent croplands and livestock managed areas in the Ethiopian Highlands, to the shades of greens representing various classifications of forest and shrublands. This puts into perspective (1) the sharp contrast in land use in the Highlands versus other areas in Ethiopia, and (2) the ongoing encroachment of croplands and pasturelands into forested areas.
Figure 3.1 Land-use GIS map with elevation.
As shown in Figure 3.1, the rural highlands of Ethiopia are classified as over 1500m above sea level, while pastoral areas are classified as under 1500m above sea level. Table 3.2 shows the estimates for livestock distributions among the two areas, according to the FAO’s Pro-Poor Livestock Policy Initiative Working Paper 19. The largest change in livestock with regard to elevation is cattle, which are far more prevalent in the Highlands (aside from camels, which are not present at all in the rural Highland areas).

<table>
<thead>
<tr>
<th></th>
<th>Rural Highland Areas</th>
<th>Pastoral Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cattle</strong></td>
<td>70-80%</td>
<td>20-30%</td>
</tr>
<tr>
<td><strong>Sheep</strong></td>
<td>48-75%</td>
<td>25-52%</td>
</tr>
<tr>
<td><strong>Goats</strong></td>
<td>27-55%</td>
<td>45-73%</td>
</tr>
<tr>
<td><strong>Camels</strong></td>
<td>none</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 3.2 Notes: Highlands are defined as areas over 1500 meters above sea level, pastoral areas are less than 1500 meters above sea level. Data from PPLPI Working Paper No. 19.

**Growing Numbers of Livestock**

**Quantitative Results**

There is a relatively steady increase in nearly all types of livestock in Ethiopia from the year 2000 through 2009. An exception is chickens, which from the years 2002-2005 declined, and in 2009 fell just short of the peak in 2002.

![Ethiopian Livestock Totals](image)

Figure 3.2 Comparison of main types of Ethiopian livestock though 2000-2009. Data obtained through FAOSTAT.
The trends seen in Figure 3.3 show an overall constant expansion in the total number of animals (despite the decrease in chicken totals). It should be noted that cattle in Ethiopia started and remained as the largest total, despite the large amount of resources required to keep them relative to other forms of livestock.

![Livestock in Ethiopia](image1.png)

Figure 3.3 Comparing trends in totals of livestock head, with a sum total added. Data obtained through FAOSTAT.

The regression line seen in Figure 3.4 shows the linear increase in the total number of cattle on average, per year with an R-squared value of 0.9287. The line represents that on average, 5,858,280 additional cattle, chickens and sheep are found in Ethiopia each year.

![Total Livestock Regression](image2.png)

Figure 3.4 Regression line derived from the total additional head of livestock per year. Data obtained through FAOSTAT.
Figure 3.5 illustrates land use trends in Ethiopia with respect to agricultural and forested areas using data from the FAO. The forest area is at a nearly constant decline of 141,000 hectares from 2000-2009, while area devoted to agriculture rises every year except from 2007-2008. Though agricultural areas include both areas devoted to crops those devoted to livestock, nearly all small-scale crop cultivation in Ethiopia is driven by livestock to some degree as discussed further below.

![Agricultural vs. Forest Areas in Ethiopia](image)

**Economic Importance of Livestock**

**Livestock Contribution to GDP**

There is a complex system of indicators used to quantify and measure livestock production’s impact on Ethiopian national GDP. The livestock sector is estimated to contribute 30-35% of annual GDP, according to the government estimates of MOFED (Halderman, 2004). However, livestock specialists frequently argue that livestock production is underrepresented in the GDP estimates of African nations. Part of the problem is caused by deficiencies in data and estimation procedures, although even accurate counts of the number of livestock raised may still leave livestock underrepresented in terms of their contribution to national GDP (Behnke, 2010). Including for the value of plowing and other underestimated services outlined below in Table 3.3, the IGAD has re-estimated the economic importance of livestock to show that livestock provided more than 45% of agricultural GDP in 2008-09 (Behnke, 2010).
Table 3.3 Livelihood benefits derived from ruminant and equine livestock, 2008-09 in billion Ethiopian birr

<table>
<thead>
<tr>
<th>Type of benefit</th>
<th>Agricultural GDP</th>
<th>Services not in current GDP estimates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value added livestock products (meat, milk, etc)</td>
<td>MOFED: 32.232</td>
<td>re-estimated: 47.687</td>
</tr>
<tr>
<td>Traction power for ploughing</td>
<td>21.500</td>
<td></td>
</tr>
<tr>
<td>Benefit from financing</td>
<td>12.800</td>
<td></td>
</tr>
<tr>
<td>Benefit from self-insurance</td>
<td>8.600</td>
<td></td>
</tr>
<tr>
<td>Benefit from risk pooling/stock sharing</td>
<td>3.650</td>
<td></td>
</tr>
<tr>
<td>Transport and haulage by equines*</td>
<td>18.959*</td>
<td></td>
</tr>
<tr>
<td>Sub-totals</td>
<td>47.687</td>
<td>65.590</td>
</tr>
<tr>
<td>Total economic benefits</td>
<td>113.196</td>
<td></td>
</tr>
</tbody>
</table>

Table 3.3 Notes: Data from IGAD LPI Working Paper No. 02 – 11, *refers to 2009-10.

Shown in Table 3.3, the total economic benefits of livestock goods and services may be more than 113 billion Ethiopian birr, which is over three times greater than MOFED’s standard GDP estimate (IGAD, 2010). This new estimate puts into perspective how vital livestock are to the Ethiopian economy, not only in terms of their product value, but their wide array of services as well. The importance of livestock and the undervaluation of their services are summed up in the following excerpt from a recent IGAD working paper:

If Ethiopian farmers and herders provision themselves with home produced goods, they also in large measure service themselves. The most important services provided by livestock include the supply of animal power (for traction, transport and haulage), and livestock as a source of financial services (as providers of credit, as a form of self-insurance and as a means of sharing or pooling risk). According to international conventions, the value of this self-servicing is not separately itemized in national accounts and therefore cannot be identified as part of the economic benefits that livestock provide (IGAD LPI Working Paper No. 02-11, 2010, p. 36).

This conclusion is reinforced by CSA surveys that estimate the value of home-produced livestock food products at 70% of total household expenditures on livestock foods. The great bulk of the meat and milk products that Ethiopians eat are not processed or traded outside the home (IGAD, 2010).

Table 3.4 displays the asset composition of Ethiopian households in a survey of 1,477 different households. Livestock were found in 78% of the households, second only to farm tools and implements. Livestock’s mean value was exorbitantly larger than any other asset in the Ethiopian household.
Table 3.4 Asset compositions from 1994 survey across 1477 households.

<table>
<thead>
<tr>
<th>Assets</th>
<th>Mean value in birr</th>
<th>Number of households</th>
<th>% sampled households</th>
</tr>
</thead>
<tbody>
<tr>
<td>Livestock</td>
<td>2,181</td>
<td>1,154</td>
<td>78</td>
</tr>
<tr>
<td>Farm tools and implements</td>
<td>49</td>
<td>1,307</td>
<td>89</td>
</tr>
<tr>
<td>Wooden and other furniture</td>
<td>112</td>
<td>1,100</td>
<td>75</td>
</tr>
<tr>
<td>Cooking materials</td>
<td>140</td>
<td>345</td>
<td>23</td>
</tr>
<tr>
<td>Radio, tape, jewelry, watch</td>
<td>66</td>
<td>305</td>
<td>21</td>
</tr>
<tr>
<td>Guns, spear, etc.</td>
<td>158</td>
<td>186</td>
<td>13</td>
</tr>
<tr>
<td>Cart</td>
<td>535</td>
<td>18</td>
<td>1.2</td>
</tr>
<tr>
<td>‘Gotera’ (grain storage basket)</td>
<td>391</td>
<td>6</td>
<td>0.4</td>
</tr>
<tr>
<td>Others</td>
<td>120</td>
<td>22</td>
<td>1.5</td>
</tr>
<tr>
<td>Sampled households</td>
<td></td>
<td>1,477</td>
<td></td>
</tr>
<tr>
<td>Holders of bank accounts</td>
<td></td>
<td>12</td>
<td>0.8</td>
</tr>
</tbody>
</table>

Table 3.4 Notes: While the coverage of the formal banking system has in all probability improved since 1994 when this data was collected, there is little evidence to suggest that livestock importance drastically declined from 1994 until today. Data taken from IGAD LPI Working Paper No. 02-11.

Environmental Implications of Livestock

Figure 3.6 depicts the overall theoretical framework used in conducting the literature review and meta-analysis to evaluate the environmental impacts of livestock in Ethiopia.
The major livestock production systems in Ethiopia which include cattle, goats, sheep, chicken, and other livestock systems, cause multiple environmental impacts including erosion, soil degradation (reduction in soil quality and supported vegetation), greenhouse gas (GHG) emissions, deforestation, and water pollution (and in the longer term, flow reduction).

Furthermore, such environmental impacts can have a large amount of feedback loops, an example of which is depicted in Figure 3.7. In this case, livestock production systems initiate the loop by causing deforestation due to cropland expansion. Deforestation then leaves the soil vulnerable to water and wind erosion, which removes surface materials and nutrients. Erosion then leads to further soil degradation, as tree and crop residues contain valuable nutrients that are lost to the soils once they are removed. And finally, the eroding soils and nutrients are lost into the water table and into the streams, rivers and ponds that the entire production system and surrounding ecosystems depend on.

![Feedback loop of deforestation due to livestock pressures.](image)

Specific environmental implications of livestock encountered in the literature are summarized below.

**GHG Impacts**

The greenhouse gas output for livestock in developing countries are laid out in Figure 3.6, which was compiled from data found in the *Environmental Implication of Livestock* series. Methane is a potent greenhouse gas with a global warming potency of more than 20 times that of carbon dioxide (IPCC, 2007). Nitrous oxide emissions, whose primary source is manure management, have more than 300 times the global warming potential of carbon dioxide. Ruminants, including cattle, goats and sheep, emit greater amounts of methane during their digestive process than do monogastrics (chickens). Chickens are the most efficient livestock in Ethiopia in terms of
producing the most meat and protein per amount of greenhouse gases emitted (Lipson et al., 2011).

Table 3.5 Environmental implications of livestock in developing countries, Lipson et al., 2011.

<table>
<thead>
<tr>
<th></th>
<th>Methane Emissions (per head, annually)</th>
<th>Nitrogen</th>
<th>% of Nitrogen volatized</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cattle</strong></td>
<td>Dairy: 46-58kg Other: 27-31kg Manure: 6-5kg</td>
<td>27-31 kg</td>
<td>22-50%</td>
<td>Ammonia, nitrogen oxides and nitrogen gas. GHG emissions, land/water pollutants</td>
</tr>
<tr>
<td><strong>Chickens</strong></td>
<td>0.02 kg</td>
<td>0.6-1.1 kg</td>
<td>50-55%</td>
<td>Chickens most efficient, meat and protein/GHGs</td>
</tr>
<tr>
<td><strong>Goats</strong></td>
<td>5 kg Manure: 0.11-0.22 kg</td>
<td>1.37 kg</td>
<td>15-35%</td>
<td>Volatization leads to ozone and aerosols</td>
</tr>
</tbody>
</table>

Vegetation Impacts

The main vegetation impacts derived from Environmental Implications of Livestock Series include:

- Livestock grazing and trampling have marked effects on vegetative cover, soil quality and nutrient loss due to erosion. Evidence of this impact is found in the 10-20% of grasslands worldwide that are degraded due to overgrazing.
- Overgrazing of pastureland causes soil erosion and releases carbon from decaying organic matter, compacting wet soils and disrupting dry soils. The effects of trampling depend on soil type.
- Desertification due to overgrazing causes a loss of 8-12 tons of carbon per hectare from soils and 10-16 tons of carbon in above-ground vegetation. In mixed farm systems, land tillage and crop production further compound the loss of native vegetative cover and leads to soil erosion, while soil compaction and soil disruption result in increased runoff and erosion.
- Livestock grazing and trampling have marked effects on vegetative cover, soil quality and nutrient loss due to erosion (Lipson et al., 2011).
Interviews

Several attempts were made to contact the Ministry of Agriculture and Rural Development (MoARD), including phone calls on four different publicly listed numbers for the Ministry during regular business hours. Of those four, only one attempt was successful, but the contact did not respond to the follow up questions via e-mail or telephone, thus limited data were obtained.

Notes from a phone interview with Dirk Hoekstra, Project Manager for ILRI projects in Ethiopia are summarized below.

What is Ethiopia’s major policy and international assistance aims for the livestock sector?

Governmental goals for the livestock sector focus on improving productivity, which will indirectly improve the per-animal environmental impacts by providing a more productive base (the same amount of erosion per cow, but less erosion per kilo of meat or per liter of milk).

Major livestock problems:
* Genetic problems (e.g., low quality breeding stock, disease)
* Fodder availability and fodder quality
* Veterinary services (access & quality)
* Marketing

These challenges are compounded by the presence of two very different livestock systems in Ethiopia - the pastoral system, and the mixed crop-livestock systems of Highland Ethiopia.

There is also rising concern over the question of how to maintain livestock production levels in the face of climate change. ILRI's recent "Livestock Exchange" online contains presentations on adapting the livestock sector to climate change in the future.

Discussion

The data gathered in this chapter highlight that human-induced land degradation is a significant problem in Ethiopia, and that livestock production is among the most significant driving forces. It is necessary to have a clear understanding of the pressures that livestock place on the availability of natural resources, and on the rural agricultural system as a whole.

Importance of Livestock

With regard to the importance of Ethiopian livestock production in Ethiopia, there was significant overlap throughout the literature review. Most prominently the two sets of working
papers conducted by partner organizations, the FAO and the IGAD, had extremely consistent findings on this issue. While the IGAD working papers focused on the quantitative measures of livestock’s contribution to GDP in Ethiopia, they acknowledged the diverse functions that livestock fulfill in Ethiopia. Many of these functions are displayed in Table 3.3. Indeed, part of the IGAD working paper’s purpose was to quantify some of these functions, such as plowing for increased crop productivity. Arguably the most important way to understand the importance of livestock in Ethiopia across existing literature is asset accumulation. Not only can livestock serve as the most common form of assets (cash), but they can also help fill the institutional vacuum created by the absence of formal financial institutions in rural Ethiopia (IGAD, 2010). Livestock can function as a form of credit in rural areas, giving owners access to economic resources represented by livestock potential without having to borrow money and pay interest (IGAD, 2010). Another value of livestock as credit defined by both sets of working papers is the form of security against risk that livestock offer (in the absence of insurance companies, premiums, or claims). Because the value of livestock in rural Ethiopia is not established by market exchanges, economics cannot attribute the amount of credit and insurance that should be attributed to livestock.

There are still ways in which to further quantify the immense value of Ethiopia’s livestock. Figures 3.3 and 3.4 quantitatively show the importance of livestock in Ethiopian livestock in broad economic terms, and relative to other household items. It is clear from both sets of data that livestock play a central role in both the Ethiopian economy and as an asset for individual households. In terms of their contribution to GDP and household assets, livestock should be considered a crucial element in Ethiopia’s economy and social well-being.

*Rural Highlands vs. Pastoral Areas*

The land use displayed by GIS mapping show that the Ethiopian rural highlands (>1500m) contain nearly all cultivated or managed areas. This data coincides with data from the FAO shown in Table 3.2, which places 70-80% of cattle within the Ethiopian highland region, but lower levels of other livestock. It can be inferred that that cattle in this region are tied into the cereal crop production of the Ethiopian highlands. Oxen are widely considered the most important domestic animals in the Ethiopian highlands as nearly all of the traction for cultivation is performed by oxen (Halderman 2004). Pastoralists, in contrast to Ethiopian highland communities, utilize their livestock on a more subsistence basis. Livestock provide their pastoralist owners with considerable protein and their main source of income and asset accumulation. With the least developed infrastructure services, livestock in pastoral areas are more than a necessity – they are pastoralists’ way of life.
Trends of Deforestation and Degradation

Because of their unique lifestyle, pastoralists have nearly constant exposure to their outdoor environment, and are sensitive to how that environment changes. Pastoral communities have a detailed knowledge of the environment of the grazing lands. This knowledge is gained through continuous herding, and is supplemented by the knowledge accumulated from historical land use (Angassa et al., 2008). Community-based knowledge of environmental change can complement ecological methods, and can improve understanding of local conditions. It has been argued that the community-based approach is more practical and relevant to environmental issues and ecological impact than many other sources such as ecological studies (Angassa et al., 2008).

Figure 3.5 illustrates the trend of increases in agricultural area and the decrease in forested areas. While agricultural expansion is not identical to livestock, it is accepted that nearly all traction for cultivation and plowing in Ethiopia are provided by livestock. This makes livestock responsible for not only degradation within the grazing land in pastoral areas, but cropland in the Ethiopian highlands as well. “The need to feed livestock grain and/or crop residues is a driver of expanding crop production in mixed farming systems into lands previously allocated to other uses. This land conversion affects soil, biodiversity, greenhouse gas emissions and water quality” (EPAR 155, pg. 1). FAO data of forest cover showed a consistent decline from 141,000-140,400 hectares lost each year (Figure 3.5 and Appendix). This data reinforces statistics cited in Ellen Winberg’s Participatory Forest Management report on Ethiopia (2010). Consistent with other estimates of annual forest loss, the FAO data shows that forest cover in Ethiopia is indeed shrinking. The literature surrounding Ethiopian agriculture contests that agricultural production, and specifically the demand for cropland and grazing land.

Vegetation Impacts and Degradations

The data within the EILS, are supported by a Journal of Arid Environments article on the changes in soil nutrients and vegetation structure as a response to grazing in Ethiopia. Heavy grazing leads to excess defoliation of standing biomass and herbaceous vegetation as well as a decline in species diversity and net productivity as grazing increases (Tessema et al., 2011). The conclusion of this report was that using soil quality parameters, heavy grazing in Ethiopia alters herbaceous vegetation composition through an increase in the abundance of annual species with a decline in perennial grasses.

A 2011 study in the Journal of Environmental Management on the botanical composition of grasses and soils characteristics in relation to land-use suggested that grazing pressure may be the primary cause of differences in grass layers in Ethiopia.

Moreover, grazing pressure had also an effect on the silt content. The higher sand content is probably caused by increasing run off and soil erosion, triggered by the higher percentage of
bare ground and low basal cover, as well as low standing biomass of the herbaceous vegetation. Grazing affects the flux of nutrients in grazing lands through trampling, consumption, excreta deposition and redistribution and export (Tessema et al., 2011).

A 2011 study conducted by the Ethiopian Agricultural Research Organization supports the findings of factors influencing rangeland degradation include increases in encroachment by undesirable woody plants, expansion of weeds, reduction in herbaceous/woody layers and recurrent droughts. Overgrazing and over-utilization of woody plants have also brought about reductions in the species composition of important fodder plants, reducing the grazing/browsing capacities of the rangelands.

**Productivity**

An area of livestock production that was reiterated in FAO Working Papers, The Environmental Implications of Livestock Series, and within Interviews was productivity and efficiency per animal. Dirk Hoekstra, Project Manager for ILRI projects in Ethiopia, stated in his interview that the most important goal in the Ethiopian livestock sector was to improve the per-animal environmental impacts by providing a more productive base (the same amount of erosion per cow, but less erosion per kilo of meat or per liter of milk). In order to achieve a greater productivity per animal, the following need to be addressed:

- genetic problems (i.e. low-quality breeding stock, disease);
- fodder availability and fodder quality;
- veterinary services (access and quality); and
- marketing.

**Climate Change**

Ethiopia is a country with a very diverse and highly variable climate. Historically, there has been a strong link observed between climate variations and the overall performance of the country’s economy (Forum for Environment, 2011). Ethiopia has direct and disproportionately high dependence on natural resources and climate sensitive livelihoods coupled with the prevalence of rampant poverty, leaving the country in a highly vulnerable position (Forum for Environment, 2011). Climate change is likely to harm developing countries that generate a major portion of their GDP from climate sensitive sectors such as agriculture. According to the FAO Working Paper 19, Ethiopia derives 30-35% of its total GDP from agriculture (FAO, 2004). Climate change has the potential to have massive implications for Ethiopia’s drought prone arid environment, as well as the economy that relies so heavily on that environment.

The broader trends of environmental degradation as a result of livestock production in Sub-Saharan Africa have been explored by the EILS. The greenhouse gas emission from livestock in
developing countries (Ethiopia has the largest livestock population in Africa) shown in Figure 3.6 are most directly related to climate change. The relative inefficiency of grazing cattle in developing regions may be partially explained by feed. Pasture-raised livestock may emit from 3 to 3.5 times the amount of methane as compared to intensively raised livestock due to lower digestibility of their feed (Lipson et al., 2011). Also, in a resource-constrained farm system, a large proportion of feed is often spent on minimal maintenance and not on generating products, which makes their resource intake inefficient (Lipson et al., 2011). These gases contribute to the estimated 18% of global anthropogenic greenhouse gas emissions that livestock are responsible for (Steinfeld et al., 2006).

Climate change affects biodiversity, soil degradation reducing water quality, nitrate and sediment pollution of water. Climate change and variability are key drivers for environmental degradation, though their effects will be most severely felt in the coming decades. Its key effects will be increased dryness and higher temperatures, reductions in primary productivity, land use changes, changing animal disease distributions, land degradation in some cases, changes in species composition (and thereby animal diets and feeding strategies), livestock productivity, incomes and food security (Ayantunde et al., 2011).

**Herder Perceptions/Local Voices**

Degradations in biological and physical rangeland resources have become serious challenges, and are well understood by the pastoral communities that are most affected. The studies documenting local perceptions of land degradation reinforce and sharpen findings.

By considering herders’ knowledge and involving them in the decision-making process for development, a more sustainable use of the local resources and a better future for pastoralists could be promoted (Angassa, 2008). New policy should recognize the importance of reintroducing fire for the management of bush encroachment and be linked to communities’ fodder management strategies. In this regard, future management programs for the control of bush encroachment also need to understand the mechanisms of bush encroachment in relation to land use and the rehabilitation and management of bush-invaded rangelands (Angassa, 2008).

Rangeland degradation is less understood by policymakers development planners and researchers, confused with desertification, influenced by biases of western intellectuals. As a result, pastoral perceptions are overlooked, and the production system considered as ecologically unfriendly and unsustainable (Angassa, 2008).

**Recommendations**

Mitigation strategies for decreasing land degradation as a result of livestock in Ethiopia, informed by the EILS reports:
• Engage in nutrient management strategies that encompass: (1) effective nutrient cycling between plants, soil and animals, (2) improved plant and animal nutrient retention and efficiency, (3) alternative uses of grazing land and (4) multi-use buffers on grazing or cropland periphery.

• Decrease animal morbidity and mortality: Dairy cow mortality across the production cycle in developing countries is estimated at four percent. Unproductive or unusable livestock represent an investment of feed with low or no output, and producing feed (or grazing of land) is inextricably linked with some degree of land degradation. This recommendation is supported by the ILRI interviews, as productivity increases were cited as the primary goal of the livestock sector.

• Remove grazing from marginal areas and concentrate it in productive areas where ecosystem resilience and degradation resistance is greatest (Lipson et al., 2011).

MoARD needs to work collaboratively with FAO and IGAD and researchers to effectively implement mitigation strategies to help improve livestock production efficiency. Better feed and grazing strategies would allow for more cattle on less land and for that land to be degraded to a lesser extent. Though livestock is only part of the agricultural expansion that causes deforestation, it is a fundamental component inherently linked with crop production.

Carbon sequestration efforts to help reduce the impact of greenhouse gas emissions generated from livestock production. This is an especially appealing policy option if funding is available from international development partners.

In order to effectively enact and monitor any potential livestock policy, there must be a prerequisite of full participation of relevant stakeholders to promote sustainable land and livestock management practices (Forum for Environment, 2011). For livestock policy in Ethiopia, that requires the participation of the following stakeholders:

• Government agencies: ministries (i.e. MoARD), the regional and zonal bureaus, and woreda offices and community level development agents;
• research institutes (FAO, IGAD, and ILRI);
• regulatory agencies including the Environmental Protection Authority (EPA);
• NGOs and international development partners; and
• local land users and managers.

Successful livestock policy will require all be involved and invested in some degree with the policy making process and support the proposed measures to improve livestock productivity and reduce the negative externalities associated with livestock production in Ethiopia.
Conclusion

As a country in the developing world with a substantial population growth rate, Ethiopia is struggling to feed itself. Understandably, agricultural expansion in Ethiopia is the government’s top priority, according to the Federal Policy and Investment Framework from 2010-2020 documents. Paramount to Ethiopia’s agricultural expansion is the livestock sector, which is estimated to account for 45% of agricultural GDP or more.

Current trends related to expanding agriculture in Ethiopia, such as deforestation and other forms of land degradation are a high level risk to the improvement living standards within the country. There is forest cover loss in Ethiopia due to a variety of factors. Fuel wood demand from increased population pressures and agricultural expansion are among the biggest contributors to forest loss and degradation. Changes in vegetation cover and biodiversity have altered traditional grazing lands which have supported the livestock production system in Ethiopia for thousands of years.

Anthropogenic climate change spurred by livestock generated GHG emissions is a growing threat to further land degradation in Ethiopia. As much of Ethiopia is composed of arid or semi-arid habitats, drastic changes in precipitation and droughts exacerbated by climate change could further disrupt the already fragile agricultural production systems of the country.

Ethiopia is fortunate to have a large body of international organizations aiding in research dedicated to help mitigate issues within agricultural production and food security. The FAO and other related organizations have provided substantial policy recommendations supported by decades of data and research to aid in livestock productivity and efficiency. While Ethiopia is in a precarious position regarding its natural resources and agricultural systems, there are tools and policy options available to help move in the right direction.

Just as crucial as scientific studies is the incorporation of local knowledge and perceptions of environmental degradation. Any future policy surrounding Ethiopian livestock production systems needs to take into account:

- the enormous social and economic value of livestock to rural Ethiopians;
- the fragile and already much degraded rangeland and highland ecosystems;
- the feedback loops that the environmental impacts of livestock create; and
- local knowledge and what Ethiopians perceive to be the most crucial indicators of environmental degradation as it pertains to livestock production.
Works Cited


Additional References


Environmental Policy Review 2011: Key Issues in Ethiopia

Chapter 4 Lake Water Management in three Ethiopian Rift Valley Watersheds

Katie Graichen
Research Highlights

Environmental Policy Review 2011: Lake Water Management in three Ethiopian Rift Valley Watersheds

Katie Graichen

Anthropogenic forces drive degradation of lake water quality. The impacts of a degraded lake are complex and interrelated.

The Ethiopian national water policy identifies hydrological basins as the unit of analysis for water management. This goal sets the stage for integrated, collaborative, and participative management approaches.

This chapter examines water quality drivers, impacts, and policy responses through case studies of three lakes.

The institutions playing a part in this issue range from local to federal to international. These institutions are both formal and informal and serve purposes such as regulation and funding.

Urbanization, industry, agriculture, and deforestation are the major anthropogenic drivers of many more specific processes and outputs which degrade lake water quality in Ethiopia. Degraded lakes have numerous social, economic, and ecological impacts.

Poverty and underdevelopment in Ethiopia underlie the anthropogenic forces that degrade lakes.

Integrated Water Management tries to find the most effective way to manage existing resource bases with the help of diverse stakeholders. Adaptive management meanwhile uses monitoring and evaluation as the basis for management goals and plans.
Environmental Policy Review 2011: Lake Water Management in three Ethiopian Rift Valley Watersheds

By Katie Graichen

Executive Summary

“Lake Water Management in Three Ethiopian Rift Valley Watersheds” is the fourth chapter in Environmental Policy Review 2011, a report produced by the Environmental Policy Group in the Environmental Studies Program at Colby College in Waterville, Maine.

Lakes in Ethiopia are often adjacent to one or more urban areas, along with farmers and other resource users drawing their livelihoods from the lake and surrounding land (i.e. for agriculture, forestry, and fishing). It is thus no surprise that these anthropogenic forces threaten water quality. As a result, policies that intervene at any part of the human-lake interaction — whether it be specific water management policies or economic policies governing urbanization — play a key role in determining the current and future states of Ethiopian lakes.

Through literature reviews, case study comparisons, and interviews, this study identified the mechanisms involved with lake water quality and addressed options for appropriate policy frameworks. Case studies include three lakes in the Ethiopian Rift Valley: Lake Awassa, Lake Ziway, and Lake Koka. Each provides unique insights into lake water quality management challenges.

Ultimately, lakes are a crucial example of a natural resource upon which humans depend, yet one that without proper policies in place becomes degraded beyond a point where it can be used. Policy recommendations include standardized monitoring of lakes, a buffer zone system for zoning and development regulation, and a participative approach to lake management.
Environmental Policy Review 2011: Lake Water Management in three Ethiopian Rift Valley Watersheds

By Katie Graichen

Introduction

Across geographic and temporal scales, humans are drawn to water for both the concrete and intangible resources it provides. Inevitably, this human dynamic impacts ecological factors such as water quality. The question from an environmental policy perspective then becomes how to create and shape environmental policies that result in as close to a ‘win-win’ situation as possible. Specifically, this chapter asks:

• How do human factors influence the water quality of lakes in Ethiopia?
• How is the human-lake system managed?
• What opportunities exist for watershed management to improve water quality?

Humans drive degradation of lake water quality in several primary ways, among them deforestation, agriculture, and development (Biswas et al., 2004). There are many processes which result from these drivers and serve to directly decrease water quality. These include soil erosion and siltation, overfishing, and chemical fertilizer runoff, among others (Concern for Environment, 2009). As a result of lake degradation there are immediate impacts on human and natural health, as well as secondary or tertiary consequences as a result of decreased productivity and resource levels (Reynolds et al., 2010). Identifiable anthropogenic drivers are measured by direct processes that threaten lake water quality. The impacts of decreased water quality are complex, interrelated, and difficult to measure, but also (ideally) ameliorable through well-designed policy interventions.

Approach and Goals

The goals of this chapter are to:

• illustrate the human-lake systems at play in the Ethiopian Rift Valley;
• investigate the role of and options for watershed management; and
• provide policy recommendations for improved watershed management for Ethiopian lakes.

In order to understand the systems at play here, it is important to define the term “watershed” (alternately called a “catchment”), which refers to an area that contains all of the tributaries, streams, rivers, lakes, and other bodies of water that connect to drain to a single river, ocean, or some larger body of water (USGS, 2011). The factors that influence a watershed may differ in type and scale based on geographic location. Additionally, the way watersheds are managed will
change based on the governance and institutions of the area. However, one underlying process of a watershed that is the same anywhere in the world is that something that occurs in one part of the watershed will have some impact downstream (as long as there is a “downstream” to speak of). At the end of the watershed, meanwhile, environmental impacts will merely accrue with no significant outlet (UNEP, 2011).

**Areas of Focus**

Many of the Ethiopian Rift Valley Lakes (ERVLs) are categorized as endorheic, meaning that they are the endpoints of watersheds and do not drain further (Ramsar, 1992, p. 2, 6). Considering that 97% of the surface water in Ethiopia drains out of the country, ERVL’s that are endorheic or semi-endorheic represent exceptions where the water generally stays within the boundaries of a lake’s watershed (Kloos & Legesse, 2010, p. 69). For example, herbicides that drain into an endorheic ERVL will remain in that lake; they aren’t going anywhere else. Herbicides that drain into a lake that drains into an endorheic lake will impact both lakes at varying levels (UNEP, 2011). The heightened volatility of the human-lake dynamic in these areas makes them important places to study.

The primary focus of my research is three lake case studies in the central Ethiopian Rift Valley. Each case study involves an ERVL and a nearby city. Each case study lake and city is contained within its own watershed, and is also connected to a larger watershed (see Figure 4.4). Below is a map of the three case study areas in Ethiopia. Beneath the map is a table of descriptive parameters for the lakes.
Figure 4.1 Map of case study locations, DIVA-GIS; Google Earth, 2011.
### Table 4.1 Statistics of the three case study lakes, World Lake Database, 2010.

<table>
<thead>
<tr>
<th>Lake</th>
<th>Surface Area (km²)</th>
<th>Volume (km³)</th>
<th>Max. Depth (m)</th>
<th>Mean Depth (m)</th>
<th>Lat.</th>
<th>Long.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awassa</td>
<td>129</td>
<td>1.3</td>
<td>22</td>
<td>11</td>
<td>7°03'N</td>
<td>38°27'E</td>
</tr>
<tr>
<td>Koka</td>
<td>250</td>
<td>2.28</td>
<td>13</td>
<td>9.14</td>
<td>8°28'N</td>
<td>39°10'E</td>
</tr>
<tr>
<td>Ziway</td>
<td>485</td>
<td>1.1</td>
<td>9</td>
<td>2.5</td>
<td>7°54'N</td>
<td>38°45'E</td>
</tr>
</tbody>
</table>

Lake Awassa is the southernmost lake of the case studies, and its composition is brackish (Kloos & Legesse, 2010, p. 73). Of the three lakes studied here, Awassa has the smallest surface area, but the greatest average depth. Lake Ziway, a freshwater lake, has the largest surface area, but has the shallowest average depth. Lake Koka has the largest volume, and lies in the middle of the three in terms of surface area and average depth (Kloos & Legesse, 2010; World Lake Database, 2010). It is also the northernmost lake of the case studies and closest to the capital of Ethiopia, Addis Ababa. However, it is important to note that Lake Koka is distinct from the other two cases as it is a man-made reservoir resulting from the construction of a dam in the late 1950's, while Lakes Awassa and Ziway are both natural lakes (Kloos & Legesse, 2010). The water in the watershed flows from south to north, so Lake Awassa comprises the headlands of the watershed that flows to Lake Koka.

### Historical Context

Today, Ethiopia is recognized as one of the most fragile countries in the world (Nega, 2010). This has been attributed to several historical factors, some of which persist today. The country is exceptionally poor and underdeveloped, with one third of the population surviving on less than one US dollar per day. The country struggles with widespread malnutrition, disease, and lack of access to education (UNICEF, 2011). The Human Development Index (HDI), “an alternative to conventional measures of national development,” ranks Ethiopia 174th out of 187 countries with comparable data (UNDP, 2011). Meanwhile, Ethiopia’s history of authoritarian governments – including “an absolute monarchy until 1974, a communist totalitarian dictatorship from 1974-1991, and an ethnic-based authoritarian regime since 1991” – also contributes to poverty as promises of economic success have not been realized (Nega, 2010, p. 1402).

This economic and political fragility has influenced social pressures such as the need for low-cost fuel wood and land for subsistence agriculture, which in turn feeds the cyclical nature of environmental degradation in Ethiopia. Other conditions such as illiteracy, lack of adequate healthcare systems, and limited electricity access, especially in rural areas, make it difficult to break out of this cycle (USAID, 2007). The poor often view natural resources differently than other stakeholders because they rely on them for their livelihoods. Policymakers may be concerned about an issue with threatened natural resource stocks, while poor households may not see it as an issue or opportunity (Reardon & Vosti, 1995).
Along lakeshores in particular, rapid urbanization and tourism have taken off in recent years. Population explosion around lakes, overfishing, and waste disposal from hotels and tourism are just some of the anthropogenic factors arising from lake area development (Concern for Environment, 15-16). Lakes and lakeshores are popular places for people to congregate for many reasons, and as a result there is inevitably pressure on and conflict surrounding these locations: “Exclusive rights to land are less important farther from the water source” (Edossa et al., 2007, p. 147).

Methods

The initial focus of this chapter is on institutions – local to global – which play a role in the issue of lake management. This section includes laws, governmental and nongovernmental bodies, and other stakeholders. The remainder of the research is based on the theoretical model outlined in Figure 4.2, which was derived from a variety of sources. It encompasses the various categories of anthropogenic drivers of harmful processes which degrade lake quality and in turn impact ecological, human, and economic health. Urbanization leads to development, creating waste and pollution (Gebremariam, 1998; Tedesse, n.d.). Factories and their industrial processes give off chemical effluents (Al Jazeera, 2009; Gebremariam, 1998). Agriculture may lead to either chemical fertilizer runoff or waste from livestock, and deforestation reduces the capacity of the soil to prevent erosion (Gregersen, 2007; Ayenew, 2006; Donahue & Johnston, 1998; Reardon & Vosti, n.d.; Tedesse, n.d.). These factors all deteriorate lake water quality. As a result, poor lake water quality hurts human health, economic health, and ecosystem health, which are themselves interrelated (Hengsdijk et al., 2009, pp. 24-25).
I explored three case studies of Ethiopian Rift Valley Lakes to find where they fit into this model. I first produced a map of the watersheds of each lake and the overall watershed. For each specific case, I created a map with points of interest from the urban area and researched background information. I looked at trends in lake characteristics such as salinity, water levels, and other chemical indicators that cause eutrophication and other forms of lake degradation (Kloos & Legesse, 2010). Where applicable, I included information from NGO and key informant interviews, in addition to any available evidence of collaborative processes used to address lake water quality.

Data sources included academic articles from online databases and websites. These articles were specific to the topic of Ethiopian Rift Valley lakes, their water quality, and the current and potential management schemes surrounding them (Reynolds et al., 2010; Gebremariam et al., 2002; Gebremariam, 1998). Such sources provided actual data for lake water quality and also informed my theoretical understanding of lake processes.

I used annual reports from two Ethiopian NGOs: Concern for Environment and Forum for Environment. I also interviewed and/or corresponded via email with members of these two
NGOs, including the Director of Concern for Environment and a Program Manager with Forum for Environment. I also corresponded with Dr. Zinabu Gebremariam, a well-established professor in the field of Ethiopian Rift Valley Lakes and director of the Higher Education Strategy Center in Ethiopia. These personal communications and annual reports were essential for gathering direct accounts of the role of NGOs in lake management, as well as perceptions and valuations of different threats to lake water quality.

Finally, I used data from the World Lake Database, DIVA-GIS, and Google Earth to create the tables and figures seen in this report. For example, I created three maps of the points of interest at my three case study lakes using ArcMap 10. The points of interest layer was generated on top of a DIVA-GIS administrative boundaries data layer and the Bing Maps basemap layer in ArcGIS using points obtained from Google Earth. I searched on Google Earth within each city for features such as hotels, hospitals, restaurants, schools, bus stations, stadiums, markets, etc. to include places that could be responsible for a high level of pollution as well as serve as markers of the urban environment. I created a total of 24 points of interest for the city of Awassa, 27 points of interest for the city of Nazret, and 13 points of interest for the city of Ziway. I also created additional maps using spatial analyst tools in ArcGIS to map the watersheds of the three case study lakes.

Finally, I systematically looked at lake water quality across the three sites, specifically focusing on collaborative and participative approaches highlighted in Berry and Mollard (2010), Kloos and Legesse (2010), Donahue and Johnston (1998), Gregersen (2007), and also emphasized in current Ethiopian environmental law (Ministry of Water Resources, 2001).

Laws, Institutions, and Stakeholders

Given the multiple levels of social and political organization in Ethiopia – local, regional, and national – one must look at each level to find the institutions that apply to water policy for the chosen case study lakes. The institutions involved in water management policy are predominantly involved in formulating regulations and subsequently enforcing them.

Local Level

At the local level, there exist numerous small units such as water desks, water user associations, irrigation cooperatives, and land administration committees. These units all hold some small responsibility and report to higher levels of woreda- or kebele-level government (Hagos et al., 2011).

There may be any number of informal local institutions governing water management that can be attributed to the ethnic and cultural groups in Ethiopia. One such example is the gadaa system
in the Oromia region, whereby male age groups move up in position in society until they reach their forties, at which point they are the most politically active and powerful. After this point, the men may retire from their societal obligations, but the previous age group (called the *gadaa*) is responsible for holding office, visiting the different regions in Borana Zone, resolving disputes, and assembling together as leaders (Edossa et al., 149). Such informal institutions often conflict with the way formal governmental institutions are arranged, though they likely have ways of dealing with natural resource management that work quite effectively for that particular place (Edossa et al., 155).

**Federal Level**

At the federal level, several institutions address water policy. The primary one is the Ministry of Water Resources (MoWR), which set the national water policy in 1999. One of the activities this policy undertook was designating the “hydrological boundary or basin as the fundamental planning unit and water resources management domain” (Alem et al., 2011). Arguably, this means that the government conducts its water policy planning within the framework of a more environmentally appropriate, watershed-type approach. At the Rio Earth Summit in 1992, the resulting Agenda-21 provided the basis for this watershed-level planning:

> Water resources planners must forget about political boundaries in order to harness and explore the water resources in a particular region in an integrated manner, making sure that it strikes a balance between water required for drinking, agricultural, fisheries, navigational, and environmental needs, not only for the nation, but most optimally for the region (Biswas et al., 2004, p. 84).

Ethiopia also has an Environmental Protection Authority (EPA) that is broadly tasked with creating and implementing policies that protect the environment. Like in the US, the EPA in Ethiopia requires an environmental impact statement to determine whether or not an action or project may be undertaken (Hagos, 2009). The EPA and the country’s comprehensive national environmental policy were created simultaneously in 1994. The national environmental policy provides a broad overview of its goals and factors to keep in mind for different areas of the environment. In terms of water resources, such points include: natural ecosystems can regulate water quality and quantity themselves, the introduction of non-native species must be seriously scrutinized, water management ought to be participative in nature, human health must be kept in mind, and “protection of the interface between water bodies and land” is vital (EPA, 2011, pp. 11-12).
International Level

Internationally-based funders, global NGOs, and organizations like USAID may play a role in initiating water management or research projects. For its projects, the World Bank requires an Environmental and Social Impact Assessment (ESIA) (MoWR, 2010). Another example is the Global Environment Facility’s $25 million project for “Community-based Integrated Natural Resource Management: Improving Ecosystem Integrity and Livelihoods” in the Amhara region in Ethiopia. The project focuses on Integrated Watershed Management (IWM) in two watersheds with the goal of linking decreased resource degradation with increased productivity, living standards, and community and ecosystem resilience (GEF, 2004).

Table 4.2 Overview of water-related institutions.

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local</td>
<td>Water desks, urban water supply utilities, water user associations, irrigation cooperatives, land administration committees, informal institutions (i.e. gadaa system in Oromia)</td>
</tr>
<tr>
<td>Federal</td>
<td>Environmental Protection Authority (EPA) – 1994 National Environmental Policy; Ministry of Water Resources (MoWR) – 1999 national water policy</td>
</tr>
<tr>
<td>International</td>
<td>World Bank, other international funding sources, treaties and conventions (i.e. Agenda-21 at Rio 1992)</td>
</tr>
</tbody>
</table>

Overall, institutions engaged with water management in Ethiopia span all levels of society from local to national and beyond. Given the complexities and sometimes overlapping responsibilities, oftentimes sound policies may exist, but implementation of them is poor (FFE_4B, 2011). Other times, policy frameworks fail to work together, whether it be between top-down national proclamations and local kebele administrations or between woreda politics and indigenous social and political structures governing natural resource management. In addition to these challenges, it is difficult logistically to shape institutions to watersheds because they do not obey administrative borders (Gregerson, 2007). Nevertheless, it is necessary to look at such natural features as a whole so that management of water resources is not fragmented by boundaries between regions.

The figure below shows the pathways of information flows between different water-related entities in Ethiopia. Each level gathers data from the lower level(s) to pass on to higher level(s) – a bottom-up process. The institutions in Figure 4.3 may generate data of their own. They may also engage in top-down information sharing by passing down guidelines, training, and reports (Alem et al., 2011).
Figure 4.3 Inter-institutional informational flows at various levels of authority in water management, Alem et al., 2011.
Results

These tables compare the three case study lakes. Koka and Ziway are both in the Oromia region, whereas Awassa is in the Southern Nations, Nationalities, and Peoples region. Awassa and Nazret are similarly sized cities with 258,808 and 220,212 people, respectively. Ziway is a smaller city with a population of 41,920. The cities of Awassa and Ziway are both located right on their respective lakes, while Nazret is comparatively distant from Lake Koka. Awassa is the only city in the comparison with an airport. Both Awassa and Ziway are near region boundaries and Koka is not. Education level data for the individual cities was considered as a potential variable of interest, but could not be found.

Table 4.3 A Case comparison table, World Lakes Database, 2010; CSA, 2007; Gebremariam, 1998.

<table>
<thead>
<tr>
<th>Lake</th>
<th>City</th>
<th>Region</th>
<th>Population</th>
<th>Altitude (m)</th>
<th>Distance to lake</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awassa</td>
<td>Awassa</td>
<td>SNNP</td>
<td>258,808</td>
<td>1,708</td>
<td>Near</td>
</tr>
<tr>
<td>Ziway</td>
<td>Ziway</td>
<td>Oromia</td>
<td>41,920</td>
<td>1,636</td>
<td>Near</td>
</tr>
<tr>
<td>Koka</td>
<td>Nazret</td>
<td>Oromia</td>
<td>220,212</td>
<td>1,590</td>
<td>Far</td>
</tr>
</tbody>
</table>

Table 4.3 B Case comparison table, World Lakes Database, 2010; CSA, 2007; Gebremariam, 1998.

<table>
<thead>
<tr>
<th>Lake</th>
<th>City</th>
<th>Airport</th>
<th>Near boundary</th>
<th>Δ Water level</th>
<th>Δ Salinity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awassa</td>
<td>Awassa</td>
<td>Y</td>
<td>Y</td>
<td>rise</td>
<td>decrease</td>
</tr>
<tr>
<td>Ziway</td>
<td>Ziway</td>
<td>N</td>
<td>Y</td>
<td>drop</td>
<td>increase</td>
</tr>
<tr>
<td>Koka</td>
<td>Nazret</td>
<td>N</td>
<td>N</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

The last two columns – change in water level and change in salinity – represent variables that may be explained by components of Figure 4.2 (Gebremariam, 1998). The region and near boundary categories were considered to give institutional context. Regions likely have different levels of industry or agriculture, and may govern matters such as effluent levels in differing manners. Populations of the case study cities is important because the impacts of processes like development are density-dependent – i.e. the more people there are, the greater the impact of the development process on lake water quality (Gebremariam, 1998). The presence of an airport was considered because presumably an airport has a high degree of runoff from the runway and/or terminal (Sulej et al., 2011). Finally, distance from the lake was considered because the proximity of urban developments to the lakes in question should affect the speed and magnitude of processes’ impacting the water quality of the lakes (Line & Spooner, 1995).
Anthropogenic Drivers

To expand on the findings behind Figure 4.2, the following anthropogenic drivers will be described here: urbanization, industry, agriculture, and deforestation. Population pressures and urbanization significantly affect cities near lakes and the lakes themselves: “Urbanization and human settlement in close proximity to the Ethiopian lakes are among the greatest potential causes of change in water quality and quantity” (Gebremariam, 1998). Continuous increases in population harm soils, cause pollution and water scarcity, and in turn impair future development (Tedesse, 2011; Biswas et al., 2004). Urban development and the construction of roads on steep slopes or across streams increase chances of landslides and the blocking of riparian corridors (Gregersen, 2007).

Although much of Ethiopia depends on agriculture and livestock production, water is still diverted from lakes for some industrial purposes (Kloos & Legesse, 2011). Industrial activity in general produces chemicals that run off into lakes (Sulej et al., 2011).

Agriculture, which typically takes the form of either crop farming or livestock herding, is widely recognized as having deteriorating impacts on the quality of nearby water. Many cases show that when agricultural production intensifies, farmers utilize more pollutants, which causes nutrient oversaturation, eutrophication, and red tides in river, lakes, and streams in the surrounding area (Tedesse, 2011; Donahue & Johnston, 1998).

Deforestation, which may occur due to need the for fuel wood, land for livestock production, or timber or non-timber forest products, is another common threat to water quality of lakes. With the loss of “protective vegetative cover,” a landscape loses the qualities of its soil that keep it from eroding. Deforestation leads to increased sedimentation, or the filling of water bodies with sediment from surrounding areas (Kloos & Legesse, 2011; Gregersen, 2007).

Processes Driving Lake Degradation

At a 2006 workshop held in the city of Awassa, the Gund Institute for Ecological Economics ran the “Green Awassa” atelier in which participants from the local agricultural community, local women’s groups, government officials, NGOs, academics, and other stakeholders voiced their understanding of environmental problems and proposed solutions. Participants identified the major problems as well as proximate and secondary impacts facing Lake Awassa in particular, though the threats and impacts identified through the process are likely applicable to other situations as well. For example, having identified the problem of “poor water quality,” the participants at the atelier outlined proximate impacts: decreased water security, human health concerns, and loss of biodiversity. Secondary impacts included an increase in women’s workload, decrease in agriculture and household productivity, lack of jobs (i.e. from tourism), and loss of food and medicine stocks (Reynolds et al., 2010).
The following sections present the information currently available on lake water quality (including anthropogenic drivers of degradation) and lake management (including collaborative management approaches) in the three case study sites.

**Case Study 1: Lake Awassa**

*General Context*

Lake Awassa is a brackish lake, with salt levels between 1 and 2 g/L of water. Kloos and Legesse (2010) report that the water level for Lake Awassa is rising. They note that this is attributed to the increasing silt load deposited in the lake’s bed by tributaries. Interestingly, they report that salinity is increasing along with chemical and organic pollution from urbanization (Kloos & Legesse, 2010). The lake features a tilapia fishery (Sissay, 2003) and a popular fish market on the southern edge of the city’s waterfront (Google Earth, 2011). Dr. Zinabu Gebremariam’s 1998 paper concluded that Awassa was a “fast-growing city” with several textile factories. The city also has an airport (Google Earth, 2011). Kloos and Legesse (2010) indicate that pollution of the lake has increased recently, given the number of buildings constructed and activities taking place on the lakeshore. A map of Lake Awassa and the surrounding area is shown in Figure 4.4.

*Interviews*

In an email correspondence with the Director of the Awassa-based NGO Concern for Environment brief answers were provided to a list of questions (Appendix 4A), but was able to expand on those answers somewhat during the phone interview that occurred later in the month. Mainly, the Director revealed that water quality data for Lake Awassa are scarce – and that most of the records that could reveal an increase or decrease in Lake Awassa water quality over time simply did not exist. He did state that “some improvements on the protection of the lake” have been made, though no further details were provided (CFE_4A, 2011a). Appendix 4A contains the full email correspondence.

The Director of Concern for Environment was then interviewed on October 14, 2011, via an international phone call from Waterville, Maine, USA. The interview lasted approximately ten minutes. The questions surrounded the organization’s 2009 workshop on Lake Awassa. Since that workshop, Concern has met several times and conducted field visits to follow up, especially to some reforestation projects around the lake. The Director confirmed that some improvement on the threats to the lake identified at the workshop (the biggest of which was deforestation) have taken place. According to the interviewee one way to solve environmental problems is through education, training, and awareness (CFE_4B, 2011b). See Appendix 4B for the full notes from the interview.
Despite their satisfaction with their 2009 workshop Concern for Environment also recognized the limitations of meetings and workshops. In the 2009 annual report about its celebration of World Environment Day, they stated:

Concern for the Environment is very proud when many people came to celebrate World Environment Day at the shore of Lake Awassa. The World Environment day was celebrated by cleaning and removing the rubbish and the waste from Lake Awassa. There were no talking, clapping hands, and making speech after speeches. The ceremony started with actual rubbish collecting and engaging in to the actual problem solving. This is a good start. Workshop after workshop without any deeds is found to be useless. (p. 12, emphasis added).

Evidence of Collaborative Processes

The city of Awassa has hosted two recent meetings – one in 2006 called the “Green Awassa” Atelier to identify the major environmental and social constraints, and another in 2009 hosted by Ethiopian NGO Concern for Environment, focused specifically on threats to Lake Awassa. Included in the Concern for Environment 2009 Annual Report was the list of threats that those in attendance of a 2009 workshop identified: population explosion around the lake, deforestation, soil erosion, sedimentation, solid waste disposal, chemical waste disposal, waste from hotels, hospital waste, tourist waste disposal, diverting urban runoff to the lake, overfishing, grass cutting along the shores, car washing on the lakeshore, and horticultural farming on the lakeshore, amongst others. One person also commented on the sugarcane producers in nearby Wondo Genet (Concern for Environment, 2009).

One of the attendees of the 2009 Lake Awassa workshop introduced the concept of “dependency syndrome,” which the Concern for Environment Director explained as “the status of depending on some one for something” (CFE_4A, 2011a). In this case, dependency syndrome refers not to humans depending upon someone or another country for economic aid, but rather dependence upon a natural resource – the lake – for economic vitality. People depend on Lake Awassa for a number of different things: some agricultural lands are irrigated by the lake, cattle and sheep are brought to the lake to drink, people on the western shore of the lake drink the water, people fish and recreate on the lake, and the lake and its renowned bird sanctuary draws tourists (Ayenew, 2006). But at the same time although many people are aware that activities such as agriculture and overfishing ultimately drive lake water quality degradation, most do not have access to alternative employment opportunities – they are dependent upon the resource that their own activities are degrading.
Figure 4.4 Lake Awassa and Awassa points of interest, DIVA-GIS, 2011; Google Earth, 2011.
Case Study 2: Lake Ziway

General Context

Lake Ziway is a freshwater lake that is used for irrigation year-round (Kloos & Legesse, 2010; Gebremariam, 1998). The lake and its basin are home to part of a seasonal migration route for Palearctic birds (Ayenew & Legesse, 2007). Large-scale irrigation projects have decreased the volume of the lake while slightly increasing its salinity (Kloos & Legesse, 2010). The lake’s extensive use for irrigation, which began in the 1970s (Ayenew & Legesse, 2007), can be linked to the industrial flower farms in the surrounding area.

Besides irrigation, Lake Ziway is also being impacted by the city of Ziway itself. Like Awassa, Ziway is a rapidly urbanizing area, and so pollution is similarly affecting Lake Ziway. On the western shoreline of the lake, there have been water hyacinths found, an indicator of eutrophication due to the nutrient enrichment from these various sources (Hengsdijk & Jansen, 19).

Ziway is considered an “open lake” as opposed to a closed or endorheic lake (Ayenew & Legesse, 2007). In 2009, a dam was being constructed on the Bulbula River, Lake Ziway’s outlet for the purpose of irrigation (Jansen, 2009). At most, sources describe this dam as either under construction or temporary (Wageningen UR, 2011; Jansen, 2009). It is unknown whether this project was completed, intended to be permanent, halted due to concerns, or to be revisited or not for other reasons.

A map of Lake Ziway and the surrounding area is shown in Figure 4.5.

Evidence of Collaborative Processes

The Bulbula River dam project was controversial because it was thought to compromise Lake Ziway’s status as an open freshwater lake. One of the reasons the lake is fresh is that nutrients are able to “flush” freely using the Bulbula River as an outlet (Jansen, 2009, p. 4). Without this process occurring, salinity would build up in the lake to potentially undrinkable levels. Opponents of the dam expected it to also have the consequences of decreased fishery revenues, decreased water quality for Ziway, and increased competition for water both upstream and downstream (Jansen, 2009).

In the case of Lake Ziway, collective recognition of the potential negative consequences of a dam generated enough discord to inspire the 2009 report from Herco Jansen on the implications of the dam. The paper clearly lays the issues out, supported by data, pictures, and predictions (Jansen, 2009). Given the lack of literature following up on this specific issue, the outcome is unclear.
Collaboration on lake management in Ziway has been evident in recent years. In 2008, two Dutch institutions – a university and government organization – collaborated with the Horn of Africa Regional Environment Center for a four-day workshop entitled “Towards a Sustainable Future of the Western Shoreline of Lake Ziway: Participatory Land Use Plan Development” (Hengsdijk et al., 2009). The participants evaluated strengths and weaknesses of current land use schemes and identified opportunities for future changes (Hengsdijk et al., 2009). They also outlined objectives, responsibilities, and timelines for follow-up activities. Follow-ups involved contacting institutions including the regional Bureaus of Agriculture and Rural Development, federal ministries, and the EPA (Hengsdijk et al., 2009).

Herco Jansen also put together a comprehensive report the following year in 2010 called “Coping with Competing Claims on Land and Water in the Central Rift Valley” (Jansen, 2010). This report continued the discourse from the 2008 workshop. It also acknowledged the participation of the following stakeholders: Plant Research International, Horn of Africa Regional Environment Centre, Agricultural Economics Institute, Ethiopian Institute for Agricultural Research, Addis Ababa University, Rift Valley Children and Women Development, Oromia Land and Environmental Protection Bureau, Ziway Drinking Water Supply, Ziway Fisheries Institute, Sher PLC, Intermon Oxfam, Central Rift Valley Working Group, Netherlands Embassy, Dutch Government Service for Land and Water Management, Wageningen International, and Halcrow and GIRD Consultants (Jansen, 2010).
Figure 4.5 Lake Ziway and Ziway points of interest, DIVA-GIS, 2011; Google Earth, 2011.
Case Study 3: Lake Koka

General Context

Lake Koka is actually a reservoir created by the Koka Dam, constructed in the late 1950s and opened in 1960 for hydropower, flood control, and irrigation (Kloos & Legesse, 2010). Kloos & Legesse call the project an example of “hastily planned and implemented projects,” not for the least of reasons being that it evicted the Jille people in the 1960s without compensation (2010, p.81). However questionable this decision may have been fifty years ago, it nevertheless resulted in a lake that has come to draw people to its resources. A map of Lake Koka is shown in Figure 4.7.

Evidence of Collaborative Processes

In 2009, Al Jazeera reported on the degraded state of Lake Koka in a two-part video that has been posted online. The video’s description reads, “What few realize is that [Ethiopia] is currently experiencing phenomenal economic growth. This has come at a cost to the environment and to Ethiopia’s poor who depend on it.” Again, people have come to depend on the lake for what it provides, and the disturbingly vivid images of thick, green substances collecting on the surface of the lake due to heavy pollution prove that the quality of this lake in particular has been degraded (see, e.g., Figure 4.6). In this case, media documentation of the issue might encourage action or at least conversation between concerned stakeholders and local communities.

Figure 4.6 Image from Al Jazeera report, Al Jazeera, 2009.
Figure 4.7 Lake Koka and Nazret points of interest, DIVA-GIS, 2011; Google Earth, 2011.
Personal Communications

Two other key informants provided me with information. One was Program Manager for the Ethiopian NGO Forum for Environment. The other was a professor, former president of Hawassa University, and current director of the Higher Education Strategy Center in Ethiopia.

The Forum for Environment Program Manager was interviewed on October 21, 2011, through an international phone call from Waterville, Maine, USA. This interview lasted thirty to forty minutes, and was conducted along with fellow researcher Olivia Kefauver. The respondent was asked about his organization, and he described at length the nature of Forum for Environment as “a local environmental NGO that collaborates with likeminded governmental and nongovernmental organizations.” He talked about the areas of focus (“thematic areas”), methods, and activities with which Forum for Environment engages. He also addressed the role of collaboration in facing environmental issues and noted that environmental policies may exist, but the problem is in implementing them (FFE_4B, 2011). It is also always challenging merely to bring stakeholders with varying interests together. However, the Program Manager noted the recent rise in environmental concern and discussion. Now, he said, one can talk about environmental issues at all levels and it is well received compared with other issues, such as human rights (FFE_4B, 2011). See Appendix 4B for full interview notes.

Dr. Zinabu Gebremariam corresponded via email over the course of several dates in October, 2011. Dr. Gebremariam was extremely helpful in answering a list of questions pertaining to Ethiopian Rift Valley Lakes and their management, and providing a list of relevant journal articles. When asked about data sources for this project’s case studies, he asserted that there is “no single source for all the information,” but he and colleagues have written extensively on ERVL subjects, and he specified several of the articles included in the Works Cited of this report (Gebremariam, 2011). While he could not think of any examples of lake restoration in Ethiopia, he did say that the potential for such restoration “all depends on the type of degradation and its magnitude” (Gebremariam, 2011). See emails to and from Dr. Gebremariam in Appendix 4A.

Discussion

The following section is broken down based on the components of Figure 4.2, the theoretical model of the human-lake interaction. The model focused on:

- anthropogenic drivers of lake water quality degradation;
- processes contributing to lake water quality degradation;
- lake water quality degradation itself; and
- impacts of lake water quality degradation on human and environmental health.
Anthropogenic Drivers

In answering the first of this chapter’s research questions, “How do human factors drive water quality in Ethiopian lakes?” there was a widespread consensus among the sources consulted. Human activities tend to be concentrated on lakeshores because of the wide variety of opportunities that the lakes provide.

While people may be aware that their activities ultimately drive lake water quality degradation, they sometimes do not have the capacity to break out of those harmful activities. This gets back to the term “dependency syndrome” in the context described in the results section. People have found ways of making a living using the lake – whether it be through fishing or wildlife domestication for tourism or opening a tannery near the lakeshore – that degrade lake water quality in various ways.

Processes Contributing to Lake Degradation

Generally, the processes that threaten lakes are clearer than the impacts of those threats. There are multiple effects of one problem, such as urbanization leading to both increased waste production and pollution of the air, water, and land. Pollution can be measured in terms of wastewater discharge from buildings and homes (Boadi & Kuitunen, 2002). Industrialization may be occurring simultaneously, which can manifest as increased effluent discharge from industrial complexes, nutrient loads in the water, eutrophication, and biodiversity loss (Boadi & Kuitunen, 2002).

Because the processes in the human-lake system can be measured, they can be managed. Potential policy changes or initiatives can affect this part of the systems model. For example, Houlahan and Findlay (2004) studied the distance at which land-use activities have an impact on water bodies. They concluded that impacts could occur at great lengths, much greater than typically protected by buffer zone schemes. However, such schemes (i.e. the United States’ Coastal Zone Management Act) prevent development directly adjacent to water bodies. This could minimize the most direct sources of runoff by discouraging direct waste dumping from a building into the lake. While each lake is impacted by land use within its own watershed, lakes may also be impacted by upstream water bodies. This includes inflowing rivers and lakes that drain to closed water bodies (UNEP, 2011).

Monitoring Lake Water Quality

Being able to effectively monitor lake water quality is a key component of designing appropriate policies for a lake. There are calls from a number of sources for more and better science in the field of water resources for the purpose of sharing and disseminating information (Alem et al., 2011; Johnson & Mappin, 2005). Potential indicators include chlorophyll, secchi depth, total
phosphorous, total nitrogen, dissolved oxygen content, and phytoplankton biodiversity and biomass (Alem et al., 2011). Such data are not available for the lakes in the case studies here, but the implementation of a monitoring program with standard components would be simple to design. It would require investment in equipment (secchi disk, YSI meter for chemical indicators, etc.) and training for basic scientific procedures and equipment maintenance.

Monitoring should take place at least once a month as opposed to once a year or less. Testing as infrequently as once a year could result in merely seeing seasonal variations instead of meaningful changes (Gebremariam, 1994).

A final component of monitoring would be to keep track of points of interest in a more in-depth manner. This would give a more comprehensive view of the point and non-point sources of degraded water quality. It would then be easier to pinpoint effluent sources or major sources of pollution and direct regulation (i.e. polluter pays schemes) towards those sources.

Impacts on Human, Economic, and Ecological Health

At the 2009 workshop concerning Lake Awassa, stakeholders identified a list of threats to the lake from which impacts can be inferred. For example, disposal of wastes into the lake implies water quality that is harmful to the health of plants, animals, and humans that depend on it (Concern for Environment, 2009).

One question to consider regarding impacts of decreased lake quality is the measurability of those impacts. Again, on the other side of the equation, threats like wastewater discharge and chemical concentrations are measurable. One must choose metrics like profits from tourism or disease rates or species richness to measure economic, human, and ecosystem health. The Ethiopian Rural Household Survey (ERHS) provides a regular source of information on human statistics, and the Human Development Index (HDI) is useful for national-level quality of life indices.

The three areas of impacts identified in Figure 4.2 are also interconnected. This gives incentive to focus on policy solutions that at least minimally benefit all three. For example, maintaining biodiversity – i.e. bird species around lakes – will also help economic health by benefiting the tourism industry (Ramsar, 1992). The example of Lake Koka shows the drastic consequences of a development paradigm that did not account for the health of the environment. While economic and industrial development are necessary for the success of any country, these concepts must also take into account the health of the environment, which is inextricably linked to the wellbeing of humans.

Policies to bolster economic welfare, assist the sick, or recover ecosystems are important, but policies targeting processes that cause these things in the first place is intuitive. For example, one
anticipates less disease in the long-term with policies that construct a new wastewater treatment facility with appropriate infrastructure, or limit allowable industrial effluent levels as opposed to a policy that funds one-time extra doses of medicine to hospitals and clinics. This paper argues not that healthcare and other sectors that help on the ‘effects’ side of the equation are less important than those on the ‘causes’ side, merely that it makes sense that cause-side policies could decrease the burden on the effects-side.

How Should Lakes be Managed?

Over the past fifty years or so, there has been a trend towards global efforts to increase technology, resource use, and output. Yet issues of social inequality and environmental destruction persist, signaling the need for a better management scheme (Biswas et al., 2009). Considering the economic strife that Ethiopia has faced and continues to struggle against, the following statement is especially pertinent: “systems for controlling resource access and use typically reflect the ways in which society is organized and thus recreate and reproduce the inequities in society” (Donahue & Johnston, 1998).

Importantly, lake systems in the Great Rift Valley clearly do not reflect political jurisdictions, a fact which makes it difficult to manage them through conventional government institutions. The map below depicts the watersheds of the three case study lakes: all three lakes are contained within the same larger watershed. Lake Awassa has a small associated watershed, but both the lake and associated watershed constitute the headwaters of the rest of the macro-watershed. Lake Ziway’s watershed leads into that of Lake Koka (Figure 4.8).

Together, the watershed of the three lakes overlaps the Regional State borders between the regions of SNNP, Oromia, and Addis Ababa (borders in red). Successful management of lake water quality thus demands an institutional framework that allows water resource issues to be addressed while keeping the watershed in mind. The 1999 national water policy that identified the ‘hydrological boundary or basin’ as the unit of analysis represents an important step in this direction.
Figure 4.8 Map of case study lake watersheds, author calculations based on DIVA-GIS data.
Two approaches that align with the ideal of watershed-based management are Integrated Watershed Management (IWM) and Adaptive Management. The goal of Integrated Watershed Management is to develop, manage, and sustain production systems that are well-suited to the existing environment and resource base (Gregersen, 2007). IWM involves what one author calls “concertation,” or the consulting with stakeholders before making a decision (Berry & Mollard, 2010, p. 99). By allowing participation in the policymaking process, potential mistakes will be uncovered and addressed (Berry & Mollard, 2010).

Adaptive management has to do more with procedure: it is the systematic monitoring and evaluation of past experience and introducing the resulting lessons directly into adjusted goals and plans (Gregersen, 2007). Together with IWM, a common thread in many sources encountered in this research was the need for participation, consensus, sharing of responsibilities and information, education, and training (Gregersen, 2007; Johnson & Mappin, 2005).

The meetings discussed above – the Green Awassa atelier, the Concern for Environment workshop, and the Lake Ziway workshop – represent a promising strategy for promoting awareness, and the reports of the proceedings from these events give directions for ways to meaningfully engage stakeholders (Reynolds et al., 2010; Concern for Environment, 2009; Hengsdijk et al., 2009). These meetings step back from economic hardships to see the environmental impacts of human activities and to brainstorm ways humans can directly improve the situation. As Concern for Environment noted in its 2009 Annual Report, “many people do not recognize the social aspect that influences the wellbeing of the lake” (p. 15). However, meetings can only go so far before the actors involved should take action (Concern for Environment, 2009, p. 12).

Moving forward, there is a continued need for awareness and understanding of the link between social and environmental problems, as well as a need for action. The issue of water quality of lakes presents definite challenges to achieving a positive relationship between humans and their environment, but it also provides an opportunity for watershed management and community engagement to improve this relationship.

Education and awareness were presented consistently as an imperative, justified as everything from a public policy option to a necessary component of a strong collaborative approach (Biswas et al., 2004; Gebremariam, 1998). Dr. Zinabu Gebremariam promoted advocacy and awareness of the environmental processes of a lake or a watershed in the following way: “One must convince the educated fisheries personnel of the Ministry of Agriculture as well as the uneducated fishermen that deforestation in the catchment area of a lake is crucial to the fish” (Gebremariam, 1998). At the heart of this sentiment is the fact that people must understand both the environmental processes at work as well as their own and others’ places within these processes. There is power in numbers, a sentiment echoed by Forum for Environment: “The more you collaborate, the more you can influence policy” (FFE_4B, 2011).
Conclusion

Poverty is an overarching circumstance that defines the human-lake interaction to a certain extent. For example, Ethiopia has the lowest Human Development Index (HDI) rating in the Nile Basin and the highest percentage of people not using potable water in Sub-Saharan Africa – 78% (Egypt is at 2%). Eighty-five percent of Ethiopians depend on subsistence agriculture (crops or livestock), which in turn is dependent upon unpredictable rains (Kloos & Legesse, 2010). Illustrating the complex and difficult nature of the link between poverty and nature, one author states, “the poor are both victims and agents of environmental damage” (Biswas et al., 2004, p.72).

Lakes are key components of watersheds where humans tend to gather to take advantage of the various resources that lakes offer. Each lake has an associated watershed and may be part of a larger watershed. The effects of land use and water quality among these different levels is difficult to predict. The Ethiopian Rift Valley lakes provide compelling case studies because they represent an entire watershed from the headlands (Lake Awassa) to the end (Lake Koka).

Common threats to lake water quality lead to common and interrelated impacts that may be cyclical and complex in nature. Figure 4.2 provides the framework of these interrelations. This model does not contain every detailed input and output, but rather serves theoretically to identify options for policy interventions.

In Ethiopia, arguably the most important institutional development for lake management to date is the adoption of the watershed, basin, or catchment as the fundamental planning unit because this looks at watersheds as they occur in nature rather than as they fit into regional or other human-constructed boundaries.

Increased standardization of water quality monitoring ought to be established. The resulting scientific data shall inform policymakers on a case-by-case basis along with consideration of social factors including land or lake use (i.e. agriculture, fisheries) and other areas unexamined in this project (i.e. geological background of the areas, groundwater processes).

A buffer zone system, where land development uses are stricter closer to lakes, would discourage direct dumping of wastes and effluents into the water.

Finally, an integrated watershed approach to management might better include participative and collaborative methods. Each stakeholder that is a part of the policymaking process must understand his or her place in the overall system of threats and impacts (participative) and be willing to engage with the interests of other stakeholders (collaborative) to determine the best way to manage a lake. Awareness and education comprise an essential part of such a process.
Works Cited


Environmental Policy Review 2011: Key Issues in Ethiopia

Chapter 5 Waste Management in Ethiopia

Matthew Cheever
Research Highlights

Waste management is a major problem in Ethiopia. Case Studies of Addis Ababa (the national capital) and Bahir Dar (a major tourist destination) were used to study current waste management practices and to assess their strengths and weaknesses. Unlined open dumps were shown to have a direct relationship with unprotected water sources in rural and urban settings. Private sector involvement in waste management, like that of Dream Light Waste Management Company operating in Bahir Dar, has decreased the amount of unlined waste disposal areas around the city. Environmental NGOs can help play a role in solving Ethiopia’s waste management issues by constructing lined, capped landfills in urban areas and building latrines in rural areas.
Environmental Policy Review 2011: Waste Management in Ethiopia

By Matthew Cheever

Executive Summary

“Waste Management in Ethiopia” is the fifth chapter in *Environmental Policy Review 2011*, a report produced by the Environmental Policy Group in the Environmental Studies Program at Colby College in Waterville, Maine.

Waste management in Ethiopia is a problem that affects water quality and health. This chapter offers additional insights into how waste management affects health in Ethiopian cities and rural communities using qualitative and quantitative data to respond to the research question: “how do current waste management practices affect local water quality and disease rates?”

A review of existing literature highlights toilet availability and use, drinking water sources, and disposal of garbage as three variables having strong relationships with sickness rates. Case studies of two major Ethiopian cities – Addis Ababa (the capital city) and Bahir Dar (a major tourist destination) – further illustrate the current urban waste management landscape in Ethiopia. An analysis of 2009 Ethiopian Rural Household Survey (ERHS) data then explores rural waste management issues in greater detail.

Unlined open dumps were shown to have a significant relationship with unprotected water sources in rural and urban settings. Private sector involvement in waste management collection appears to be effective in some urban areas.

NGOs can play a role in helping to address Ethiopia’s waste-health crisis by building latrines in rural areas, building lined covered landfills in cities, and stimulating private sector involvement in urban areas.
Environmental Policy Review 2011: Waste Management in Ethiopia

By Matthew Cheever

Introduction

Collecting and managing solid and human waste is an important challenge for countries across the world. This problem is often magnified in cities where a dense concentration of people leads to a substantial amount of waste generation (Zerbock, 2003). In developing countries like Ethiopia, this problem is exacerbated by an influx of people moving to urban centers (Montgomery, 2008). Densely populated areas are more susceptible to health risks as disease can be spread quickly (Harris & Kiel, 2006).

The implementation of effective waste management practices has been identified as essential for economic development in low-income countries in particular (Scheinberg, 2010). Urban centers are usually the hardest hit as efforts to develop and grow lead to an influx of economic opportunities and people (Gilbert, 1998). In the Middle Ages the Bubonic Plague swept through cities as waste was improperly disposed of in the streets (Dobe et al., 2011). Given the tragic consequences of the past, it is vital that improving waste management practices in the growing cities of Ethiopia be a top priority.

With more and more people moving to urban centers in Ethiopia, cities like Addis Ababa and Bahir Dar are under increasing pressure to manage waste effectively in order to avoid outbreaks of disease. With the Akaki River running through Addis Ababa, and Bahir Dar located on Lake Tana, there is temptation to use these water bodies as a quick and easy waste removal solution. If waste is deposited in local water ways, the likelihood of water borne chemical diseases rises dramatically (Kuma, 2004). Therefore, it is essential to study how current waste management practices affect local water quality and disease rates.

Waste management in Ethiopia is important because only a small percentage of the country’s inhabitants have access to safe drinking water: 21% in rural areas, 84% in urban areas, and 30% country-wide. Additionally, only 7% of populations in rural areas, 68% in urban areas, and 15% of people country-wide have adequate access to latrines or other improved human waste disposal options (Kumie, 2005). Access to latrines is a critical aspect of waste management, especially since the practice of open defecation is prevalent in the country, which can contaminate groundwater and lead to disease (WHO, 2008; PLAN, 2007).

This chapter seeks to contribute to the understanding of waste management processes and public health by investigating waste management in Ethiopia through a multi-step approach. First, local and regional laws at the ground level were examined. National laws about waste management were then investigated to see if there were any discrepancies between what the law
and the reviewed literature said in terms of actual implementation. After a thorough examination of local and national laws, the relationships between non-governmental organizations (NGOs), international institutions, and these laws were explored. From the gathered research, this paper makes recommendations for Addis Ababa, Bahir Dar, and other cities in Ethiopia for ways to improve waste management practices.

Table 5.1 Definitions of key terms in regards to waste management.

<table>
<thead>
<tr>
<th><strong>Solid Waste</strong></th>
<th>“Anything that is neither liquid nor gas and is discarded as unwanted”</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Solid Waste Management</strong></td>
<td>“The collection, transportation, storage, recycling, or disposal, of solid waste, or the subsequent use of disposal site that is no longer operational”</td>
</tr>
</tbody>
</table>

Table 5.1 Note: Solid Waste Management Proclamation No. 513/2007.

Table 5.2 Definitions of key terms in regards to access to clean water and latrines

| **Drinking water supply accessibility** | The geographical proximity of safe source of drinking water points within a 15 minute walk or a radius of 1 km from users' homes |
| **Adequateness of water supply** | The amount of drinking water that is available to support an individual's daily basic needs required for drinking, culinary, and other domestic purposes to satisfy his personal hygiene. Recommended values are 20 and 50 litres per day per capita for rural and urban residents, respectively |
| **Drinking water coverage** | The proportion of populations or households who have access to a safe drinking water source that ensures and/or limits the absence of pathogenic micro-organisms |
| **Latrine coverage** | The proportion of population or households who have access to some kind of latrine |

Table 5.2 Note: Abera, Kumie and Ali, Ahmed. 2005.

**Methods**

I used both qualitative and quantitative methods to investigate the research question: “how do current waste management practices affect local water quality and disease rates?”

**Qualitative Methods**

I began by conducting an extensive literature review of academic papers, formal reports, state issued pamphlets, local laws, regional laws, and national laws. This gave me a good background on existing laws and past research about solid waste management in Ethiopia in urban and rural areas. I retrieved data on water sources, sanitation, facilities, and health expenditures on urban
areas from the World Development Indicators (WDI) of the World Bank and the World Health Organization (WHO). I investigated the effectiveness of laws and policies at the various political levels and highlighted discrepancies between the mandates and what is happening in reality through looking at two important Ethiopian cities as case studies: Addis Ababa and Bahir Dar.

Background on Addis Ababa

Addis Ababa is the capital of Ethiopia, located in its own region (of the same name) with a population of about three million people (Abiye et. al., 2009). Settled in the late 19th century, today the city is comprised of three government levels, including the formal city government at the top, ten sub-city administrations in the middle, and 99 kebele – roughly equivalent to a neighborhood – at the bottom (UN, 2010). In 2010, it was estimated that the city of Addis Ababa generated upwards of 0.4kg/capita of waste per day, with more than 200,000 metric tons collected each year (UN, 2010). For waste collection the city is divided into 549 zones serving 800 households; one municipal waste crew is designated for each zone. It is estimated that only 65% of the waste generated in the city is collected, with the rest being deposited in open sites, drainage channels, and rivers (UN, 2010). The city is home to major landfill sites; Repi Landfill and Korah Dump are the two most prominent. Both landfills are open, unlined dumps. The Korah dump is located adjacent to the community of Korah, home to some 80,000 of the city’s poorest people: many in this community reportedly use the dump as a food source (Cox, 2010).

Background on Babir Dar

Bahir Dar is the capital of the Amhara region in northern Ethiopia. It is located on Lake Tana, the headwaters of the Blue Nile, and is a major tourist destination. The city has expanded rapidly throughout the 20th century and today sewage discharge into Lake Tana has become a serious and highly visible problem (Kassie, 2011). At the same time, as the city modernizes, it is converting more and more land into streets, parking lots, hotels, etc., increasing the amount of surfaces that cannot absorb the seasonal rains in the area. This storm runoff overflows sewage systems and creates an influx of contaminated water entering Lake Tana (Wondie, 2009).

Table 5.3 Comparison of city characteristics of Addis Ababa and Babir Dar, Mahiteme, 2005.

<table>
<thead>
<tr>
<th>City</th>
<th>Region</th>
<th>Population</th>
<th>Nearest fresh water source</th>
<th>Official local landfill</th>
<th>Private sector involvement in solid waste management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Addis Ababa</td>
<td>Addis Ababa</td>
<td>3,384,569</td>
<td>Akaki River</td>
<td>Repi Landfill</td>
<td>Minimal Involvement</td>
</tr>
<tr>
<td>(Capital)</td>
<td></td>
<td></td>
<td></td>
<td>Korah Dump</td>
<td></td>
</tr>
<tr>
<td>Babir Dar</td>
<td>Amhara</td>
<td>221,991</td>
<td>Lake Tanna</td>
<td>None</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(Dream Light P.L.C)</td>
</tr>
</tbody>
</table>
Figure 5.1 Water bodies and rivers in relation to two major cities.
Characteristics of the two urban case studies are summarized in Table 5.3. The World Development Indicators (WDI) and the World Health Organization (WHO) supplied additional data on water sources, sanitation facilities, and health expenditures in both urban and rural areas.

**Quantitative Methods**

To further explore waste management and health in rural areas I obtained data from the 2009 “Ethiopian Rural Household Survey” (ERHS) performed by the International Food Policy Research Institute (IFPRI). The survey sample includes 1,477 households across four Regional States; trained interviewers surveyed the family members on issues including health, water quality, toilet facilities, and education (ERHS, 2009). Surveys were conducted in 1989, 1995, 1997, 1999, 2004, and 2009. I used the ERHS survey’s 2009 data on the types of toilets used (q1p3s2), on garbage disposal (q2p3s2), water sources (q4p3s2), and sickness rates (q1ap3s3, q1bp3s3) to analyze trends in sickness rates in relation to these variables.

In terms of assessing drinking water source, waste management, toilet use, and its relation to sickness, I used the statistical program Stata 12.0 to run a regression on the data obtained from the ERHS. I specifically looked at health outcomes as a function of garbage disposal, water source, and type of toilet, with region, age and occupation as control variables. The occupation “farmer” was used as a specific control variable, as most rural Ethiopians are farmers. My preliminary hypothesis was that a person’s source of drinking water would have a correlation with being sick in the last 40 days (and if so, for how many days). I based this hypothesis on information gathered from Ethiopian authors who made claims that open water sources including rivers are widely used as waste disposal sites (Forum for Environment-Bahir Dar, 2010; Kuma, 2004), suggesting protected water sources might improve health outcomes.

Since the ERHS also has available information on the type of toilet used in rural areas; I added the type of toilet to some regression models. This decision was grounded in the fact that latrine coverage has only grown by as little as 0.2% per year over the last 30 years (see Table 5.2), and that latrine coverage for the country of Ethiopia was 15% in 2005 (Kumie & Ahmed, 2005). These statistics show that access to latrines has been a major issue for Ethiopia, and likely plays a role in current issues of health and sanitation.

In order to determine which regression was most appropriate to use for this analysis, I first looked at the distribution of the number of days sick (in the last four weeks) that Ethiopians reported (see Figure 5.2). The distribution of responses had a high number of respondents answering that they were sick “0” days. Figure 5.3 shows the distribution of days sick of people after I eliminated those people responding “0” days sick. Given the binary dichotomy between “not being sick any days in the last four weeks”, and those who answered “being sick some number of days,” I chose to use a Heckman model. Heckman models are used to eliminate selection bias when working with a non-randomly selected sample (Wiggins, 2001). Since there
may be systematic differences between people who get sick and people who never get sick, the people who get sick are non-randomly selected from the population. I ran three Heckman models relating sickness rates to how one’s garbage is disposed of; type of toilet used, and type of drinking water source, respectively. The calculations of these models can be found in Tables 5.8, 5.9, and 5.10, in the results section.

Figure 5.2 General distribution of the number of days sick reported by each respondent.

Figure 5.3 Distribution of the number of days sick each respondent gave, after eliminating those who were not sick at all (sick “0” days).
Laws and Institutions

In order to fully understand current waste management practices and their resulting effects it is important to examine the legal system that governs waste. Ethiopia follows a civil law pattern where laws are written by legislators instead of mandated by judges. The political legal system is similar to the United States as there is a federal government and state governments, with the federal government having more power over regional governments. There is a Federal Supreme Court as well as provisions for each state to have its own district, appeals, and Supreme Court.

In terms of environmental law, Ethiopia’s Constitution is the most important source of environmental law. The basis for the Environmental Policy of Ethiopia are articles 92.1 and 92.2 of the Constitution of the Federal Democratic Republic of Ethiopia:

- Article 92.1: “Government shall endeavor to ensure that all Ethiopians live in a clean and healthy environment”;
- Article 92.2: “Government and citizens shall have the duty to protect the environment” (Forum for Environment, 2010).

The government issues environmental proclamations that are aimed at various sectors of the environment (land, biodiversity, etc.). The major environmental body in Ethiopia is the Environmental Protection Authority (EPA). The EPA is responsible for federal level environmental protection by formulating the national environmental policy. It is also responsible for making sure that other governing bodies such as the Ministry of Agriculture, the Ministry of Mines; the Ministry of Energy; and the Ministry of Water Resources are implementing policy that is consistent with the Federal Democratic Republic of Ethiopia’s Constitution. Federal level environmental policy is seen more as overarching while regional policy (that must fit within federal policy) is seen as far more important for on-the-ground implementation (Forum for Environment-Bahir Dar, 2010; Kuma, 2004).

The EPA issued the Environmental Policy of Ethiopia which refers to waste management in three different articles, either directly or indirectly:

- Article 3.7 addresses issues related to human settlement, urban environment and environmental health;
- Article 3.8 addresses issues related to the control of hazardous Materials and pollution from industrial waste; and
- Article 3.9 addresses atmospheric pollution and climate change.

The primary national policy on waste management is the Solid Waste Management Proclamation No. 513. Released in February of 2007, the proclamation’s main goal is to increase community participation. The proclamation states:
it is essential to promote community participation in order to prevent the adverse effects and to enhance the benefits resulting from solid wastes; and

- solid waste management action plans designed by, and implemented at, the lowest administrative units of urban administrations can ensure community participation (Proclamation No. 513, 2007).

The Proclamation has five parts made up of 19 articles. These articles cover topics of obligation, solid waste management planning, collection & storage, transportation, treatment, disposal, incineration, recycling, and hazardous waste (See Table 3.1). The Solid Waste Management Proclamation works hand in hand with the Environmental Pollution Control Proclamation No. 300/2002 which mandates that all urban governments are obligated to devise and implement safe and effective mechanisms to handle, transport, and store municipal waste. It also states that any transporting or treatment of municipal waste can only be done with a permit from the Ethiopian Environmental Protection Agency (Forum for Environment-Bahir Dar, 2010).
Table 5.4 Breakdown of Solid Waste Management Proclamation No. 513 and the Environmental Pollution Control Proclamation.

<table>
<thead>
<tr>
<th>Solid waste management Activity</th>
<th>Law or Act</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source reduction/segregation - households</td>
<td>Solid Waste Management proclamation, Article 11.1</td>
<td>Households shall ensure that recyclable solid wastes are segregated</td>
</tr>
<tr>
<td>Collection and storage</td>
<td>Solid Waste Management proclamation, Article 11.2</td>
<td>Urban administration shall ensure that adequate HH solid waste collection facilities are in place to ensure the installation of marked waste bins by streets and in other public places guaranteeing the collections of solid waste from bins with sufficient frequency</td>
</tr>
<tr>
<td>Transportation</td>
<td>Solid Waste Management proclamation, Article 13.2</td>
<td>Urban administration shall set the standards to determine the skills of drivers and equipment operators and prevent overloads of solid waste</td>
</tr>
<tr>
<td>Treatment</td>
<td>Environmental Pollution Control Proclamation, Article 5.1</td>
<td>All urban administrations shall ensure the collections, transportation, and, as appropriate, the recycling, treatments or safe disposal of municipal waste through the institution of an integrated municipal waste management system</td>
</tr>
<tr>
<td>Disposal/Landfill</td>
<td>Solid Waste Management proclamation, Article 14,15</td>
<td>Construction of solid waste disposal sites and auditing existing solid waste disposal waste</td>
</tr>
<tr>
<td>Recycling and reuse</td>
<td>Solid Waste Management proclamation, Article 7.1</td>
<td>Manufacturer or importer of glass container or tin cans shall...collect and recycle glass or tins</td>
</tr>
<tr>
<td>Hazardous waste</td>
<td>Environmental Pollution Control Proclamation, Article 4.2</td>
<td>Any person engaged in the collection, recycling, transportation, treatment or disposal of any hazardous waste shall take appropriate precaution to prevent any damage to the environment or to human health or well-being.</td>
</tr>
</tbody>
</table>

Table 5.4 Note: Information from Forum for Environment – Bahir Dar 2010.
Regional solid waste management laws in Ethiopia are essentially the same as the national policy (Hailu, 2000). In the Amhara region, for example, where Bahir Dar is the capital, the regional law is the Basic Solid Waste Management Directive of Amhara Regional State Health Bureau 2009, which addresses issues of garbage classification, collections and storage, treatment, disposal, and recycling in the same manner as the national governmental policy (Forum for Environment-Bahir Dar, 2010).

**International Waste Conventions**

Ethiopia has ratified two important International Conventions in hopes of reducing the amount and severity of solid waste in the country (See Table 5.5). The Basel Convention is an international treaty whose goal is to decrease the movement of solid waste and hazardous waste between countries. The specific aim of the treaty is to prevent developed countries from transferring hazardous waste to less developed countries. Less developed countries often take the waste of others in return for monetary compensation. The Rotterdam Convention stipulates that hazardous waste importers must use full disclosure when dealing with potential importers. This transparency includes “proper labeling, the inclusion of directions on safe handling, and informing purchasers of any known restrictions or bans” (FFE, 2010).

<table>
<thead>
<tr>
<th>Proclamation Number and Date</th>
<th>Convention</th>
</tr>
</thead>
</table>

**Other International Institutions**

The Bill and Melinda Gates Foundation is a multi-billion dollar foundation dedicated to reducing global poverty and improving global health. One of the Foundation’s main priorities is issues of water quality, sanitation, and hygiene in Africa. The foundation works to find sanitation options that are inexpensive and easy to use, with the hope of using waste treatment facilities to eventually reuse waste (*The Bill & Melinda Gates Foundation*, 2011).

There are three main areas of focus for the foundation when it writes grants; Sanitation Science and Technology, Delivery Models at Scale, and Policy and Advocacy. In the science area, they hope to create a waterless hygienic toilet through the “Reinvent the Toilet Challenge.” They also hope to collect the waste and use it to form building blocks that can replace conventional bricks. Another option they are pursuing is the use algae bacteria to treat waste. Bacteria treating waste...
produce nutrient rich fertilizer and methane gas which can power the facility (*The Bill & Melinda Gates Foundation, 2011*).

In terms of policy, the Foundation works to promote environmental waste policies that can work for the poor. It works primarily with local governments to implement measures for improved sanitation (*The Bill & Melinda Gates Foundation, 2011*). Environmental education is another key factor in their plan as they want to work with locals to raise awareness about sanitation and water quality in other countries including Kenya and Uganda.

**Results**

The findings reported below include summaries of the two urban case studies (Addis Ababa and Bahir Dar), followed by analyses of 2009 Ethiopian Rural Household Survey (ERHS) data to better understand waste management and health issues in rural Ethiopia. Table 5.6 highlights differences between urban and rural areas, demonstrating how urban and rural areas need to be considered differently in terms of water and sanitation challenges.

Table 5.6 Water source and sanitation data from the World Development Indicators (World Bank, 2010).

<table>
<thead>
<tr>
<th>Indicators</th>
<th>2005</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improved water source (% of population with access)</td>
<td>35</td>
<td>38</td>
</tr>
<tr>
<td>Improved water source, rural (% of rural population with access)</td>
<td>24</td>
<td>26</td>
</tr>
<tr>
<td>Improved water source, urban (% of urban population with access)</td>
<td>95</td>
<td>98</td>
</tr>
<tr>
<td>Diarrhea treatment (% of children under 5 receiving oral rehydration)</td>
<td>15</td>
<td>N/A</td>
</tr>
<tr>
<td>Health expenditure, public (% of government expenditure)</td>
<td>10.29</td>
<td>11.47</td>
</tr>
<tr>
<td>Improved sanitation facilities (% of population with access)</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>Improved sanitation facilities, rural (% of rural population with access)</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Improved sanitation facilities, urban (% of urban population with access)</td>
<td>28</td>
<td>29</td>
</tr>
</tbody>
</table>

**Case Studies**

The maps on the following pages provide aerial views of the two cities studied.

*Bahir Dar*

In the city of Bahir Dar (Figure 5.4), there are no municipal solid waste treatment facilities and no solid waste transfer stations. Presently, the only method of disposal is open, uncovered disposal fields (FFE-Bahir Dar, 2010). Due to the city’s proximity to Lake Tana, the possibility for open, unlined landfills to contaminate local drinking water, or for refuse to be washed into the lake from storm runoff, is high (Wondie, 2009). The lake is so contaminated that many, including a woman from Bahir Dar that was interviewed, refuse to swim in it (Kassie, 2011).
Figure 5.4 Aerial view of Bahir Dar.
Nevertheless, there is evidence to suggest that waste management in Bahir Dar has improved significantly in recent years. Most notably, the city of Bahir Dar recently moved from government funded waste management collection to private sector collections, a transition that started in 2009 (Melaku, 2011). The private waste management company currently active in the city is called Dream Light Waste Management P.L.C., which was created in response to the poor cleanliness of the city. The company relies heavily on engaging the community through household waste management and house to house collections, all in return for small service fee (FFE-Bahir Dar, 2010). Household waste collection has greatly reduced the amount of open pit dumps on city streets. The local community covers about 50% of Dream Light’s costs through service fees of $0.80 US dollars per household and $1-75 US dollars per commercial site (FFE-Bahir Dar, 2010).

Addis Ababa

Contrary to the situation in Bahir Dar, solid waste management in the city of Addis Ababa is handled primarily by the city government. As one author notes: “the involvements of NGOs and other private actors are very minimal” (Mahiteme, 2005, p. 10).

Tadesse Kuma’s report characterizes the cleanliness of the city as

Eye-catching piles of garbage, flying ‘fesal’ (which is increasingly used for packaging), rubbish, construction demolition and moved-earth from new construction sites littering the urban space indefinitely. Obnoxious odors emanating from decomposing solid wastes, semi-liquid and liquid waste are sickening all citizens (Kuma, 2004, p. 4).

Addis Ababa provides many open garbage containers on streets and expects citizens to dispose of their waste in them. Waste is then collected and deposited in one of the city dumps. Repi Landfill is shown in Figure 5.5; Korah Dump is nearby, adjacent to the Akaki River.

Figures 5.6-5.9 compare Addis Ababa waste statistics with Ethiopia as a whole.
Figure 5.5 Aerial view of Addis Ababa, Repi landfill indicated by red asterisk.
The following graphs compare the solid waste practices of Addis Ababa to the rest of Ethiopia (African Development Bank Group, 2010). Figure 5.6 shows that the majority of people in Addis Ababa and Ethiopia nationally burn their garbage as the primary means of disposal.

Figure 5.6 Percentage of population that disposes of rubbish by burning in Addis Ababa and nationally; African Development Bank Group, 2010.

Figure 5.7 shows that just over 25% of rubbish in Addis Ababa is collected by the government or NGOs, while less than 5% of rubbish generated nationally is collected by these institutions.

Figure 5.7 Percentage of rubbish disposal by the government or NGO in Addis Ababa and nationally; African Development Bank Group, 2010.
Figure 5.8 shows that a small percentage of the population in Addis Ababa and nationally, disposes of garbage in pits or heap dumps. (Note different scale from the previous figures).

![Rubbish Disposal by Pit/Heap (%)](image)

Figure 5.8 Percentage of the population that uses a pit/heap for rubbish disposal in Addis Ababa and nationally; African Development Bank Group, 2010.

Finally, Figure 5.9 shows that a substantial percentage of the population in Addis Ababa, and nationally, dispose of their garbage by “other means.” The African Development Bank Group did not speculate on what “other means” actually signifies.

![Rubbish Disposal by Other Means (%)](image)

Figure 5.9 Percentage of the population that disposes of rubbish by "other means" in Addis Ababa and nationally; African Development Bank Group, 2010.
Additional data on waste water connections were obtained from the African Development Bank Group. Table 5.7 shows information on waste water connections for the city of Addis Ababa. Only a small fraction of the population of Addis Ababa uses a waste water connections due to that fact that the connections costs $132 US dollars, and 39% of the Ethiopian population lives under the international poverty line.

Table 5.7 Waste water data for Addis Ababa, Ethiopia; African Development Bank Group, 2010.

<table>
<thead>
<tr>
<th>Residential wastewater connections</th>
<th>Wastewater connection charge (USD/conn.)</th>
<th>Wastewater operating revenues (USD/year)</th>
<th>Length of wastewater collection system (km)</th>
<th>Treated water (m³/year)</th>
<th>Resident Population in service area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethiopia</td>
<td>1,521</td>
<td>132.01</td>
<td>28,056.80</td>
<td>137</td>
<td>60,164,070</td>
</tr>
</tbody>
</table>

Rural Data

Figure 5.10 shows how the source of drinking water affects the rate of sickness in the regions of Tigray, Amhara, Oromia, SNNP.

Figure 5.10 Rates of sickness by water source investigated across four regions.
For regression results, outcomes that are statistically significant are starred.

Table 5.8 Regression comparing sickness rate and days sick with the type of toilet used.

<table>
<thead>
<tr>
<th></th>
<th>Coefficient</th>
<th>Standard error</th>
<th>z</th>
<th>P&gt;z</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days sick</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Toilet</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pit Latrine</td>
<td>-2.919</td>
<td>1.415</td>
<td>-2.06</td>
<td>0.039*</td>
</tr>
<tr>
<td>Toilet</td>
<td>-2.035</td>
<td>1.431</td>
<td>-1.42</td>
<td>0.155</td>
</tr>
<tr>
<td><strong>Region</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amhara</td>
<td>-2.896</td>
<td>0.962</td>
<td>-3.01</td>
<td>0.003***</td>
</tr>
<tr>
<td>Oromia</td>
<td>-3.683</td>
<td>0.920</td>
<td>-4.00</td>
<td>&lt;0.001***</td>
</tr>
<tr>
<td>SNNP</td>
<td>-3.152</td>
<td>0.982</td>
<td>-3.21</td>
<td>0.001***</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td>-0.014</td>
<td>0.018</td>
<td>-0.81</td>
<td>0.416</td>
</tr>
<tr>
<td>Constant</td>
<td>15.762</td>
<td>2.609</td>
<td>6.04</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Ill</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Toilet</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pit Latrine</td>
<td>-0.153</td>
<td>0.133</td>
<td>-1.15</td>
<td>0.249</td>
</tr>
<tr>
<td>Toilet</td>
<td>-0.186</td>
<td>0.134</td>
<td>-1.39</td>
<td>0.166</td>
</tr>
<tr>
<td><strong>Region</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amhara</td>
<td>0.235</td>
<td>0.086</td>
<td>2.73</td>
<td>0.006***</td>
</tr>
<tr>
<td>Oromia</td>
<td>0.069</td>
<td>0.082</td>
<td>0.84</td>
<td>0.401</td>
</tr>
<tr>
<td>SNNP</td>
<td>0.508</td>
<td>0.082</td>
<td>6.15</td>
<td>&lt;0.001***</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td>0.019</td>
<td>0.001</td>
<td>17.63</td>
<td>&lt;0.001***</td>
</tr>
<tr>
<td>Farmer</td>
<td>-0.240</td>
<td>0.044</td>
<td>-5.38</td>
<td>&lt;0.001***</td>
</tr>
<tr>
<td>Constant</td>
<td>-1.476</td>
<td>0.159</td>
<td>-9.27</td>
<td>&lt;0.001***</td>
</tr>
</tbody>
</table>

Table 5.8 Notes: *, **, and *** indicate statistically significant at a 5%, 1% and .1% level (respectively).

When it comes to the type of toilet used (Table 5.8), “open defecation” (the use of no toilet – the omitted category in the categorical variable Toilet), was found to lead to a significant increase in sickness when compared to those using a pit latrine. Farmers appeared less likely to become sick, and the likelihood of becoming sick increased with age.
Table 5.9 Regression comparing sickness rate and days sick with source of drinking water.

| Source       | Coefficient | Standard error | z  | P>|z| |
|--------------|-------------|----------------|----|-------|
| **Days sick** |             |                |    |       |
| **Spring**   | 0.916       | 0.628          | 1.46| 0.145 |
| **Well**     | 3.974       | 1.014          | 3.92| <0.001*** |
| **Borehole** | 0.584       | 0.770          | 0.76| 0.448 |
| **Piper water** | -0.242    | 0.753          | -0.32| 0.748 |
| **Other/Rain** | 0.339    | 1.449          | 0.23| 0.815 |
| **Region**   |             |                |    |       |
| **Amhara**   | -1.796      | 0.955          | -1.88| 0.06 |
| **Oromia**   | -2.123      | 0.947          | -2.24| 0.025* |
| **SNNP**     | -2.137      | 1.019          | -2.10| 0.036* |
| **Age**      | -0.010      | 0.018          | -0.56| 0.577 |
| **Constant** | 11.141      | 2.335          | 4.77| <0.001*** |

**Ill**

| Source       | Coefficient | Standard error | z  | P>|z| |
|--------------|-------------|----------------|----|-------|
| **Spring**   | -0.128      | 0.058          | -2.2 | 0.028* |
| **Well**     | -0.036      | 0.092          | -0.40| 0.691 |
| **Borehole** | 0.190       | 0.071          | 2.66| 0.008** |
| **Piped Water** | -0.027    | 0.070          | -0.40| 0.693 |
| **Other/Rain** | -0.131    | 0.132          | -0.99| 0.32 |
| **Region**   |             |                |    |       |
| **Amhara**   | 0.196       | 0.086          | 2.28| 0.022* |
| **Oromia**   | 0.014       | 0.084          | 0.17| 0.864 |
| **SNNP**     | 0.400       | 0.086          | 4.61| <0.001*** |
| **Age**      | 0.020       | 0.001          | 17.80| <0.001*** |
| **Farmer**   | -0.238      | 0.044          | -5.32| <0.001*** |
| **Constant** | -1.562      | 0.100          | -15.49| <0.001*** |

Table 5.9 Notes: *, **, and *** indicate statistically significant at a 5%, 1% and .1% level (respectively).

Use of fresh water springs as drinking sources was found to significantly lower the incidence of getting sick, while using a borehole as a water source (an unlined, unprotected water source) was found to increase the likelihood of being sick. Surprisingly use of wells (lined, protected water sources) was associated with an increase in the duration of sickness if a person became sick, although well-users were less likely to get sick in the first place than borehole users, controlling for demographic variables.
Table 5.10 Regression comparing sickness rate and how one’s garbage is collected.

<table>
<thead>
<tr>
<th>Days sick</th>
<th>Coefficient</th>
<th>Standard error</th>
<th>z</th>
<th>P&gt;z</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Garbage</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Burned</td>
<td>-2.291</td>
<td>0.791</td>
<td>-2.89</td>
<td>0.004**</td>
</tr>
<tr>
<td>Green Manure</td>
<td>-0.774</td>
<td>0.583</td>
<td>-1.33</td>
<td>0.184</td>
</tr>
<tr>
<td>Buried</td>
<td>-0.774</td>
<td>1.046</td>
<td>-0.74</td>
<td>0.459</td>
</tr>
<tr>
<td>Collection from household</td>
<td>-2.469</td>
<td>1.646</td>
<td>-1.50</td>
<td>0.134</td>
</tr>
<tr>
<td>Collection from dumping point</td>
<td>-3.039</td>
<td>1.135</td>
<td>-2.68</td>
<td>0.007**</td>
</tr>
<tr>
<td><strong>Region</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amhara</td>
<td>-2.823</td>
<td>0.946</td>
<td>-2.98</td>
<td>0.003**</td>
</tr>
<tr>
<td>Oromia</td>
<td>-3.401</td>
<td>0.912</td>
<td>-3.73</td>
<td>&lt;0.001***</td>
</tr>
<tr>
<td>SNNP</td>
<td>-3.099</td>
<td>0.975</td>
<td>-3.18</td>
<td>0.001***</td>
</tr>
<tr>
<td>Age</td>
<td>-0.013</td>
<td>0.018</td>
<td>-0.76</td>
<td>0.449</td>
</tr>
<tr>
<td>Constant</td>
<td>13.949</td>
<td>2.369</td>
<td>5.89</td>
<td>&lt;0.001***</td>
</tr>
</tbody>
</table>

Table 5.10 Notes: *, **, and ** indicate statistically significant at a 5%, 1% and .1% level (respectively).

The regression in Table 5.10 suggests that burning garbage is associated with an increased chance of getting sick, but only for a few days. This was statistically significant across all regions studied, as was age and occupation as a farmer (the majority of ERHS respondents were farmers). Interestingly, collection from a dumping point is also positively associated with sickness – although it should be noted that the rural sample includes relatively few households where collection from a dumping point is the norm.

**Discussion**

Findings suggest that improper waste management and toilet use are associated with sickness in Ethiopia, and that these issues must be analyzed in both urban and rural areas.
Urban Areas

As shown in Figure 5.4 the city of Bahir Dar is directly on a large body of water – Lake Tana – which experiences large inflows of waste and runoff from the city. Government, international organizations, and local NGOs can help combat this problem by funding lined landfills with effective caps. If modern lined landfills can be built in urban areas, then water contamination would likely decrease. Additionally, covering the trash with a cap would prevent it from affecting the environment around it (FFE – Bahir Dar, 2010). There is definitely a major problem involving unlined disposal areas and drinking water contamination, which international and domestic actors can play a part in remedying.

Similar problems with unlined waste pit disposal exist in Addis Ababa as well (Kuma, 2004). The four graphs in Figures 5.6-5.9 show some similarities in waste management trends in the city of Addis Ababa and Ethiopia as a whole. Figure 5.6 shows that a majority of Ethiopians across the country burn garbage as their main source of waste management, and Figure 5.8 shows that a small percentage of the population in Addis Ababa and Ethiopia use a pit/heap to dispose of waste. Open pit/dump sites are a problem in both urban and rural areas (Mahiteme, 2005). But current data suggest a relatively small percentage of waste in Ethiopia is being placed in open pit dumps, and a much larger percentage is being disposed of by “other means.” The African Development Bank did not clarify what “other means” signifies, but a review of literature speculates that this waste is being disposed of in the streets or into local water sources (Kumie, 2005 & 2004; Mahiteme, 2005). This research has shown that a majority of waste disposal sites, whether official sites or not, are unlined, which can greatly increase the rate of sickness due to contaminants seeping into the ground water (UN Report, 2010; Kuma, 2004). This issue is again portrayed in Table 5.9 where source of drinking water is regressed against being sick.

Rural Areas

In terms of drinking water sources, boreholes are primary ways that rural Ethiopians access drinking water because of its affordability and practicality in areas without infrastructure (Kumie, 2005). A borehole is an unlined, hence unprotected, water source where people dig directly into the ground and use the water they find (PLAN, 2007). This trend is troubling due to the findings in Table 5.7, where it was found that there was a connection between using “no toilet” and getting sick. The practice of open defecation is areas where bore holes are numerous is a recipe for disaster due to the possibility of human waste seeping into groundwater.

In 2008, only 8% of the rural Ethiopian population had access to improved sanitation facilities (flush toilet/protected system) as shown in Table 5.6. With the prevalence of open defecation in rural communities, there is certainly a need for latrines in each village, an action that government as well as international and local NGOs might finance, while also educating the local community on sanitation and latrine use.
Private Sector Involvement

Private sector involvement is another avenue that the city of Addis Ababa might strongly consider. Implementing effective private sector involvement, much like Dream Light in Bahir Dar, could work to alleviate the number of pit dumps, and offer effective house to house collection that would dissuade citizens from throwing waste in to streets or rivers. NGOs can either act as private companies doing the waste management, or they can provide the seed money for small businesses to start up in the waste management sector.

Conclusions

An investigation of waste management practices in the cities of Addis Ababa and Bahir Dar has underscored the challenges of waste management and the potential for private sector involvement in urban areas. It is recommended that private sector waste management be promoted by through financing private sector companies in urban areas. Dream Light Waste Management Company operating in Bahir Dar has shown to be more effective than previous practices in waste collection, and at a lower expense to the local people. That said, while improving the amount of waste collected from households, Dream Light may still contribute to environmental and health problems by placing waste in unlined, uncovered, disposal sites in the city. The city of Addis Ababa meanwhile is a prime candidate for private sector involvement in waste management as effective household collection will reduce the amount of open disposal sites/bins on city streets. The main issues in both urban areas are the lack of lined, covered landfills available to receive waste. If government and NGO actors are also able to construct modern lined, capped landfills, then unlined drinking water sources can be better protected, lowering rates of water contamination, and preventing disease and illness.

In rural areas of Ethiopia, the protection of groundwater is even more paramount due to widespread borehole use. Bivariate and regression analyses of 2009 Ethiopian Rural Household Survey data highlighted significant relationships between latrine and toilet use, drinking water sources, garbage disposal methods and sickness rates. Unprotected water sources like boreholes are at a high risk for being contaminated by waste through groundwater percolation. Sources of drinking water are affecting sickness at a varying scale across all regions, specifically in rural areas. If lined disposal sites are created in rural villages, they can handle waste without contaminating groundwater. Government and NGOs can also help protect ground water by building latrines in rural areas, which will greatly reduce human waste from contaminating water sources. International donor involvement in the financing and building of lined landfills and latrines could greatly reduce the contamination of groundwater and sickness rates in urban and rural areas alike.
Works Cited


Chapter 6 Rural Electrification & Renewable Energy in Ethiopia

Jillian Howell
Research Highlights


Jillian Howell

What renewable energy resources and technologies are available in Ethiopia that can lessen the negative environmental impacts of current energy use, specifically in rural areas?

This paper provides a literature review and spatial analysis of institutions, the electrical grid system, and the current state of the rural energy sector. Alternative energy options are reviewed and evaluated based on environmental and economic costs and benefits.

Case studies of Uganda and Kenya provide lessons for renewable technologies in East Africa and guide policy recommendations for Ethiopian government and civil society.

There is a disparity between rural and urban energy use in Ethiopia, as rural areas are largely left off of the central electrical grid.

Ethiopia has great potential to implement renewable technologies to decrease reliance on traditional fuel sources and increase rural electrification.

Policies addressing the energy sector should be implemented in stages:

Immediate: Pursue energy efficiency through fuel efficient biomass cook stoves.

Short term: Increase rural electrification through small off grid hydropower facilities.

Long term: Expand the central electrical grid to rural areas and generate power through geothermal energy.

By Jillian Howell

Executive Summary

“Rural Electrification and Renewable Energy in Ethiopia” is the sixth and final chapter in Environmental Policy Review 2011, a report produced by the Environmental Policy Group in the Environmental Studies Program at Colby College in Waterville, Maine.

The current energy regime in Ethiopia, one that is heavily reliant on the burning of biomass, has had major implications for the environment. The use of traditional fuels as the main source of energy by rural households, which comprise the vast majority of Ethiopia’s population, is especially an area of concern. Deforestation, land degradation, decreases in agricultural productivity, and increased greenhouse gas emissions have resulted from these patterns of unsustainable fuel consumption, and are further exacerbated by Ethiopia’s growing population’s increased energy demands.

This research aims to describe the current energy context in Ethiopia, and evaluate the potential for various alternative energy technologies to increase electricity access in rural areas. Research was carried out through a literature review of institutions governing the energy sector and renewable energy resources and technologies, a spatial analysis exploring energy disparities between rural and urban areas, and case study comparisons of neighboring countries to see what lessons may be learned about rural electrification and renewable technologies from other East African nations.

Findings suggest that Ethiopia has an abundance of potential renewable energy sources that, if pursued, could significantly alter the nature of Ethiopia’s energy sector and cause a shift away from the combustion of biomass and towards a future of country wide electrification. Efficient cook stove technologies are available to increase energy efficiency immediately while Ethiopia is still reliant on biomass, with Uganda providing an example of a country successfully reducing fuel wood consumption through improved cook stove use. In the short- to medium-term, off-grid small-scale hydropower can increase rural access to electricity, further reducing demand for traditional biomass fuels. Finally, central grid expansion to rural areas and electricity generation by geothermal energy should be the long term goal, and can be guided by Kenya’s experience with geothermal energy.

By Jillian Howell

Introduction

Background

The current use of traditional biomass fuels cannot meet the energy needs of Ethiopia’s growing population without compromising the health of the environment (Ethiopian Environment Review, 2010; Karakezi, 2003). For cooking and lighting needs, most Ethiopians rely on unsustainably sourced fuels such as charcoal and fuel wood. A 2010 report by the Ethiopian non-governmental organization (NGO), Forum for Environment, found the Ethiopian population as a whole is almost exclusively reliant on traditional biomass sources, using charcoal and fuel wood to meet 94% of total energy requirements, with petroleum and electricity representing the remaining 6%. Fuel wood consumption to this degree is a major issue, as it is associated with extensive deforestation and land degradation (Mulugetta, 2007; Karakezi, 2003; Karakezi & Kithyoma, 2002). While Ethiopia’s urban population is currently increasing, following the global trend of the last half century, the overwhelming majority of Ethiopians still live in rural areas and will remain there into the foreseeable future. Because of these demographic realities, it is rural energy consumption patterns that need to be addressed if the energy sector is to become sustainable.

Ethiopia’s dependence on traditional fuel sources has resulted in the depletion of fuel wood stocks faster than they can regenerate. This pattern, paired with the country’s rate of population growth, will end in environmental disaster unless changes are made in the near future. In his 2007 report, Mulugetta (p. 4) states that

Herein lies the current dilemma of Ethiopia’s energy sector whereby consumption levels are alarmingly exceeding replenishment rates of natural resources, and yet consumption levels remain too ‘near to the ground’ to bring about any meaningful surge in economic and social development.

Dalelo (n.d.) further examines how developing countries often suffer from energy crises due to the depletion of locally available energy resources. These energy crises are inextricably linked to food shortages as deforestation rates soar to supply energy, leading to the degradation of agricultural land and reduced food production (Forum for Environment, 2010; Bishaw, 2001). Deforestation is exacerbated by growing populations’ increasing energy demands, which is met by gathering more fuel wood and clearing more land for agriculture. Loss of forest cover contributes to soil erosion and the loss of nutrients necessary for agriculture. This cycle is
positively reinforcing, as erosion and loss in agricultural productivity leads to the further clearing of forests for new farming plots (Forum for Environment 2010; Bishaw 2001). The Ethiopian Environment Review of 2010 recognized the problems of land degradation, decreases in agricultural productivity, and deforestation as detrimental environmental issues stemming directly from the current energy regime.

Environmental problems resulting from Ethiopian energy consumption also extend beyond national borders. The burning of biomass and the resulting emissions are contributing to global climate change. In particular, the incomplete and inefficient combustion by traditional cook stoves releases greenhouse gases including carbon monoxide, nitrous oxide, and methane into the atmosphere (Kees & Feldmann 2011; Panwar 2009). Meanwhile, other organic compounds and particulate matter from biomass combustion contribute to local and regional air pollution.

According to Girma Hailu, an “adequate and reliable supply of energy is crucial for the economic development of any country,” and ease of access to affordable energy is often associated with a nation’s stage of economic development (2000, p. 9). Industrial countries that have already achieved high living standards have high per capita energy consumption, while the least developed counties of the world, such as Ethiopia, have extremely low per capita energy consumption. The World Bank Group points to electricity as a crucial element to human development, as the technology leads to more free time, improved health, and higher education levels (2010). In places reliant on traditional fuels such as Ethiopia, women and children spend hours of their day walking to gather fuel for cooking and lighting purposes, leaving no time to pursue other economic opportunities. Wood burning also results in indoor air pollution that has major health implications (Mulugetta, 2007).

Developing nations have sought to escape environmental ruin through the expanded use of energy efficient and renewable technologies. Ethiopia’s renewable energy potential is considerable, with abundant biomass efficiency, biogas, solar, hydropower, wind, and geothermal possibilities available (Forum for Environment, 2010; Mulugetta, 2007 & 1999; Karekezi, 2003). But to date, the potential in rural electrification through these renewable technologies, and the implementation of energy efficient technologies in biomass consumption have largely gone untapped. While challenges to implementation of these technologies may be considerable, the environmental harm from the continuation of the current energy regime will result in even greater challenges for Ethiopia.

This chapter explores Ethiopia’s current rural energy sector and the potential for a more sustainable future by answering the following question:

- What renewable energy resources and technologies are available in Ethiopia to lessen the negative environmental impacts of current energy use, specifically in rural areas?
This question was broken down into the following three parts:

- What is the current status of the Ethiopian rural energy sector?
- What renewable energy sources are available for electricity generation, and which of these are best suited to Ethiopia?
- What insights can other nations offer into renewable energy implementation in Ethiopia?

The chapter will continue with an outline of methods used to conduct this research. This is followed by an explanation of institutions that govern the Ethiopian energy sector, including the government bodies, energy laws, policies and programs. Findings from the literature review and spatial analysis on rural and urban energy disparities are then presented, followed by an exploration of alternative energies and electricity generating technologies. The cases of Uganda and Kenya and their experiences with renewable resources and technologies is then laid out. Next, the discussion section elaborates on the rural-urban energy divide, and considers the roles of energy efficiency and rural electrification over time in Ethiopia. This report concludes with policy recommendations outlining how the future of Ethiopia’s energy sector can be clean, renewable, and sustainable.

**Methods**

In order to explore the current energy sector of Ethiopia, as well as possible options for a more sustainable future, four methods were used. First, a literature review was conducted to explore the institutional framework of the energy sector, and to understand how these institutions affect patterns of electricity access in Ethiopia. The institutions studied include the federal government and its ministries, laws, policies, and international agencies. Second, spatial analyses were conducted using ArcGIS 10 to develop a map of the current electrical grid system and examine electricity access across rural and urban areas.

Third, renewable energy alternatives available in Ethiopia that could potentially alleviate rural dependence on traditional fuel wood were reviewed. Feasibility of implementation was evaluated based on the environmental and economic costs and benefits of each technology. Information was gathered through a literature review of relevant articles about renewable technologies, as well as reports from international agencies such as the World Bank.

Finally, two case studies of successful renewable resource use by neighboring East African nations were explored in order to gain insight, and inform immediate policy recommendations. Uganda and Kenya were chosen as the comparable case studies. Uganda has been successful in the implementation of energy efficient biomass cook stoves, and Kenya has developed geothermal energy resources to generate electricity. Table 6.1 shown below summarizes basic information about Ethiopia, Kenya, and Uganda.
Table 6.1 East African country summary, African Development Bank Group, 2005.

<table>
<thead>
<tr>
<th></th>
<th>Ethiopia</th>
<th>Kenya</th>
<th>Uganda</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population (millions)</td>
<td>83.0</td>
<td>40.5</td>
<td>33.4</td>
</tr>
<tr>
<td>Population Growth (annual %)</td>
<td>2.1</td>
<td>2.6</td>
<td>3.2</td>
</tr>
<tr>
<td>Urban Population (millions)</td>
<td>14.6</td>
<td>9.0</td>
<td>4.5</td>
</tr>
<tr>
<td>% of Population that is Urban</td>
<td>17.6</td>
<td>22.2</td>
<td>13.3</td>
</tr>
<tr>
<td>Rural Population (millions)</td>
<td>68.4</td>
<td>31.5</td>
<td>29.0</td>
</tr>
<tr>
<td>% of Population that is Rural</td>
<td>82.4</td>
<td>77.8</td>
<td>86.7</td>
</tr>
<tr>
<td>Electricity Access (population %)</td>
<td>12.0</td>
<td>13.1</td>
<td>33.4</td>
</tr>
<tr>
<td>Electricity Access (urban population %)</td>
<td>85.9</td>
<td>51.4</td>
<td>3.2</td>
</tr>
<tr>
<td>Electricity Access (rural population %)</td>
<td>2.0</td>
<td>3.6</td>
<td>4.45</td>
</tr>
<tr>
<td>Annual Growth of Electricity Access (population %)</td>
<td>0.4</td>
<td>0.5</td>
<td>13.3</td>
</tr>
<tr>
<td>Surface Area (km²)</td>
<td>1,104,300</td>
<td>580,400</td>
<td>241,000</td>
</tr>
<tr>
<td>Forest Area (km²)</td>
<td>123,000</td>
<td>34,700</td>
<td>30</td>
</tr>
</tbody>
</table>

**Laws and Institutions**

The Ethiopian energy sector operates under a framework comprised of the federal government and its various agencies, autonomous regulatory bodies, federal level laws and policies, and international institutions. The Ethiopian federal government is the primary creator of energy policy and law which comes in the form of proclamations, program initiatives, laws, plans and constitutional amendments. Ministries and agencies of the government are charged with regulating and enforcing these set rules, and international aid agencies and private investors often provide financial assistance to projects in the energy sector. Table 6.2, located at the end of this section, summarizes important institutions that provide the framework under which the Ethiopian energy sector operates.

**Regional Bureaus**

Regional States have established bureaus to follow energy matters in their particular states, but these bureaus have no power to influence or affect federal policy and law in their state (Forum for Environment, 2010; Hailu, 2000).

**Federal Government**

The Federal Democratic Republic of Ethiopia has nine Regional States and two municipality administrations, and is comprised of a two-tier government structure with federal and regional levels. The federal government is mandated with defense, foreign affairs, immigrations, currency, and criminal matters, while the regional councils are concerned with political, economic, and social affairs for each particular state, as well as any matters delegated to them by the federal government. The primary sources of energy law come from the national stage in the form of
constitutional provisions and parliamentary legislation (Hailu, 2000). Overall, specific laws and proclamations regarding energy and electricity are not easily accessible and are characterized by broad generalizing policy initiatives and goals rather than specific programs (Hailu, 2000).

**National Energy Policy of 1994**

The National Energy Policy of 1994 was implemented with the goal of addressing the problem of energy supply and its utilization. The policy promotes agro-forestry and efficient use of biomass fuels, while facilitating the shift to greater use of modern fuels. The policy also encourages privatization through the removal of government restrictions on private sector participation in electricity generation, the elimination of all subsidies, and the commercialization of public utilities. The rationale behind the reform of the electricity industry was to demarcate regulatory and operational responsibilities in order to increase efficiency through private participation in the investment and management of industry (Forum for Environment 2010; Hailu 2000; Dalelo, n.d.).

Hailu (2000) outlines the following as some of the basic principles of the 1994 Energy Policy:

- The reliance on traditional energy sources as well as its use in an unsustainable manner has resulted in forest depletion, environmental degradation, and fuel wood shortages;
- the failure of other economic sectors to meet development goals and increase productivity has been due to the inability to carry out energy plans and use resources;
- inefficient energy production, major systems losses, and energy waste continue to occur due to a lack of institutions, human capacity, and financial resources to undertake effective energy development programs; and
- energy price imbalances have created difficulties in stabilizing market variations.

The National Energy Policy of 1994 overall emphasized the need for equitable distribution of electricity across regions in order to facilitate socioeconomic development (EEPCo, 1996). The generation of electricity was envisioned through the development of hydro, geothermal, natural gas, coal, wind, and solar energy resources based on socioeconomic and environmental factors.

As a result of this reform, the Ethiopian Electric Light and Power Authority, formed in 1955 with the main objective of power generation, transmission, distribution and selling throughout the country, was restructured and became the Ethiopian Electric Power Corporation (EEPCo). The EEPCo, formerly a public entity, became a fully autonomous commercial power utility through Regulation No. 18/1997. A new regulatory agency, the Ethiopian Electric Agency (EEA), was also created in 1997 and was vested with the power to supervise and regulate the electric sector. Additionally, the New Investment Code Proclamation No. 37/1996 and

**Ethiopian Power System Expansion Master Plan of 2003**

Updated in 2006, the current Ethiopian Power System Expansion Master Plan outlines Ethiopia’s energy plan for the next 25 years, with specific recommendations made for the first ten years, and several scenarios outlined for the following fifteen. The most recent master plan update called for investment in wind and geothermal energy resources in order to generate electricity. It also predicts increases in demand for electricity, which will be met through the implementation of new hydropower facilities. Plans for connecting Ethiopia’s national grid to other countries in the region, such as Eritrea and Sudan, were also set forth (EEPCo, 2006).

**Ministry of Mines and Energy (MME)**

The principle government organ responsible for the formulation of energy policy, laws, and directives that influence the development of energy resources in Ethiopia is the Ministry of Mines and Energy (MME), comprised of two main sectors, mines and energies. Since 1993, MME has undergone significant structural change and reform because of the government’s overall trend in reducing its involvement in the commercial activities of the energy sector. The energy institutions held accountable to the MME include the Ethiopian Electric Agency, the Ethiopian Rural Energy Development and Promotion Center, and the National Petroleum Depot Administration. The MME is charged with the tasks of:

- Policy formation strategy concerning energy development, and (upon approval), supervising implementation;
- the collection and maintenance of a depository of energy data;
- the undertaking of studies and research;
- ensuring availability of gas and petroleum across the country;
- determining the volume of energy reserves and ensuring its maintenance;
- issuing licenses for energy exploration;
- issuing and supervising the implementation of directives concerning small-scale production and supply of electric energy; and
- establishing research and training centers to enhance the development of energy resources (Hailu, 2000).
The Ethiopian Electric Agency (EEA)

The Ethiopian Electric Agency was established in 1997 as a regulatory body to separate institutions that are a part of the electrical industry (and benefit from profits) from those regulating the industry. The specific responsibilities of the EEA include:

- Determining the quality and setting the standard of electric services;
- ensuring that the generation, transportation, and distribution of electricity are carried out in accordance with electricity proclamations, regulations and directives;
- issuing, suspending, and revoking licenses for the generation, transportation, distribution, and sale of electricity; and
- the appraisal and supervision of the implementation of tariffs in the electric sector (Hailu, 2000).

Ethiopian Electric Power Corporation (EEPCo)

Although the EEPCo is an autonomous company and no longer a public entity, it has retained its monopoly on electricity production. The EEPCo operates two systems: the Interconnected System (ICS), and the Self Contained System (SCS), which will be explained in depth in the findings section.

Ethiopian Rural Development and Promotion Center (ERDPC)

The ERDPC is responsible for:

- The technological research and development of renewable and household energy;
- the collection and analysis of data;
- training that focuses on rural energy issues;
- the identification of energy resources suitable for rural areas;
- improving local energy technologies and adapting foreign ones; and
- studying energy supply, demand, and consumption patterns in rural areas (Hailu, 2000).

The ERDPC also administers the Rural Electrification Fund, which is part of Ethiopia’s private-led rural electrification strategy focusing on rural areas not included in the EEPCo’s system expansion plans over the next ten years. Funded by the African Development Bank, the ERDPC’s Rural Electrification Fund provides loans and technical assistance to eligible rural electrification private and non-government project promoters (Development Bank of Ethiopia, 2006).
Ministry of Water Resources (MoWR)

The MoWR was established to undertake the management of water and energy resources of Ethiopia with the overall goal of enhancing and promoting national efforts towards the efficient, equitable and optimum utilization of the available water resources for significant sustainable socio-economic development. The ministry operates on the fundamental principles that:

- Water is a natural endowment owned by the Ethiopian people;
- all Ethiopian citizens should have access to water that meets basic human needs in terms of quality and quantity;
- water is a social and economic good; and
- water resources development should be approached using a “rural-centered, decentralized management, participatory approach” and an “integrated framework,” promoting participation of all stakeholders (MoWR, 2010).

Under the current water management policy, there are three important sub-sectoral policies, which include water supply and sanitation, irrigation, and hydropower. The hydropower subsector covers small, medium, and large scale power development activities and projects, with the overall objective being “to enhance efficient and sustainable development of the water resources and meet the national energy demands as well as cater for external markets to earn foreign exchange” (MoWR, 2010). The hydropower component of the national water management policy aim to ensure that:

- All potential hydropower projects are studied and designed to be ready for immediate implementation;
- there has been long term planning;
- projects are economically viable;
- environmental, technical, and safety standards are met;
- local human capacity for hydropower development is strengthened;
- trans-regional river hydropower development is promoted though cooperation and mutual understanding; and
- negative environmental impacts of hydropower are mitigated to the greatest extent possible (MoWR, 2010).

International Institutions

International institutions including the World Bank, African Development Bank, and the United Nations Development Programme also play a large role in the energy sector. In a developing nation such as Ethiopia where government funds are limited, international development agencies often take on the role of sustainability project financiers (i.e. the World Bank Ethiopia Electricity
Access Rural Expansion Project, Phase II - GPOBA 2008; the World Bank Electricity Access (Rural) Expansion Project Phase II, 2007; the World Bank Energy Access Project, 2005). Many of the projects funded by these agencies are renewable energy projects carried out in rural areas. One example is the World Bank’s 2007 project, “Accelerated Electricity Access (Rural) Expansion,” which aims to “establish a sustainable program for expanding access to electricity in rural communities, thus supporting broad-based economic development and helping alleviate poverty” through expanding the national grid and access to mini-grids, and developing stand-alone systems in rural areas (World Bank Group, 2011).

The major institutions governing the Ethiopian energy sector are summarized in Table 6.2

<table>
<thead>
<tr>
<th>Law</th>
<th>Government Institutions</th>
<th>International Institutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proclamations Privatizing Sector</td>
<td>Ministry of Mines and Energy</td>
<td>African Development Bank</td>
</tr>
<tr>
<td>Ethiopian Power System Expansion Master Plan of 2003</td>
<td>Ministry of Water Resources</td>
<td>UN Development Programme</td>
</tr>
<tr>
<td></td>
<td>Ministry of Water and Energy</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ethiopian Electric Agency</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ethiopian Rural Development and Promotion Center</td>
<td></td>
</tr>
</tbody>
</table>

Table 6.2 Institutions governing the Ethiopian energy sector, adapted from Hailu, 2000.

Findings

Grid Extension and Off-Grid Options

The Interconnected System (ICS) is responsible for generating more than 98% of the total supply capacity in Ethiopia and consists of 11 hydroelectric facilities, 15 diesel power plants, and one geothermal power plant, with total capacities of 1842.6, 172.3, and 7.3 MW respectively (EEPCo, 2011). The ICS is the central electrical grid of Ethiopia, which supplies most urban areas. The Self Contained System (SCS) is the decentralized system responsible for most rural electrification, and is comprised of mini grid systems as well as unconnected household technologies. The mini grids are supplied by three small hydro plants and a number of isolated diesel generators (Forum for Environment, 2010). These small-scale hydropower facilities have a capacity of 6.15 MW, and the diesel generators are capable of generating 31.34 MW of electricity (EEPCo, 2011). Off-grid and stand-alone technologies of the SCS operate where it is not cost-effective or geographically feasible to extend ICS transmission lines (Brent et al., 2010; Dalelo, n.d.).
The extension of the national electrical grid is often the simplest, most cost efficient way to increase access to electricity. With low cost per connection and ease of implementation due to pre-existing infrastructure, grid extension is often the best way to electrify urban and peri-urban areas (World Bank Group, 2010). In some cases, extension of the central grid can be the most cost effective solution in rural areas as well, although most rural electrification has been realized through off-grid measures. In Ethiopia, due to geographical barriers, the dispersed nature of rural communities, and the lack of existing infrastructure, rural electrification projects have largely been based on mini grid and stand-alone household technologies (Barry et al., 2011; World Bank Group, 2010; Dalelo, n.d.). Mini grid and stand-alone systems are relatively new technologies in electrification, emerging just two decades ago. Technological development and improvement of small-scale renewable energy-based technologies, including solar photovoltaic (PV) systems, small wind generators, and micro hydropower, along with the progress made in service delivery systems, make a sustainable, low emission, renewable rural electricity sector possible. As technology continues to improve, prices are expected to go on decreasing (World Bank Group, 2010).

*Spatial Distribution of Electricity Access*

The map featured below shows the 11 hydroelectric plants, 15 diesel plants, and one geothermal plant that make up the Interconnected System (ICS) in Ethiopia as of 2011. Also shown are the three small hydro plants of the Self Contained System (SCS). The diesel generators of the SCS are not displayed because information about them was not available. Medium to high voltage transmission lines connecting the ICS are also featured. Population density was used as an indicator of rural and urban areas, with areas containing more than 150 people/km² classified as urban (OECD, 2010). The power plants and transmission lines are shown to be concentrated in urban areas.
Figure 6.1 Current electricity generating facilities, EEPCo, 2011.
Disparities in energy consumption and access are reflected in the table below, which shows the type of fuel used for cooking amongst rural and urban populations, as well as the total population. The disparity between urban and rural areas is exemplified in the access to modern fuels. In rural Ethiopia, only .06% of people have access to modern fuels for cooking, while 27.08% of urban populations have access. In addition to the divide between rural and urban energy access, these data also show how limited electricity access is to the country overall with only .02% of the rural population, and 1.31% of the urban population using electricity as cooking fuel. According to the 2010 Ethiopian Environment Report, which cites statistics from the EEPCo, overall access to electricity is at about 5% in rural areas, and 22% overall. It should be noted that access as defined here does not necessarily mean a household electrical connection, but rather close proximity of the household to a low voltage distribution line (Forum for Environment, 2010). While the numbers shown in the table below are significantly lower than overall electricity rates, they reflect the general pattern of low electricity access and use in Ethiopia.

### Table 6.3 Population percentages & cooking fuel type used in Ethiopia in 2005, African Development Bank Group.

<table>
<thead>
<tr>
<th></th>
<th>Rural</th>
<th>Urban</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access to Modern Fuels</td>
<td>.06</td>
<td>27.08</td>
<td>3.3</td>
</tr>
<tr>
<td>Access to Traditional Fuels</td>
<td>99.94</td>
<td>72.92</td>
<td>96.70</td>
</tr>
<tr>
<td>Electricity</td>
<td>.02</td>
<td>1.31</td>
<td>.17</td>
</tr>
<tr>
<td>Kerosene/Gasoline/Paraffin</td>
<td>.05</td>
<td>24.62</td>
<td>2.99</td>
</tr>
<tr>
<td>Liquid Petroleum Gas</td>
<td>0</td>
<td>1.15</td>
<td>.14</td>
</tr>
<tr>
<td>Residual/Dung/Other</td>
<td>8.33</td>
<td>3.27</td>
<td>7.72</td>
</tr>
<tr>
<td>Wood/Charcoal</td>
<td>91.61</td>
<td>69.65</td>
<td>88.98</td>
</tr>
</tbody>
</table>

### Renewable Energy Resources in Ethiopia

Although Ethiopia is reliant on traditional biomass fuels to meet its energy needs, there are abundant and diverse renewable resources and electricity generating technologies available that present Ethiopia with the opportunity to move away from the current energy regime. These resources and technologies include energy efficient biomass cook stoves, biogas, solar thermal and photovoltaic, large and small-scale hydropower, wind, and geothermal. Each resource and associated technology provide certain economic and environmental benefits and drawbacks. Table 6.4 at the end of this section summarizes these renewable energy possibilities.

*The Case for Energy Efficiency*

While Ethiopia’s current energy regime is based on the consumption of renewable fuel wood, they have encountered problems because of the rate of consumption. Fuel wood stocks are
unable to regenerate fast enough keep up with current rates of depletion. In order to make this consumption more sustainable, energy efficient technologies such as improved cook stoves could be pursued. While this would still leave people reliant on fuel wood, the amount of fuel wood needed to generate the same amount of energy would decrease, helping to alleviate pressure on forests. This strategy can be implemented immediately because of the affordability of fuel-efficient cook stoves on a household level, low maintenance requirements, and little training needed for use. Many different models of stoves have emerged, but all aim to either improve combustion efficiency, which reduces harmful emissions, increase heat transfer to cooking surfaces, which reduces fuel use, or both (Kees & Feldmann, 2011; Ruiz-Mercado et. al, 2011; USAID, 2010). One major challenge to implementation of this technology is that it requires a change in behavior. Cooking on an energy efficient stove will not happen if the use of this stove is perceived as inconvenient, ineffective, or if people are not able to prepare the same dishes as they could on their old stove. Awareness of the fuel wood problem and knowledge about the benefits of improved cook stoves also needs to be raised in order to create demand for the product. Donor organizations, especially international organizations, and the public sector have the potential to create this demand through campaigns highlighting problems associated with traditional cook stoves, and the benefits of cleaner ones (Kees & Feldman, 2011).

**The Case for Biogas**

Biogas is generated through the fermentation of oxygen-deprived organic material, and can be used for electricity generation on household and mini grid levels. Ethiopia’s large livestock population, and the involvement of most rural households in subsistence farming, which includes animal husbandry, makes animal dung readily available for biogas generation. Benefits of this technology include low investment levels on a household level. Also, it alleviates pressure on fuel wood demand, and soil fertility is maintained as the bio-slurry that remains after the gas is produced can be used as organic manure. Challenges arise though in the collection of dung, which can be difficult if livestock are not penned in one location. Also, herds must be large enough to ensure steady generation of electricity, which may prove difficult for farmers with small herds. Additionally, deforestation may be encouraged if grazing lands are expanded at the expense of forest lands (Getachew et al., 2006; Karekezi, 2003).

**The Case for Solar PV and Thermal**

Solar energy has the potential to be used in both small- and large-scale electrification measures, and can be utilized in two forms; thermal energy and photovoltaics. Thermal energy is the use of heat to run a heat engine to generate electricity, while photovoltaics involve the direct conversion of sunlight into electricity. On a household scale, solar thermal and PV can be used to generate electricity for cooking and lighting, while larger outputs of electricity could be produced at the community level through mini grids, and at an industrial level through grid
extension. Solar PV is a technology that is being widely pursued around sub-Saharan Africa with the support of international development agencies (Karakezi, 2003; Karakezi & Kithyoma, 2002).

Despite their large-scale promotion, solar PV has encountered challenges that thus far have been insurmountable to make the technology successful on any extensive scale. Not only can solar PV only be used for lighting and powering low-voltage appliances, it is extremely expensive to install, especially for low income rural populations. According to Karekezi and Kithyoma’s 2002 report,

…the cost of a typical low-end PV household system is several times higher than the GNP per capita of most sub-Saharan African countries. This comparison actually underestimates the relative high cost of the PV systems because the GNP per capita figure overestimates rural incomes by including the high-income urban residents (p. 1075).

The Case for Wind

Wind is currently included in the EEPCo’s master plan for the upcoming 25 years, although the variability of the resource presents a problem to its adoption in Ethiopia. Because of the pervasiveness of low wind speeds in sub-Saharan Africa, especially in the land-locked countries, most wind machines have been used to pump water rather than generate electricity. High technological costs, low levels of technical skills, and little awareness of the potential of the technology also create barriers to implementation. Logistically, transporting wind turbines is also a major problem because of the lack of basic transportation infrastructure. Because of these factors, neither grid connected nor off-grid wind projects have been undertaken in Ethiopia (Karakezi, 2003). A study performed by Bekele (2009) also reflected the low, variable potential of this resource. In the study, wind potential was measured from four specific sites in Ethiopia, and results found that wind energy may be integrated with other systems, including solar PV, diesel generators, and battery to generate electricity, however the potential may not be sufficient for independent wind systems.

The Case for Hydro

Hydropower is suited to areas with steep rivers that flow year round, a condition which Ethiopia satisfies (Kabaka, 2007). Currently, hydropower is the main source of electric power in Ethiopia, with only about 2.4% of the exploitable potential being used (Ethiopian Environment Review, 2010). Most of this hydropower generation though, is in the form of large-scale operations that send electricity through the Interconnected System. While hydropower is technically renewable, there are risks associated with near complete reliance on this form of production, including vulnerability to climate change and geohazards (Ethiopian Environment Review, 2010). Due to the precipitation and siltation of the reservoirs, some of the hydro power plants are losing storage volume, resulting in reduced energy output throughout the year. Another restriction of
the hydro system is caused by the variability of rainfall. In years of low rainfall and drought, the amount of water available during the rainy season from July until September does not allow for the reservoirs to be completely filled (Karakezi, 2003). Additionally, while hydropower is a clean renewable resource, damming of rivers can have major negative environmental impacts on ecosystems.

Environmental impacts associated with small-scale hydropower are much less than those connected to larger operations. Small-scale hydro is also amenable to the mini grid system, making it ideal for rural areas. Like large-scale hydropower facilities though, small-scale hydro is susceptible to periods of drought and the effects of climate change (Teklemeriam, 2000). Reliance on hydropower with little diversification could pose problems for Ethiopia in the future (Heckett & Akilu, 2008).

The Case for Geothermal

The Great East African Rift System, a hotspot of geological tectonic activity, extends for about 6500 km from the Dead Sea-Jordan Valley in the Middle East to the north, down to Mozambique in the south. The rift system is comprised of three main branches; the Red Sea Rift, the Gulf of Aden Rift, and the East African Rift, the last of which runs through Eritrea, Ethiopia, Kenya, Tanzania, Zambia, Malawi and northern Mozambique (Teklemariam et al., 2006). At the East African Rift Valley, heat energy from the interior of the earth escapes to the surface in the form of volcanic eruptions, earthquakes, hot springs and fumaroles. This energy possesses a geothermal electricity generating potential that if tapped, would provide a clean, renewable, local resource with enough capacity to meet the needs of not only Ethiopians, but would be an exportable, profit-generating commodity (Teklemariam et al., 2000).

Geothermal exploration began in Ethiopia in 1969, and research since this time has shown geothermal energy potential in both the Ethiopian Rift Valley and the Afar depression, which are both part of the great East African Rift System. Within Ethiopia, the Ethiopian rift extends for over 1000 km from the Ethiopia-Kenya border to the Red Sea, covering an area of 150,000 km², and providing an estimated potential of about 700 MW of geothermal energy. Despite this extensive potential, Ethiopia only has one geothermal power plant. The Aluto-Langano geothermal pilot power plant has been open since July 1998, although technical problems have hindered its operation throughout its lifetime, and generation is currently only at 3MW (Teklemariam et. al., 2000). Plans for greater geothermal energy use are currently included in the EEPCo’s master plan for the upcoming 25 years.

There has already been much research into potential geothermal sites, and of these areas, about 16 have been deemed suitable for geothermal electricity generation with adequate potential and capacity, while other locations have been determined capable of being developed for the direct utilization of geothermal heat in agriculture (Teklemariam, 2006; Teklemariam et. al., 2000).
Using today’s technologies, Eastern Africa has the potential to generate about 2,500-6,500 MW of energy from geothermal power. Benefits of geothermal include the diversification of the electricity sector. Hydroelectric generation is dominant, despite its vulnerability to drought, silting, and climate change, as well as the damaging effects of dam creation. Challenges to development of geothermal energy include high initial costs, risky financial investments, a lack of government and institutional support, limited technical or scientific knowledge the resource, and the geologic hazards associated with building and setting up a power plant on an active fault line in the Rift Valley. In order to overcome these constraints, support, especially financial support in the form of loans and grants from donor and development agencies is necessary. The participation of private sector investors may also provide necessary financial backing (Teklemariam et. al, 2000).

Table 6.4 Summary of renewable energy possibilities in Ethiopia, World Bank 2008; Dalelo; Mulugetta, 2007, 1999.

<table>
<thead>
<tr>
<th>Resource</th>
<th>Details</th>
<th>Size</th>
<th>Benefits</th>
<th>Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Efficient Cook Stoves</strong></td>
<td>Rocket stoves</td>
<td>Household</td>
<td>Affordable to individuals easy implementation</td>
<td>Still relies on direct combustion of biomass</td>
</tr>
<tr>
<td><strong>Biogas</strong></td>
<td>Large livestock population, cattle dung available</td>
<td>Household or mini grid</td>
<td>Not directly depleting forests</td>
<td>Financial limitations, may encourage deforestation</td>
</tr>
<tr>
<td><strong>Solar</strong></td>
<td>Thermal or Photovoltaic, strong solar regime</td>
<td>Household or mini grid</td>
<td>Clean</td>
<td>Not affordable to individual households</td>
</tr>
<tr>
<td><strong>Wind</strong></td>
<td>No operating wind facilities</td>
<td>Mini grid or grid</td>
<td>Clean</td>
<td>Wind variability, difficulty in turbine transport to site</td>
</tr>
<tr>
<td><strong>Hydro</strong></td>
<td>87% of electricity is generated from large scale hydropower</td>
<td>Mini grid or grid</td>
<td>Clean</td>
<td>High initial cost, variability of rainfall, silting at dams, dam disrupts ecosystem, need diversification</td>
</tr>
<tr>
<td><strong>Geothermal</strong></td>
<td>Electricity generating</td>
<td>Grid</td>
<td>Clean</td>
<td>High initial investment, requires skillful maintenance</td>
</tr>
</tbody>
</table>
Comparable Cases: Uganda and Kenya

**Uganda’s Energy Efficiency Promotion**

Uganda, a country where people have historically cooked on relatively inefficient three-stone fires due to limited fuel wood access and low incomes, provides an example of successful efficient cook stove implementation on a large scale. Currently in Uganda, the GTZ (German Technical Cooperation) is implementing the Ugandan Energy Saving Stove Project (UESSP) on behalf of the German Federal Ministry for Economic Development and Cooperation. This program is part of the larger Ugandan-German initiative, “Promotion of Renewable Energy and Energy Efficiency Programme” (PREEEP). The PREEP began in late 2004, and largely targets rural areas characterized by high population densities suffering from major fuel wood shortages (Kees & Feldmann, 2011).

The UESSP developed three stove models made from local materials (except for the portable metal stove) based on the “rocket stove” principle. The basic rocket stove design includes an insulated combustion chamber composed of lightweight materials that won’t absorb heat to keep fires hot (above 650 °C) to burn wood more completely. The design also includes an elbow at the bottom of the stove to feed in the wood so that it burns slowly, and only at the tips (Still & Winiarski, 2001). Research and development are ongoing by GTZ at a testing center at the Makerere University in Kampala. Since 2005, around 500,000 households in Uganda have started using these energy efficient stoves, setting an unprecedented dissemination rate in Africa for this type of technology in such a short period of time. Dissemination of the stoves was able to move so rapidly due to the use of local materials, involvement of Ugandan artisans in product creation, participation of local NGOs, implementation of a system monitoring stove use, government support in the form of acknowledgement of the technologies’ importance, and the setting of clear targets for the project. Additionally, the stoves were affordable, convenient, and perceived as a desirable modern technology. The project’s success is reflected in the following excerpt from Kees and Feldmann’s 2011 report:

A family using the improved stove saves on average 3.1 kg firewood per day, seven hours per week in cooking time and on the collection of firewood, 26 EUR per year on fuel, if fuel is bought; and – every second woman reports suffering less eye irritation, coughs or accidental burns (Kees & Feldmann, 2011, p. 7599).

**Kenya’s Geothermal Exploration**

Currently, Kenya is the greatest producer of geothermal energy in Africa. By harnessing this resource, Kenya generates a total of about 130MW annually, and thus can be looked to as a successful case study for Ethiopia to learn from (Teklemariam, 2000).
Kenya’s exploration of its geothermal resources began in the 1950s. In 1982, Kenya became the first African country to tap geothermal energy for electric power generation. Limited hydro resources, combined with geothermal’s renewability and abundance, were driving factors in the industry’s growth. Kenya’s first electricity generating geothermal plant has been operating for 24 years and has proven to be reliable and economical, which has in turn led to increased development of the industry. Over the past decades, Kenya has acquired considerable expertise in earth sciences and engineering related to geothermal resources, developing both human and technical capacity. Additionally, the development of the financial institutions necessary to support the undertakings of a risky, expensive energy producing process has followed. As of 2000, 105 wells of depths varying between 1,000 and 2,600 meters had been drilled for exploration, production, monitoring and injection. Recent studies estimate further development into the future, with total generating capacity estimated to be 1,260 MW by 2018 (Teklemariam et al., 2000).

Discussion

The Rural-Urban Divide

Currently, rural households are meeting energy demands with traditional fuels such as fuel wood and charcoal, mainly because they lack access to more modern energy technologies. Investment in the energy sector and the development of alternative energy technologies often neglects rural areas. Ethiopia is following the worldwide trend of urbanization, but the vast majority of its population still lives in rural areas. This demographic fact is at odds with the current patterns of electricity and energy generation. Mulugetta references the “modernization” development concept, which leads to the channeling of funds and investment to what is thought to be by some, the most productive and efficient centers, otherwise known as urban areas. This concept relies on the assumption that eventually, the booming urban center with the large scale energy systems including hydroelectric and thermal plants will boost industrial development and will incorporate the rural populations into the workforce where they too will reap the benefits. The reality has shown though that the rural populations, which comprise an overwhelming portion of the nation’s people, are left on the fringes (Mulugetta, 2007).

The generation of electricity can be accomplished in a variety of ways, especially with Ethiopia’s abundance of renewable resources. However, there are many constraining factors influencing the pursuit of these renewable resources. Major barriers include implementation and maintenance costs, lack of financial, technical and human capacity, little interagency coordination, and a lack of government support (Mulugetta, 2007). As Dalelo states, “rural electrification has long been top on the development agenda of many developing countries. Nevertheless, a vast majority of the population in these countries is still in the darkness” (n.d., p. 1).
Current and Potential Roles for Energy Efficiency

Energy efficiency through efficient biomass cook stoves may be exactly what the Ethiopian energy sector needs right now. This technology provides a short-run alternative to rural electrification, and is relatively easy to implement because stoves are household technologies, so there is no need for the construction of new infrastructure. Biomass combustion is the main source of energy in sub-Saharan Africa, and will continue to be the main source into the foreseeable future. Keeping this in mind, in order to make real changes in the immediate future, energy efficiency rather than a complete change in technology should be implemented in Ethiopia. Uganda’s experience with this technology may offer valuable insights as Ethiopia undertakes their own projects. An improved charcoal stove, the “Lakech,” and a biomass stove, the “Enjera” or Mirt Lakech, as well as the Mirt stove were developed and have been introduced to Ethiopia. Thus far, they have been proven to provide energy savings over traditional stove and open fire stoves. Large-scale distribution of improved stoves would help to reduce pressure on the biomass resources, and according to the 2004 UNCCDP report:

…if the whole rural and urban households (estimated to be about 14.44 million) in Ethiopia shift to the improved Lakech and Mirt stoves, a saving of about 7,778,800 tonnes of fuel wood which requires clear cutting of 137,192.24 hectares of forest will be achieved in an annual basis. This implies that sufficient distribution of these improved stoves will have significant contribution to save the biomass resources of the country in general and forest resource in particular and to combat land degradation and mitigate the effects of drought (p. 29).

Current and Potential Roles for Rural Electrification

Energy efficient technologies alone, though, are not enough. In the long term, Ethiopia should pursue an agenda of rural electrification. Electricity may not seem an appropriate technology to bring to some people in Ethiopia, as rural villages far from transmission lines with needs only for cooking and lighting may not appear to need electricity (Karakezi, 2003). The issue becomes complex though, when health and quality of life are affected by energy choices, or lack thereof. Development issues such as these are not unrelated to the environmental reasons focused on by this research that support electrification. Electricity has the potential to mitigate not only problems faced by individual households, but global climate change, and large-scale deforestation and land degradation. The recognition that the current pattern of traditional fuel consumption is degrading the environment by many developing countries has placed rural electrification on their development agenda, Ethiopia included (Mulugetta, 2007).

Electrification can proceed down a few different paths: extending the grid, establishing off-grid mini systems, or building off-grid stand-alone systems. As Figure 6.1 demonstrates, rural areas have mostly been left out of the national electricity grid system, and mini grid and stand-alone systems appear to be a more feasible option in villages characterized by low population density, and relatively large distances between households (Dalelo, n.d.). These systems, especially the
off-grid mini systems, can be powered by a number of renewable resources. According to the renewable energy paradigm, small scale, decentralized systems are most efficient for renewable energy. These system types are also inherently conducive to rural settlements (Mulugetta, 2007).

Diversification of electricity generating technologies should be a priority of the energy sector in the long run (Heckett and Aklilu, 2008). If Ethiopia continues on its current track of urbanization and population growth, rural population patterns will change. Dispersion patterns affect cost effectiveness of connecting a village or household to the national grid. Increased urbanization and infrastructure building may change the potential scope of the national grid. Depending on rates of urbanization, development of infrastructure, and population growth, the ICS may become more cost-effective than the SCS in certain places in the future.

Plan For the Future: Strategies over Time

While Ethiopia’s energy industry may be suffering from a lack of many things, options is not one of them. The future of Ethiopian rural electrification and environmental sustainability depend on the policy choices made, as well as the planning and research carried out today. If Ethiopia is to make a meaningful change, steps need to be taken immediately in the form of expanded dissemination and implementation of energy efficient biomass cook stoves. While this short-term solution is going on, a plan for the future needs to be crafted. In the near future, decentralized, off-grid methods appear to be the best fit. And with biogas technologies indirectly leading to deforestation, the high cost of solar PV, large-scale hydro power’s vulnerability to environmental factors, and wind suffering from a low potential, small-scale hydro small appears to be the most attractive option. Ethiopia also already has experience and knowledge of hydropower technology.

The future though does not just include tomorrow, or the next few years, but decades down the road as well. In this longer term vision of the future, the central grid should be expanded so that rural areas are brought into the Interconnected System. Generation for this system should be diversified away from large scale hydroelectric power. One way to do this would be to seriously explore and if applicable, pursue geothermal energy generation (Niez, 2010; Karakezi, 2003; Teklemariam et al., 2000).

Conclusions

Underlying the energy problem in Ethiopia is the dichotomy between pressing energy needs now and the need for long term planning for the future of complex rural energy and electrical settings. Short-term solutions and plans for a sustainable future often seem at odds with one another (Mulugetta, 2007).
Energy policy matters to the environment, and it is especially relevant in a developing country such as Ethiopia that is currently reliant on traditional fuels. Ethiopia’s growing population, and an increasing demand for energy are only compounding the unsustainable use of biomass, propelling Ethiopia in the direction of disaster. The potential for change in the sector though, exists. Ethiopia is endowed with renewable resources ready to be used to sustainably develop the country. Ethiopia needs to look to its neighbors who have successfully implemented renewable technologies and use NGO and international development agencies to assist in technological dissemination and financing of projects. If properly planned and executed, Ethiopia’s future could be a bright one.

Moving ahead, Ethiopia should consider the following policy recommendations:

- **Today**: Energy efficiency is the most feasible way to immediately impact the energy sector without making major changes to infrastructure. Ethiopia should therefore continue and expand its current programs of implementation of energy efficient cook stoves. Uganda has implemented an especially successful program, hence Ethiopia could adopt some of Uganda’s methods, while also learning from the country’s mistakes.

- **In the short term**: Planning and research in the short term should focus on implementing mini off-grid hydropower facilities to generate electricity for rural areas. Ethiopia has a history of hydroelectric power generation, and can therefore use the knowledge gained from this experience to bring hydropower to rural areas. Small-scale hydro will work in rural areas with dispersed populations, and is less environmentally detrimental than large hydropower facilities.

- **In the long term**: In the long term research and technical training for geothermal power and associated processes should be pursued. Geothermal energy has great potential as a renewable resource that could supply electricity to the entire country, and also generate enough energy to export for additional income. At the same time, however, the expansion of geothermal energy to rural areas will require the extension of the central grid to these areas, therefore significant planning for such major infrastructure construction will also be necessary.
Works Cited


Additional References


Appendices
## Chapter 1 Appendices

### Appendix 1A

Table 1.A Contacts

<table>
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<tr>
<th>Name</th>
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Appendix 1B

Phone Interview with Forum for Environment

In response to the following questions, sent via email on October 21, 2011.

Questions regarding Forum for Environment and water quality

1. How does Forum for Environment encourage collaboration on environmental issues in Ethiopia? For example, do you bring together stakeholders at meetings? Work with NGO’s to build capacity? Set up networks of NGO’s and other stakeholders to foster communication?

2. Does Forum do work on the water quality of lakes?

3. What are the strengths of collaboration, as opposed to having one stakeholder address an environmental issue?

4. Are there difficulties of collaboration? Does it get challenging bringing people with different opinions and interests together?

5. Is the government receptive to collaborating on environmental issues, and does this vary by region?

Questions regarding the Forum for Environment and the environmental policy environment

1. Would you tell me a little about your public meeting and dialogue forums on environmental issues?

2. What do you generally try to accomplish with these policy meetings?

3. Why is it important to have these meetings?

4. How would you describe your relationship with the environmental protection agencies?

5. Do you coordinate with government officials on programs?

6. What level of government do you primarily work with? (Federal, Regional, Woreda?)

7. What is the most important environmental issue addressed by your organization?

8. I’ve noticed that you have many local FfE groups spread throughout the regions of Ethiopia – to what extent have you found that the environmental legislation varies between regions?

9. What types of challenges, if any does this pose for your organization?

10. How would you describe the relationship between domestic environmental NGOs and the Ethiopian government?

11. Is that relationship different from that of international environmental NGOs?

12. In your opinion, does this differ from the experience of other types of (humanitarian) NGOs?

13. Could you describe any areas where existing environmental policy significantly affects your programs?

14. What are areas of environmental policy or management by the government that you believe could be improved upon?

15. Could you tell me about the Ethiopian Environment Information Network?

16. Do you know of any other organizations that would be interested in speaking with me?
Interview with Forum for Environment

21 October 2011, 7:20 AM

Introduction to FFE

FFE is a non-for-profit and non-governmental organization working on environmental communication and advocacy. It typically works in partnership with local and international as well as a number of governmental organizations. Its 5 major thematic areas include:

- forests
- protected areas
- renewable energy
- urban air quality
- climate change

Environmental communication is the core focus: awareness raising, advocacy. Currently working with many NGOs; Is serving as the secretariat of the Ethiopian civil society network on Climate Change (ECSNCC) which comprises 60 organizations working on environment and climate change related issues, making it one of the largest and visible network on environmental issues in Ethiopia.

FFE Advocacy tools include, among others:

Public meetings and public dialogue forums
Research and publications
Capacity building - Establishment and consolidation of local groups
Incentive and acknowledgement scheme

Proceedings of the public meetings are published and distributed. These meetings has helped to influence policy formation at multiple levels. These public dialogues and meetings have been very strong and effective tools. They are mostly organized at national level in partnership with with other like-minded organizations to address a number of environmental issues (over 10 different topics have been addressed over the last few years). They are very effective in bringing together different stakeholders. Policy makers and politicians including parliamentarians are invited to these dialogues and meetings.

Other activities include:

The Green Award program is another good model of collaborative advocacy program of FFE – collaborative advocacy works better in Ethiopia than the “confrontational” advocacy.

Research & Publications (e.g., Ethiopian Environment Review): FFE commission researches on a number of topical issues and publish the research findings for a wider distribution

Campaigns:

Has initiated and run different Campaigns. The most recent one’s include: A) America take the lead: Two million petition cards were signed, collected and delivered to the white house B) Countdown to Copenhagen: 32,000 petition cards were signed, collected and handed over to the Ethiopian lead negotiator and the Executive secretary of the UNFCCC

Networking:

Initiated and joined a number of national, regional and international networks working on diverse environmental issues. Instrumental in sharing information and knowledge, capacity building as well as strengthening leverage for lobbying and advocacy

Establishing and Consolidating local groups
Work to consolidate local FFE groups. Currently 12 groups in 6 Regional States working towards building a national environmental movement

quote: “rather than being in Addis and shouting out to the communities…”
quote: “the more you collaborate the more you can influence policy”
These groups can focus on local issues and have a degree of autonomy, which means they can have a louder voice in the community.

On policies in Ethiopia:
quote: “…very good and very nice policies on paper.”
The problem lies when we come to actual implementation, but this problem of implementation is not unique to the environment sector, but it also applies to other sectors as well. It is a common feature of developing nations.
Almost all of the necessary policies seem to be in place, but they are often not enforced. Improper implementation of policies means there is still an effort required.
However, thus far FFE has had no serious problems with policy in implementing their work.

On water:
Water was previously a thematic area of FFE, but no longer. Can provide contacts of organizations working on water next week. Suggested that we check with Hawassa University for water quality data.

On challenges to working in Ethiopia:
Yes of course there are challenges, especially with advocacy but not impossible.

On government receptivity:
Legally there is no problem on working on environmental issues as an NGO in Ethiopia. As could be true for any developing country sometimes a local official will stop you all of a sudden by himself but this is not policy of the government, but in general environmental NGOs are given more space than, for example, human rights NGOs.
FFE has a good relationship with the EPA and other relevant government organizations including Parliamentarians and line Ministries.

Past Challenges
The issue of environment was simply not an issue in the eyes of the government or the general public a few years ago. Now you can talk about the environment at all levels, from Woreda to National. We believe that FFE has contributed its share to the change.
Generally, there is no legal problem for any environmental NGO in Ethiopia to register as Ethiopian Resident Charity (must raise 90% of its funds out of the country). Once legally registered fulfilling all other requirements it is possible to operate in any part of the country.

Follow-Up Email Exchange:
23 October 2011
We would all like to thank you for your time this past Friday, and your patience in answering our questions. We have attached our compiled notes in a Word document to this email - please look over these notes to ensure that we have accurately represented the subject matter of our talk on Friday October 21st.
After going through our notes, we had two brief follow-up questions:

- What year did Forum for Environment start the public dialogue meetings?
- How often have they been held?

During our talk on Friday, you also mentioned that Forum for Environment had 6-7 years’ worth of public meeting minutes available; would it be possible for you to send these to us? Documentation of these meetings would be very enlightening and help us in fully understanding the work of your organization.

Finally, we were also wondering if there was any research, writing or other work that our class might be able to do
that would be of use to Forum for Environment. One of Colby College's strengths is in the application of Geographic Information System (GIS) software for making detailed maps - would Forum for Environment like any maps, graphs or figures produced relating to your work? For example, you mentioned that Forum for Environment was partnering with 12 local grassroots groups within Ethiopia - if you were interested, we could produce a map depicting the location of these groups, along with any other indicators that would be useful. Attached to this email is an example of a GIS map produced by one of our students working on forest cover and carbon sequestration as an example of what we can produce.

Thank you again for your time and effort. We are happy for the opportunity to become familiar with your organization, and look forward to future communication.

24 October 2011

Our public meetings started in 2000. Each year we pick specific thematic topic and the number of each year's meetings depend on the nature of the topic and availability of resources. We can share with you some of the proceedings of past meetings with you by surface mail.
Appendix 1C

Email Exchange with Concern for Environment (CFE)
28 October, 2011

1. What level of government do you primarily work with?
2. Do you find that certain environmental policies make it easier or harder for Concern to do its work? Please provide an example if possible.
3. Do the communities in SNNP comply with environmental policies? Which policies are enforced and which policies are not enforced?
4. Does Concern for Environment attempt to improve/influence environmental policy? How? At what levels of government?
5. What NGOs were present at the Provocative Environmental training workshop carried out between August 27-28, 2009? (An exact list is not needed - but please provide a list of as many participants as you can remember).
6. In your opinion are environmental NGOs treated differently than humanitarian NGOs in Ethiopia?

28 October, 2011

1. The level of Government we are working with is the regional Level, since we are registered to work at regional level.

2. The Environmental policies and other environmental related proclamations make our works easier. The polices are helpful and make no difficulty in our works.

3. Communities also participate in implementing the government policies.

4. We have no problems to give our comments to the regional policy makers. But most of the time, Concern is occupied in advocacy works and hence we do very little attempts in policy influencing issues.

5. I will refer the report of 2009 to find the names of NGOs which were engaged in provocative environmental policy issues.

Follow-Up Email Exchange 2, CFE
14 November, 2011

Subject: Follow-up Questions from Colby College, USA

Over the course of my research I have come up with some additional questions about environmental policy and NGOs in Ethiopia. If you have time to answer them, I have listed some questions below. We can speak by phone to discuss these questions, or you can respond via email, depending on which is more convenient for you. Thank you again for your time and assistance with my research! I look forward to hearing from you.

1. Do you think that there is a problem with implementing environmental policies? What do you consider to be the key reasons why environmental policies are not implemented?
2. Are environmental issues a high priority for the government of Ethiopia? What issues are considered to be more important than the environment?

3. Is the Ethiopian government ever suspicious of environmental NGOs? Do you know of any example of environmental NGOs being shut down by government?

4. In what ways do environmental NGOs assist the government with implementing environmental policy? In what ways could environmental NGOs assist the government more?

5. In what ways does the government assist environmental NGOs? In what ways could the government assist environmental NGOs more?

6. Do environmental policies differ greatly across regional states? Or does the national policy serve as the standard for regional environmental policies?

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16 November, 2011

Subject: Re: Follow-up Questions from Colby College, USA

I will try to answer your questions which I can. But you have to know that I can not answer your questions on behalf of the government.

NGOs in our region (South Region) assist the government by participating in development endeavours. There are NGOs that are working in land rehabilitation, afforestation etc. The Environmental policies usually do not differ from regions to regions. Of course, Ethiopia is a federal country. Regions can adapt the federal polices to suit their regional context. The government assist the NGOs in many ways. Facilitation, monitoring, evaluations, and enhancing etc. are some of the areas that the government assistance to the NGOs. If you are not satisfied, you can get more information when you came and ask questions to government personnels
Appendix 1D

Interview Transcript, Professor in Addis Ababa University

Questions asked:
1. I have heard that some environmental policies are comprehensive and well written, but there is often a problem with implementation. In your opinion is this the case?
2. Is it common for environmental policies to be re-evaluated, rewritten?
3. Do environmental policies vary by region/local governments? Are there significant differences?
4. Does the government take input from NGOs when forming policy? How much access do NGOs have to policy formulation?
5. How would you describe the relationship between domestic environmental NGOs and the Ethiopian government?
6. Is that relationship different from that of international environmental NGOs?
7. In your opinion, does this differ from the experience of other types of (humanitarian) NGOs?

2 November 2011, 7:40 AM

General Comments on Environmental Policy of Ethiopia
In addition to the National Environmental policy (1997) there are some sectoral policies, e.g., water policy, forest policy, but an overall observance of policies is not in place.

- Whenever the government thinks that the public should participate, an announcement for a hearing is made. At this hearing, the public can voice their concerns. Some out of their own initiatives suggest some amendments, or promote further enactment of current legislation (is this the public, or NGOs who are invited?)

Problems with policies?
- Quote: “there is no concrete commitment on the ground as you now see in the papers”
- Capacity for implementation.
- Also government priorities. The government is trying to encourage investment to promote economic development. Some investors don’t want to do Environmental Impact Assessments (EIA) although they are technically required. The government currently prioritizes development over the environment.

Quote: “It may not be easy to balance environmental interests and development interests so the priority is development with a high tolerance for environmental degradation.”

Are policies revisited/revised?
- Sometimes when there is popular pressure to do so – people complain sometimes, for example when they lose their cattle due to chemical pollution or when they suffer health hazards as a result of fresh water pollution by industrial wastes.

Quote: “We don’t have any problems making laws! But they are not implemented…”
- Capacity problems include manpower for enforcement, but also expertise – there is a lack of experts who can test and interpret the pollution levels in water, land, etc., and facilities to do so
- There are standards for industrial and other pollutions but there is no follow up and implementation of such standards.

Federal versus Regional State policies
- The main federal environmental law is the National Standard (Federal Framework Environmental Law).
• Regional States are permitted/encouraged to come back with their own policies, but these must be “better ones” (cannot be weaker than the Federal framework).
• Most policies are similar across the states – all are adaptations of the national plan – but when it comes to implementation there is high variability across states.
  o Some Regional States do not even ask for an EIA to lure investors. – Investors are converging on the State of Oromia for its proximity to road infrastructure (80-90% of investors would like to be in this region).
• When it comes to issuing laws, the Regional States usually “cut and paste” from the Federal laws. (note: this may suggest a stronger role for the Federal government than previously thought – the Federal law may set the overall agenda)

**NGOs in the policy process**

• NGOs participate in reform, can even suggest amendments or new regulatory initiatives but of late government banned many NGOs alleging that they are involved in activities that are beyond their scope of statutes.
• For example, there were over 40 environmental NGOs in SNNP last year which were banned by government on the ground of suspicion that they were doing advocacy activities not related to environmental protection.
• Lately (when?) because of an increase in the amount of environmental legislation issued, many environmental NGOs were established.
• The government banned NGOs at one point – they were confused about the role of NGOs and saw them as a threat.
• According to the official position of the government as long as NGOs are clear about their statutes (environmental activities only) there is no problem – but there is always a suspicion by government that the NGOs might be doing something else and the government has a tight control on their operation.
• Today the government’s public commitment to environmental protection necessitates cooperation with NGOs.
• With issues that necessitate discussion of government, advocacy and responsibility, you have to blame someone and often this is the government (Is this a source of tension between the government and NGOs?)

**International NGOs in Ethiopia?**

• There are not many, e.g., FarmAfrica, though some large, professional and well-accepted NGOs have had success through working with government

**Are some types of NGOs (e.g., humanitarian versus environmental) treated differently than others by government?**

• If an NGO is purely concerned about environment there is no problem. If it engages in other activities then there is more suspicion. Bigger established NGOs working closely with the government have no problems in general.
Question: In our last conversation you mentioned that the government’s public commitment to environmental protection necessitates cooperation with NGOs - in what activities do the government and NGOs work together?

- Cooperation can go both ways:
  - if an environmental NGO wants to consult with the government about what environmental sector to be involved in, the government will suggest an area (example: promotion of environmental awareness, dissemination of information), and can provide the NGO with information relating to environmental problems.

- In most cases, environmental NGOs involved in natural resource protection worked with the government at some point or another, these groups provide advice to the government on natural resource issues.

- NGOs can also assist the government through:
  - environmental protection activities and management (tree-planting campaigns, soil conservation, water harvesting, and plant production to fight deforestation, etc)
  - environmental education and promotion of environmental stewardship (for example, assist the government in telling/teaching the public that lives in rural areas that they if they live near forests, they should take care of the forests and wildlife)

- Additionally because the government has limited funding to spend, the government is happy when the NGOs provide assistance in the form of the activities listed above, and provide their own funding to do the said activities.

- Areas of assistance like these are welcomed by the government.

Question: In your opinion, what level of government has the most power in environmental decision-making?

- Regarding law-making, the regional or towns make the laws.
- Concerning implementation, it all depends on which sector is responsible: different environmental sectors have different ministries that are responsible for implementation of laws.
- Because Ethiopian economy is primarily an agrarian economy, the Ministry of Agriculture and Rural Development (MoARD) is the most important ministry in many sectors and cases dealing with rural resources.
  - MoARD can delegate some of its power (to whom?, when would they choose to do this?)
- Most of the (natural?) resources are in the rural setting, but there is specialization in management of specific issues. (Implementation? or Projects?) are delegated by competence – if you have experts (in different government ministries?) in certain areas, they will handle that specific environmental issue.

Question: Under the 2009 Charities and Societies Proclamation, do any environmental NGOs fall under the category of Ethiopian Charities/Societies, (who are prohibited from receiving more than 10% of their funding from abroad)?

- Most of NGOs receive some form of funding from foreign sources. This law is “paralyzing almost all of the environmental NGOs in this country”. There is no NGO that can ___ (operate? function?) without getting some assistance from foreign donors. Most NGOs look for, and expect (financial) assistance, and although they may not get all of their funding from foreign sources, most of the funding for NGOs in Ethiopia comes from foreign sources. Even locally based NGOs extend their hand to foreigners; they ask for assistance and they always get it. As of 2009 NGOs have to be very dependent on internal sources, as a result of the CSP law.
- The government is suspicious of NGOs for several reasons:
Some NGOs squander and misuse funding that they receive for their organizations’ activities. The activities that the funds are used for can’t always be described as purely political – for example, 90% of funds may go to private individuals (paying family relatives for instance) and only allocating 5-10% of funds for the public good. Accountability of funds is not very clear, and the government feels responsible for these activities.

The government thinks that funding that comes from abroad comes paired with influence from foreign sources – they worry that these influences may be contradictory to government interests. The government is very tense, and highly suspicious about this kind of interference.

- As mentioned in our last conversation the SNNP government was very suspicious of NGOs calling themselves “natural resource conservation NGOs”. Around 40 environmental NGOs were banned last year because the government was afraid that they would talk about surveillance taking place during the (elections?).
  - These NGOs were here to protect the environment – there was nothing wrong in terms of their statues, but the government believe that they were doing something else.
  - One by one, these NGOs are emerging, and changing some things within their organizations, and reregistering to do the same environmental protection work

Question: How do you think the role of environmental NGOs will change in the future? (Clarified, will the government still be very suspicious of them, or will their importance be able to expand?):

- The government has a clear policy that the public has to get involved with environmental protection and conservation. This involvement can come through NGOs – the general public may not be in a position to become involved in environmental protection unless organized through NGOs

- NGOs are in a position to assist the government with environmental policies and laws, but the political commitment of the government with environmental policies and laws is unpredictable.
  - For instance: The government is looking for foreign investment; if investors find it difficult to do environmental impact assessments (EIAs), the government will want to change: in certain sectors, permits (to develop?) may not be subject to environmental clearance
  - quote: “so we are going back, the government is playing down some of the environmental issues and giving blind eyes to the observance of standards”
  - The government might tell them to “cool down”, but they may not be told they have to stop entirely.
  - quote: “there are laws, so there will be a place for them” (NGOs)
Skype Discussion with HoAREC
16 November, 2011, 7:30 AM

Talking points/Questions:
How does Ethiopia compare to other countries in the Horn of Africa region in terms of implementation capacity/level of environmental policy implementation?

If you consider the great Horn of Africa – Uganda, Kenya… then Ethiopia is not as strong as Kenya, but considering Sudan, Somalia, Eritrea, Djibouti, then definitely it has a much stronger capacity in implementation, not only in environmental issues but in most development projects such as safety net or other World Bank project, etc. They have a very good record of implementation for these projects. There is a VERY good environmental policy, but the problem is this policy is not as such backed by any finance. So most of the development assistance comes from outside… only funding available is for infrastructure, health, education etc…. The environmental policy is there but we do not even have an environmental ministry, we have the EPA which is under the executive branch, does not have its own a ministerial portfolio. Everything is geared towards for example agriculture, water, and energy which have very strong portfolios. Environmental policies by very nature is poorly implemented – the problem is mainly it is not covered by official development assistance funding, there is little for environment relative to other sectors such as agriculture, water and energy.

Do environmental NGOs assist the government with implementing environmental policy? In what ways? Is this the case in Ethiopia? In what ways does the government assist environmental NGOs?

Yes they do, most of the environmental NGOs advocate for, in the same line as government policy. You don’t see much … not problems due to government policy, but mostly it’s an international issue. In climate change negotiations what government and NGOs advocate for is the same thing (they are in agreement). Government is heavily associated with NGOs for implementation. EPA doesn’t have strong capacity, relies mostly on the support from NGOs. In implementing, government & NGOs have good relations.

Does govt help NGOs? Yes. Even now government & NGOs are having a meeting about climate change. A good flow of information. I’m not saying that everything is perfect – there is a gap and there is a lot the EPA should do in terms of being more inclusive of NGOs. But overall the government depends heavily on NGOs in terms of trying to change the environment, mainly because it doesn’t have a separate ministry to do the job.

HoAREC – if the government has to choose between a land use plan or allocating the resources to water and energy they will choose water and energy. So HoAREC provides support in land use planning and secures funding for land use planning programs.

Who participates in policy advocacy? Is it typical that the larger NGOs are the ones driving policy change? How do smaller NGOs participate in policy dialogue?

There are no really large NGOs in Ethiopia - most of the NGOs are small or “middle” NGOs. Some small NGOs have had a very big impact – they are specialized in what they do – some of the smaller NGOs have had the largest impact on policy. I’m speaking of indigenous NGOs. Is role of international NGOs different? Yes, under the new NGO law the international NGOs cannot engage in policy advocacy. You have to register as a local NGO, with 90% of funding sourced locally. But they have made an exception for environmental NGOs – even international NGOs are allowed to engage in advocacy on environmental issues. But I’m not talking about international NGOs – these are not permitted to do any advocacy. But local NGOs that are registered as international NGOs, so long as they only do environment, they can engage in advocacy. Don’t know how this came about. But this shows how the government would like to be more for the environment.
Is the Ethiopian government ever suspicious of environmental NGOs? Do you know of any example of environmental NGOs being shut down by government?

I don’t know – I don’t think so. There were many NGOs, not environmental NGOs, that were shut down when the new law came into place – they did not meet the new guidelines. But I don’t know of any environmental NGOs that were shut down.

Are environmental issues a high priority for the government of Ethiopia? How does this compare to other nations in the Horn of Africa region?

Definitely a high priority – even now the Prime Minister is a leader on the issue of climate change for the whole of Africa. When compared to the Horn of Africa I would rank them first (outside of Kenya, only considering the “Horn in the proper sense”). In most Horn of Africa countries, the environmental issue is important in development.

Quote: “The issue of the environment and development, along with climate change are greater here than anywhere else. They do not have strong implementation, not because they don’t want to, but because there is no funding or international assistance for environmental issues.”
Appendix 1F

Interview with Environmental Protection Authority
Interview with Head, Environmental Policy and Legislation, EPA
17 November, 2011, 7:30 AM

Questions:
1) Specifically, what are operating constraints for the EPA? (What are some of the main challenges in the environmental policy system?)

All capacity constraints can be expected in developing countries. In terms of implementation, Ethiopia is a recent beginner…there was a publication in 2002 (of what?). All laws and policies have been in place since then so it has been a short time. There are capacity issues, issues of expertise, experience is not much developed, geography following federal system (how so?) regional (system?) is also a mess also the question of capacity in all stances in federal and regional.
## Appendix 1G

Table 1.G List of Local Groups and their legal status, Forum for Environment

<table>
<thead>
<tr>
<th>No</th>
<th>Local FfE Groups</th>
<th>Region</th>
<th>Year of Establishment</th>
<th>Legal Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Welmera Concern for Environmental &amp; Development</td>
<td>Oromia</td>
<td>2002</td>
<td>Legalized</td>
</tr>
<tr>
<td>2</td>
<td>Assela Forum for Environment</td>
<td>Oromia</td>
<td>2002</td>
<td>Legalized</td>
</tr>
<tr>
<td>3</td>
<td>Concern for Environment Awassa</td>
<td>SNNP</td>
<td>2002</td>
<td>Legalized</td>
</tr>
<tr>
<td>4</td>
<td>Dire Forum for Environment</td>
<td>Dire Dawa CA</td>
<td>2003</td>
<td>Legalized</td>
</tr>
<tr>
<td>5</td>
<td>Beshoftu Forum for Environment</td>
<td>Oromia</td>
<td>2003</td>
<td>Under process</td>
</tr>
<tr>
<td>6</td>
<td>Assosa Environmental Protection Association</td>
<td>Benishangul</td>
<td>2004</td>
<td>Legalized</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gumz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Arbaminch Forum for Environment</td>
<td>SNNP</td>
<td>2004</td>
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<tr>
<td>8</td>
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<td>9</td>
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<td>Amhara</td>
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<td>Mekele Forum for Environment</td>
<td>Tigray</td>
<td>2006</td>
<td>Legalized</td>
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<td>11</td>
<td>Forum for Environment Bahir Dar</td>
<td>Amhara</td>
<td>2008</td>
<td>Legalized</td>
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<td>12</td>
<td>Gambella Forum for Environment</td>
<td>Gambella</td>
<td>2008</td>
<td>Legalized</td>
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Appendix 1H

Table 1.H Latitudinal and Longitudinal Data in Decimal Degrees for Local Forum for Environment Groups

<table>
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<tr>
<th>Name</th>
<th>Lat_DD</th>
<th>Lon_DD</th>
<th>Year_Est</th>
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<td>34.14273056</td>
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<td>12.59963611</td>
<td>37.46655833</td>
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<td>37.38295278</td>
<td>2004</td>
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<tr>
<td>Dire Forum for Environment</td>
<td>9.588491667</td>
<td>41.87003611</td>
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<td>34.53421667</td>
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<td>Arba Minch, Ethiopia</td>
<td>6.033038889</td>
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<td>39.245525</td>
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Source for Coordinate Data: Google Earth. Name & Year Established Data Source: Forum for Environment
Chapter 2 Appendices

Appendix 2A

Table 2.A International institutions relevant to Ethiopian forests, see notes for sources.

<table>
<thead>
<tr>
<th>Institution</th>
<th>Date</th>
<th>Description</th>
<th>Institution Evaluation</th>
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<tr>
<td>Convention on Biological Diversity</td>
<td>1994</td>
<td>Binding treaty on sustainable development focusing on conservation of biodiversity, sustainable use of biodiversity, and fair/equitable distribution of diversity benefits</td>
<td>Recognizes the importance of forest resources in Ethiopia and outlines threats; fails to outline robust action plans for protecting forests</td>
</tr>
<tr>
<td>UN Convention to Combat Desertification</td>
<td>1997</td>
<td>Convention to fight desertification and its effects</td>
<td>No information</td>
</tr>
<tr>
<td>UN Framework Convention on Climate Change and Kyoto Protocol</td>
<td>1994, 2005</td>
<td>Convention encouraged reduction of GHG emissions, protocol obligated reduction</td>
<td>Created CDM, under which projects such as the 2006 Humbo Community-based Natural Regeneration Project have been internationally supported</td>
</tr>
<tr>
<td>Global Environment Fund</td>
<td>1990</td>
<td>Investment and management of private equity in clean technology, emerging markets, and sustainable forestry</td>
<td>Grant supporting projects pertaining to environment such as Country Partnership Program on Sustainable Land Management</td>
</tr>
</tbody>
</table>

Figure 2.B1 Land use in Tigray region, Ethiopia, in 2005 and 2009. The three land uses noted are not representative of all land uses in Tigray (i.e., those identified as other in figures 2.4 and 2.5), GlobCover, 2011.

Figure 2.B2 Land use in Amhara region, Ethiopia, in 2005 and 2009. The three land uses noted are not representative of all land uses in Amhara (i.e., those identified as other in figures 2.4 and 2.5), GlobCover, 2011.
Figure 2.B3 Land use in Oromia region, Ethiopia, in 2005 and 2009. The three land uses noted are not representative of all land uses in Oromia (i.e., those identified as other in figures 2.4 and 2.5), GlobCover, 2011.

Figure 2.B4 Land use in SNNP region, Ethiopia, in 2005 and 2009. The three land uses noted are not representative of all land uses in SNNP (i.e., those identified as other in figures 2.4 and 2.5), GlobCover, 2011.
## Appendix 2C

Table 2.C.1 2005 Land cover type and coverage (ha) in study regions, GlobCover, 2011.

<table>
<thead>
<tr>
<th>2005 GlobCover Land Use</th>
<th>Tigray (ha)</th>
<th>Amhara (ha)</th>
<th>Oromia (ha)</th>
<th>SNNP (ha)</th>
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<tbody>
<tr>
<td>Irrigated croplands</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Rainfed croplands</td>
<td>427,533</td>
<td>330,812</td>
<td>1,048,152</td>
<td>184,398</td>
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<td>Mosaic Croplands/Vegetation</td>
<td>1,108,820</td>
<td>4,938,039</td>
<td>7,206,009</td>
<td>2,263,540</td>
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<tr>
<td>Mosaic Vegetation/Croplands</td>
<td>1,180,772</td>
<td>833,657</td>
<td>7,015,453</td>
<td>3,577,801</td>
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<tr>
<td>Closed to open broadleaved evergreen or semi-deciduous forest</td>
<td>1,207</td>
<td>14,006</td>
<td>947,637</td>
<td>262,103</td>
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<tr>
<td>Closed broadleaved deciduous forest</td>
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<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Open broadleaved deciduous forest</td>
<td>30,870</td>
<td>485,228</td>
<td>1,847,233</td>
<td>634,770</td>
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<tr>
<td>Open needleleaved deciduous or evergreen forest</td>
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<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Closed to open mixed broadleaved and needleleaved forest</td>
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<td>0</td>
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<tr>
<td>Mosaic Forest-Shrubland/Grassland</td>
<td>905,976</td>
<td>3,456,330</td>
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<td>Mosaic Grassland/Forest-Shrubland</td>
<td>5,367</td>
<td>59,181</td>
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<td>Closed to open shrubland</td>
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<td>7,201,810</td>
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<td>Closed to open grassland</td>
<td>45,571</td>
<td>93,517</td>
<td>163,558</td>
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<td>Sparse vegetation</td>
<td>400,515</td>
<td>43,081</td>
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<td>Closed to open broadleaved forest regularly flooded (fresh-brackish water)</td>
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<td>0</td>
<td>936</td>
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<tr>
<td>Closed broadleaved forest permanently flooded (saline-brackish water)</td>
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<td>---------------------------------------------------------------</td>
<td>-------------</td>
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<tr>
<td>Irrigated croplands</td>
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<tr>
<td>Rainfed croplands</td>
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<td>705</td>
<td>15,956</td>
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<tr>
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<td>Mosaic Forest-Shrubland/Grassland</td>
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<td>5,057,579</td>
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<td>Mosaic Grassland/Forest-Shrubland</td>
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<tr>
<td>Closed broadleaved forest permanently flooded (saline-brackish water)</td>
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<td>Closed to open vegetation regularly flooded</td>
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### Table 2.D Contacts during the Fall of 2011.

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<th>Name</th>
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<th>Email</th>
<th>Telephone</th>
<th># of Times Contacted</th>
<th>Did they Respond?</th>
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<tbody>
<tr>
<td>Wondo Genet</td>
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<td>Professor</td>
<td></td>
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<tr>
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<td>Ministry of Water Resources</td>
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<td></td>
<td>President</td>
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<td>Mechanism &amp; Joint Implementation</td>
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Appendix 2E

The GIS model outlined in Figure 2.E1 is a basic reclassification procedure consisting of two steps. First, I utilized the reclass tool to identify areas of forest and no forest in the 2005 and 2009 data. Second, by adding the two reclassified rasters using the raster calculator I was able to identify forest change (forest loss, unchanged forest and forest growth).

Figure 2.E1 Reclassification of GlobCover Land Cover model.

Figure 2.E2 depicts the method I utilized to calculate mean distance of roads, cities, regional boundaries and railroads from areas of forest (those created in Figure 2.E1). This model consists of three steps. First, for each variable I used the Euclidean Distance tool to create Euclidean distance rasters. Second, I used the raster calculator to multiply the Euclidean distance raster by the forest change raster so that the output would be the forest raster with Euclidean distance values for each pixel. Third, I divided the mean distance of each Euclidean distance raster by the maximum Euclidean distance possible in that raster no normalize the values. I also incorporated population density into this model by skipping the Euclidean distance step so that forest pixels would assume the population density value.

Figure 2.E2 Mean Euclidean distance analysis model.
Appendix 2F

Figure 2.F Variables representing governance institutions, access to forests, and population pressures in relation to forest cover change 2005-2009, GlobCover, 2011 and GADM, 2011.
# Chapter 3 Appendices

## Appendix 3A

**GIS- LCCS & the GlobCover legend**

<table>
<thead>
<tr>
<th>Value</th>
<th>GlobCover legend</th>
<th>LCCS Label</th>
<th>LCCS Entry</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>Post-flooding or irrigated croplands (or aquatic)</td>
<td>Irrigated tree crops // Irrigated shrub crops // Irrigated herbaceous crops // Post-flooding cultivation of herbaceous crops</td>
<td>A11 Cultivated Terrestrial Areas and Managed Lands</td>
</tr>
<tr>
<td>14</td>
<td>Rainfed croplands</td>
<td>Rainfed shrub crops // Rainfed tree crops // Rainfed herbaceous crops</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Mosaic cropland (50-70%) / vegetation (20-50%)</td>
<td>Cultivated and managed terrestrial areas / Natural and semi-natural primarily terrestrial vegetation</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Mosaic vegetation (50-70%) / cropland (20-50%)</td>
<td>Natural and semi-natural primarily terrestrial vegetation / Cultivated and managed terrestrial areas</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>Closed to open (&gt;15%) broadleaved evergreen or semi-deciduous forest (&gt; 5m)</td>
<td>Broadleaved evergreen closed to open trees // Semi-deciduous closed to open trees</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>Closed (&gt;40%) broadleaved deciduous forest (&gt;5m)</td>
<td>Broadleaved deciduous closed to open (100-40%) trees</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>Open (15-40%) broadleaved deciduous forest/woodland (&gt;5m)</td>
<td>Broadleaved deciduous (40-20%) woodland</td>
<td></td>
</tr>
<tr>
<td>70</td>
<td>Closed (&gt;40%) needleleaved evergreen forest (&gt;5m)</td>
<td>Needleleaved evergreen closed to open (100-40%) trees</td>
<td></td>
</tr>
<tr>
<td>90</td>
<td>Open (15-40%) needleleaved deciduous or evergreen forest (&gt;5m)</td>
<td>Needleleaved evergreen (40-20%) woodland // Needleleaved deciduous (40-20%) woodland</td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>Closed to open (&gt;15%) mixed broadleaved and needleleaved forest (&gt;5m)</td>
<td>Broadleaved closed to open trees / Needleleaved closed to open trees</td>
<td></td>
</tr>
<tr>
<td>110</td>
<td>Mosaic forest or shrubland (50-70%) / grassland (20-50%)</td>
<td>Closed to open trees / Closed to open shrubland (thicket) // Herbaceous closed to open vegetation</td>
<td>A12 Natural and Semi-natural Terrestrial Vegetation</td>
</tr>
<tr>
<td>120</td>
<td>Mosaic grassland (50-70%) / forest or shrubland (20-50%)</td>
<td>Closed to open shrubland (thicket) // Herbaceous closed to open vegetation / Closed to open trees</td>
<td></td>
</tr>
<tr>
<td>130</td>
<td>Closed to open (&gt;15%) (broadleaved or needleleaved, evergreen or deciduous) shrubland (&lt;5m)</td>
<td>Broadleaved closed to open shrubland (thicket)</td>
<td></td>
</tr>
<tr>
<td>140</td>
<td>Closed to open (&gt;15%) herbaceous vegetation (grassland, savannas or lichens/mosses)</td>
<td>Herbaceous closed to very open vegetation // Closed to open lichens/mosses</td>
<td></td>
</tr>
<tr>
<td>150</td>
<td>Sparse (&lt;15%) vegetation</td>
<td>Sparse trees // Herbaceous sparse vegetation // Sparse shrubs</td>
<td></td>
</tr>
<tr>
<td>Code</td>
<td>Description</td>
<td>Natural and Seminatural Aquatic Vegetation</td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>-----------------------------------------------------------------------------</td>
<td>--------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>160</td>
<td>Closed to open (&gt;15%) broadleaved forest regularly flooded (semi-permanently or temporarily) - Fresh or brackish water</td>
<td>Closed to open (100-40%) broadleaved trees on temporarily flooded land, water quality: fresh water // Closed to open (100-40%) broadleaved trees on permanently flooded land, water quality: fresh water</td>
<td></td>
</tr>
<tr>
<td>170</td>
<td>Closed (&gt;40%) broadleaved forest or shrubland permanently flooded - Saline or brackish water</td>
<td>Closed to open (100-40%) broadleaved trees on permanently flooded land (with daily variations), water quality: saline water // Closed to open (100-40%) broadleaved trees on permanently flooded land (with daily variations), water quality: brackish water // Closed to open (100-40%) semi-deciduous shrubland on permanently flooded land (with daily variations), water quality: saline water // Closed to open (100-40%) semi-deciduous shrubland on permanently flooded land (with daily variations), water quality: brackish water</td>
<td></td>
</tr>
<tr>
<td>180</td>
<td>Closed to open (&gt;15%) grassland or woody vegetation on regularly flooded or waterlogged soil - Fresh, brackish or saline water</td>
<td>Closed to open shrubs // Closed to open herbaceous vegetation</td>
<td></td>
</tr>
<tr>
<td>190</td>
<td>Artificial surfaces and associated areas (Urban areas &gt;50%)</td>
<td>Artificial surfaces and associated areas</td>
<td></td>
</tr>
<tr>
<td>200</td>
<td>Bare areas</td>
<td>Bare areas</td>
<td></td>
</tr>
<tr>
<td>210</td>
<td>Water bodies</td>
<td>Natural water bodies // Artificial water bodies</td>
<td></td>
</tr>
<tr>
<td>220</td>
<td>Permanent snow and ice</td>
<td>Artificial perennial snow // Artificial perennial ice // Perennial snow // Perennial ice</td>
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</tr>
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</table>

Environmental Policy Review 2011
Appendix 3B

Table 3.B1 Livestock totals by type in Ethiopia, FAOSTAT, 2011.

<table>
<thead>
<tr>
<th></th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
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<th>2006</th>
<th>2007</th>
<th>2008</th>
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<td>35383300</td>
<td>40638800</td>
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<td>43124600</td>
<td>47570700</td>
<td>49297900</td>
<td>50884000</td>
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<tr>
<td>Goats</td>
<td>8597770</td>
<td>9620890</td>
<td>11000000</td>
<td>12000000</td>
<td>14850600</td>
<td>16364000</td>
<td>18559700</td>
<td>21709400</td>
<td>21798500</td>
<td>21960700</td>
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<tr>
<td>Sheep</td>
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<td>11438200</td>
<td>14321800</td>
<td>16000000</td>
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<td>23633000</td>
<td>26117300</td>
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<td>25979900</td>
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<td>Chickens</td>
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<td>37764000</td>
<td>40930000</td>
<td>38000000</td>
<td>35656000</td>
<td>32222000</td>
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<table>
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<tr>
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<tr>
<td>109710000</td>
<td>2005</td>
</tr>
<tr>
<td>119516300</td>
<td>2006</td>
</tr>
<tr>
<td>134905400</td>
<td>2007</td>
</tr>
<tr>
<td>134162600</td>
<td>2008</td>
</tr>
<tr>
<td>136824600</td>
<td>2009</td>
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</table>

Table 3.B3 Livestock totals as a function of time, FAOSTAT, 2011.

Regression Statistics (Total Livestock by Year)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>Multiple R</td>
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</tr>
<tr>
<td>R Square</td>
<td>0.9287</td>
</tr>
<tr>
<td>Adjusted R Square</td>
<td>0.9198</td>
</tr>
<tr>
<td>Standard Error</td>
<td>5211268.562</td>
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<tr>
<td>Observations</td>
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<table>
<thead>
<tr>
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<th>SS</th>
<th>MS</th>
<th>F</th>
<th>Significance F</th>
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<td>Regression</td>
<td>1</td>
<td>2.8E+15</td>
<td>2.8E+15</td>
<td>104.258</td>
</tr>
<tr>
<td>Residual</td>
<td>8</td>
<td>2.2E+14</td>
<td>2.7E+13</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>9</td>
<td>3E+15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Coefficients</th>
<th>Standard Error</th>
<th>t Stat</th>
<th>P-value</th>
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</thead>
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<tr>
<td>Intercept</td>
<td>-1.163E+10</td>
<td>-10.112</td>
<td>7.8E-06</td>
</tr>
<tr>
<td>Year</td>
<td>5,858,280.24</td>
<td>10.2107</td>
<td>7.3E-06</td>
</tr>
</tbody>
</table>
Questions/Talking Points:

As an impoverished nation, what are the most readily available innovations accessible to Ethiopia?

We look at innovation in a much broader sense and as a social process that helps translate knowledge into developmental outcomes. Even if we go by a narrow definition, it is not easy to answer the question. There must be hundreds of technologies, practices, processes and institutional arrangements and policies that could be used in the agricultural sector. It is not a straightforward listing of technologies, as you might be interpreting it. You need to understand that innovation is very context specific and so is the relevance of technologies and knowledge. Ethiopia and Ethiopian farmers (as is the case with almost all developing countries) are not one homogenous entity and one size does not fit all.

The Ethiopian government through the Ministry of Agriculture has stated that increasing agricultural productivity is their top priority. How can innovations in fodder and other areas of livestock production improve productivity? Are productivity improvements likely to improve or worsen the environmental impacts of livestock in Ethiopia?

And if you look at innovation in a narrow sense of technology or practice, do people not adopt technologies/practices which would increase the productivity which is yield or production per unit of input? On the environmental impacts – how I wish life were that simple and so black and white, that we can say productivity improvement simply improves or worsens environmental impact of livestock! All kinds of productivity increases do not have the same effect on environment.

What agricultural investments would be the most worthwhile for a country like Ethiopia to pursue?

Agriculture is a very broad and complex field and it depends on what your objectives are – what do you want to achieve through your investments. Is it economic growth and efficiency; is it broadbased development for poverty alleviation; is it environmental sustainability while achieving economic growth; is it just about protecting environment?? Different objectives demand different strategies for different sections of the populations and hence, different investments!
Chapter 4 Appendices

Appendix 4A

Table 4.A Key informant contact information.

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Organization</th>
<th>Email Address</th>
<th>Phone #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Director</td>
<td>Higher Education Strategy Center</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Program Manager</td>
<td>Forum for Environment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Director</td>
<td>Concern for Environment</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Email correspondence with Director, Concern for Environment

2 October, 2011.

Subject: Questions from Colby College

I am part of a team of advanced students at Colby College in Waterville, Maine, USA, studying an array of environmental policy issues in Ethiopia. My professor introduced me to your organization through a Concern for Environment annual report. I am focusing my work this semester on watershed management strategies that can benefit the environment as well as development, such as tourism around lakes. I became interested in this topic when I read in the annual report about the 2009 workshop about threats to Lake Awassa. I want to investigate the issues brought up at this workshop as well as see how organizations, conferences, and NGOs in the US have tackled these types of issues. If you don't mind, I have several questions:

1) Do you have a list of who attended the 2009 workshop on Lake Awassa (and a little background on who they are or where they are from)?
2) Is there some kind of record, like minutes from the meeting, and is Dr. Zebene Asfaw's presentation still available?
3) Have there been any follow-up meetings or workshops on this issue?
4) One comment on the workshop (as noted in the annual report) was that Concern for Environment was a growing organization and that perhaps this constrained the amount of attention the workshop got for potential attendees. How has Concern grown as an organization since this 2009 workshop? Have you enlisted the support of the Mayor of Awassa to call meetings, as suggested at the end of the 2009 workshop?
5) Another attendee of the workshop discussed "dependency syndrome". What is dependency syndrome and how does it come into play with the issues facing Lake Awassa and its surrounding communities?
6) Have the issues brought up at the 2009 workshop improved? Has collaboration among the various stakeholders occurred? Why/why not?

I hope you will be interested in working with me; please let me know if you have any thoughts or would like more information. Thank you!
3 October, 2011
Subject: Re: Questions from Colby College

I will try to answer your question very shortly.
1) The list of participants was not available
2) There are records such as the paper presented
3) Dependency syndrome are the status of depending on someone for something. For example, there may be some people who depend on assistance such as food or other things
4) There were some improvements on the protection of the lake.

Email Correspondence with Professor, Director of Higher Education Strategy Center

19 October, 2011
Subject: Water Quality Research

I am part of a team of undergraduate students studying an array of environmental policy issues in Ethiopia. Specifically, I am researching water quality management, and I am wondering if you could help me to answer a few questions.

1) Where can I find information on water quality for the following Lakes Awassa, Koka, and Ziway?
2) What kind of data on water quality is collected in Ethiopia, and who collects this data?
3) What are the biggest threats to the quality of lakes in Ethiopia? I.e. deforestation, agricultural chemicals, human waste, sedimentation, eutrophication, other chemical contaminants, others?
4) If a lake becomes degraded, how can the conditions be improved. Can the lake quality be fully restored? And are there any examples of successful restoration in Ethiopia?
5) Do environmental policies on water vary by region? Are there some regions that do a better job managing water quality than others?

I hope you will be interested in working with me; please let me know if you have any thoughts or would like more information. Thank you!

29 October, 2011
Subject: Re: Re: Water Quality Research

Please find my responses to your questions inserted in CAPS under each of your questions hereunder:
1) Where can I find information on water quality for the following Lakes Awassa, Koka, and Ziway?

THERE IS NO SINGLE SOURCE FOR ALL THE INFORMATION YOU WANT. BUT PLEASE FIND THE REFERENCES HEREUNDER THAT WILL GIVE YOU A GENERAL VIEW OF THE WATER QUALITY ISSUES IN ETHIOPIAN RIFT VALLEY LAKES (ERVL).

THERE LAST TWO PAPERS WILL ANSWER MANY OF YOUR QUESTIONS.
2) What kind of data on water quality is collected in Ethiopia, and who collects this data?
THE ANSWERS TO THESE QUESTIONS CAN BE OBTAINED FROM THE ETHIOPIAN ENVIRONMENTAL PROTECTION AGENCY. PLEASE FIND WEBSITE OF THIS AGENCY FROM THE INTERNET.

3) What are the biggest threats to the quality of lakes in Ethiopia? I.e. deforestation, agricultural chemicals, human waste, sedimentation, eutrophication, other chemical contaminants, others?

THE PUBLICATIONS I HAVE LISTED (ESPECIALLY THE LAST TWO) WILL GIVE YOU THE ANSWERS TO THESE QUESTIONS.

4) If a lake becomes degraded, how can the conditions be improved. Can the lake quality be fully restored? And are there any examples of successful restoration in Ethiopia?

IT ALL DEPENDS ON THE TYPE OF DEGRADATION AND ITS MAGNITUDE! THIS IS A VERY GENERAL QUESTION AND I AM SURE YOU CAN FIND THE INFORMATION FROM THE INTERNET AND/OR OTHER SOURCES. I CANNOT THINK OF ANY EXAMPLES OF LAKE RESTORATION IN ETHIOPIA.

5) Do environmental policies on water vary by region? Are there some regions that do a better job managing water quality than others?

ENVIRONMENTAL WATER POLICIES (LIKE MANY OTHER POLICIES) ORIGINATE FROM THE FEDERAL GOVERNMENT. HOWEVER REGIONS CAN MAKE CHANGES ON SUCH POLICIES THAT ARE ISSUED BY THE FEDERAL GOVERNMENT. I DO NOT HAVE ANY INFORMATION (AND I DONOT THINK THAT THERE IS ONE). DATA ON SUCH COMPARISONS MAY NOT EXIST AND IF IT DID, YOU WILL GET IT FROM THE ETHIOPIAN EPA.

I hope this helps.
Appendix 4B

Interview Notes from Telephone Interview with Director, Concern for Environment
October 14, 2011, 7:45 AM

After the 2009 workshop on Lake Awassa (hosted by CFE), they have met several times and conducted field visits, namely to some reforestation projects around the lake.

There has been improvement to the threats of the lake, some signs of positive changes.
Biggest threat around the lake causing degradation is deforestation.
One way to solve the problem is through education, training, and awareness.

Interview Notes from Telephone Interview with Program Manager, Forum for Environment
October 21, 2011, 8:00 AM

FFE is a local environmental NGO that collaborates with likeminded governmental and nongovernmental organizations.

The group has five major thematic areas: forests, protected areas, renewables, urban areas, climate change.

It focuses on communication, advocacy, and awareness often on the ground at the grassroots level. Public meetings, dialog forums are a platform for idea exchange. These things also influence policy formulation at multiple levels.
It has built an informal climate change network of sixteen organizations aimed at capacity building.
Water quality is not a current thematic area of FFE, but there are probably 1-2 organizations that he knows of working on water quality. Check with Hawassa University for water quality data.
FFE often has large public meetings on sensitive issues, publishes results to stakeholders and policymakers.
Green Hour Program: almost all 9 regions, collaboration and advocacy, incentive scheme for individuals and organizations.
Other activities: research and publications, networking (national+international organizations).
Established and consolidated 12 local groups in 6 regions, encouraging a nationwide green movement. These groups can focus on local issues and have a degree of autonomy, which means they can have a louder voice in the community.
"The more you collaborate, the more you can influence policy."

Environmental policies in Ethiopia: nice policies on paper, problem is IMPLEMENTATION.
Always challenging to bring people together. Some individuals will not be as receptive (i.e. a local official can stop your efforts). No problem on the side of the government, environmentalism is generally more welcome than other areas like human rights.

FFE has a good relationship with the EPA and other Parliamentarians and Ministries.

The environment has not been considered an issue until recently. FFE contributes their share to the fact that you can talk to all levels of society about environmental issues.
Improper implementation of policies means there is still an effort required.
Chapter 5 Appendices

Appendix 5A

STATA DO FILE

*Question (How do household characteristics of Ethiopian respondents affect the likelihood of sickness in the past 4 weeks?)
*Do-file for use with the 2009 Ethiopian Rural Household Survey (ERHS) available through IFPRI.

*To merge the demographics file with other files you must create a unique identifier variable that combines region, peasant association, and household ID codes.
*Change the directories in the code below so that they match the source & destination of your data files.

clear
use C:\Users\mcheever\Documents\Matt\R7p1_s1a_yyrv2.dta
gen uniqueID=region*100000+pa*1000+hhid
sort uniqueID idp1s1a
qui by uniqueID idp1s1a:  gen dup = cond(_N==1,0,_n)
drop if dup>0
save "C:\Users\mcheever\Documents\Matt\ERHS2009.dta", replace

//Merging individual-level demographics and individual-level data files

*To merge demographics with individual-level illness data (Part 3, Section 3)
clear
use "C:\Users\mcheever\Documents\Matt\R7p3_s3.dta", clear
*Generate the unique identifier to be used when merging files.
gen uniqueID=region*100000+pa*1000+hhid
*Generate an additional identifier that designates each individual within the household - note that this variable has a different name in each individual-level data file, but the values are always the same.
gen idp1s1a = idp3s3
sort uniqueID hhid idp1s1a
qui by uniqueID hhid idp1s1a:  gen dup = cond(_N==1,0,_n)
drop if dup>0
*Merge with the ERHS2009 file. The specification "1:1" tells Stata that both datasets have several observations per household so it should match one for each family member.
* Note that people not answering this section of the survey are dropped.
merge 1:1 uniqueID hhid idp1s1a using "C:\Users\mcheever\Documents\Matt\ERHS2009.dta"
drop _merge
save "C:\Users\mcheever\Documents\Matt\ERHS2009health.dta", replace

*Sanitation

clear
use "C:\Users\mcheever\Documents\Matt\R7p3_s2.dta", clear
*Generate the unique identifier to be used when merging files.
gen uniqueID=region*100000+pa*1000+hhid
sort uniqueID hhid
qui by uniqueID hhid:  gen dup = cond(_N==1,0,_n)
drop if dup>0
*Merge with the ERHS2009 file. The specification "1:1" tells Stata that both datasets have several observations per household so it should match one for each family member.
* Note that people not answering this section of the survey are dropped.
merge 1:m uniqueID hhid using "C:\Users\mcheever\Documents\Matt\ERHS2009health.dta"
drop _merge
save "C:\Users\mcheever\Documents\Matt\ERHS2009healthandsan.dta", replace
* Focus on the following survey questions (ERHS 2009)
* q4p3s2 = What is your main source of drinking water?
* q1ap3s3 = Any illness or injury in the last four weeks?

tab q4p3s2 q1ap3s3

gen source= q4p3s2

gen ill= q1ap3s3

replace ill=0 if ill==2

replace ill=. if ill<0 | ill==77

replace source=. if source<0 | source==77

*label our new variable

label define ill1 0 "No" 1 "Yes"

label values ill ill1

*check to make code and labels worked

tab ill

*label our new variable

label define source1 1 "Pond or Dam" 2 "Stream or River" 3 "Spring" 4 "Well" 5 "Borehole" 6 "Rain" 7 "Shared Pipe" 10 "Others" 11 "Piped Water"

label values source source1

*check to make our code and labels worked

tab source

*merge/replace small N categories for water source

replace source = 2 if source==1

replace source = 10 if source==6

replace source = 7 if source==11


tab source


gen age= q2p1s1a

gen farmer= q4ap1s1a

replace farmer=0 if farmer>1 | farmer<1

gen days_sick= q1bp3s3

* clean duration sickness variable

histogram days_sick

replace days_sick=0 if days_sick==-.77

replace days_sick=0 if days_sick>=77

histogram days_sick

* eliminate one extreme outlier (sick > 40 days)

histogram days_sick if days_sick>0

replace days_sick=. if days_sick>40

histogram days_sick if days_sick>0

heckman days_sick i.source i.region age, select (ill=i.source i.region age farmer)
*How is garbage disposed of?
    gen garbage= q2p3s2
    replace garbage=. if garbage==-99
    label define garbage1 1 "Household Dump" 2 "Burned" 3 "Green Manure" 4 "Burried" 5 "Collected from HH" 6 "Collected from Dumping Point"
    label values garbage garbage1

*Regression for waste disposal and water source
    logit ill i.garbage i.source

    tab garbage
    tab source

    logit ill i.garbage i.source if region==1
    logit ill i.garbage i.source if region==3
    logit ill i.garbage i.source if region==4
    logit ill i.garbage i.source if region==7

    heckman days_sick i.garbage i.source i.region age, select (ill=i.garbage i.source i.region age farmer)

    gen toilet=q1p3s2
    replace toilet=. if toilet >=7

    tab toilet

    *merge/replace small N categories for sanitation
    replace toilet = 2 if toilet==1
    replace toilet = 3 if toilet==4
    replace toilet = 6 if toilet==5

    *label our new variable
    label define toilet1 2 "Flush Toilet" 3 "Pit Latrine" 6 "No Toilet"
    label values toilet toilet1

    *check to make our code and labels worked
    tab toilet

    *******************************************
    label list garbage1
    heckman days_sick i.garbage i.region age, select (ill=i.garbage i.region age farmer)
    heckman days_sick i.toilet i.region age, select (ill=i.toilet i.region age farmer)
    heckman days_sick i.source i.region age, select (ill=i.source i.region age farmer)

    *not controlling for region
    heckman days_sick i.garbage age, select (ill=i.garbage age farmer)
    heckman days_sick i.toilet age, select (ill=i.toilet age farmer)
    heckman days_sick i.source age, select (ill=i.source age farmer)
## Appendix 5B

Table 5.B Key informant contact information.

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Organization</th>
<th>Email Address</th>
<th>Phone #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dean, School of Public Health</td>
<td>Main Office</td>
<td>Addis Ababa School of Public Health</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main Office</td>
<td>ActionAid-Ethiopia</td>
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<tr>
<td>Main Office</td>
<td>Bill and Melinda Gates Foundation</td>
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<tr>
<td>Main Office</td>
<td>Center for Disease Control and Prevention (CDC)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Vice President for Information &amp; Strategic Communication</td>
<td>The University of Bahir Dar</td>
<td></td>
<td></td>
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</tr>
</tbody>
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