Chapter 4 Lake Water Management in three Ethiopian Rift Valley Watersheds

Katie Graichen

Research Highlights

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

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Katie Graichen
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- 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.

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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.

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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.

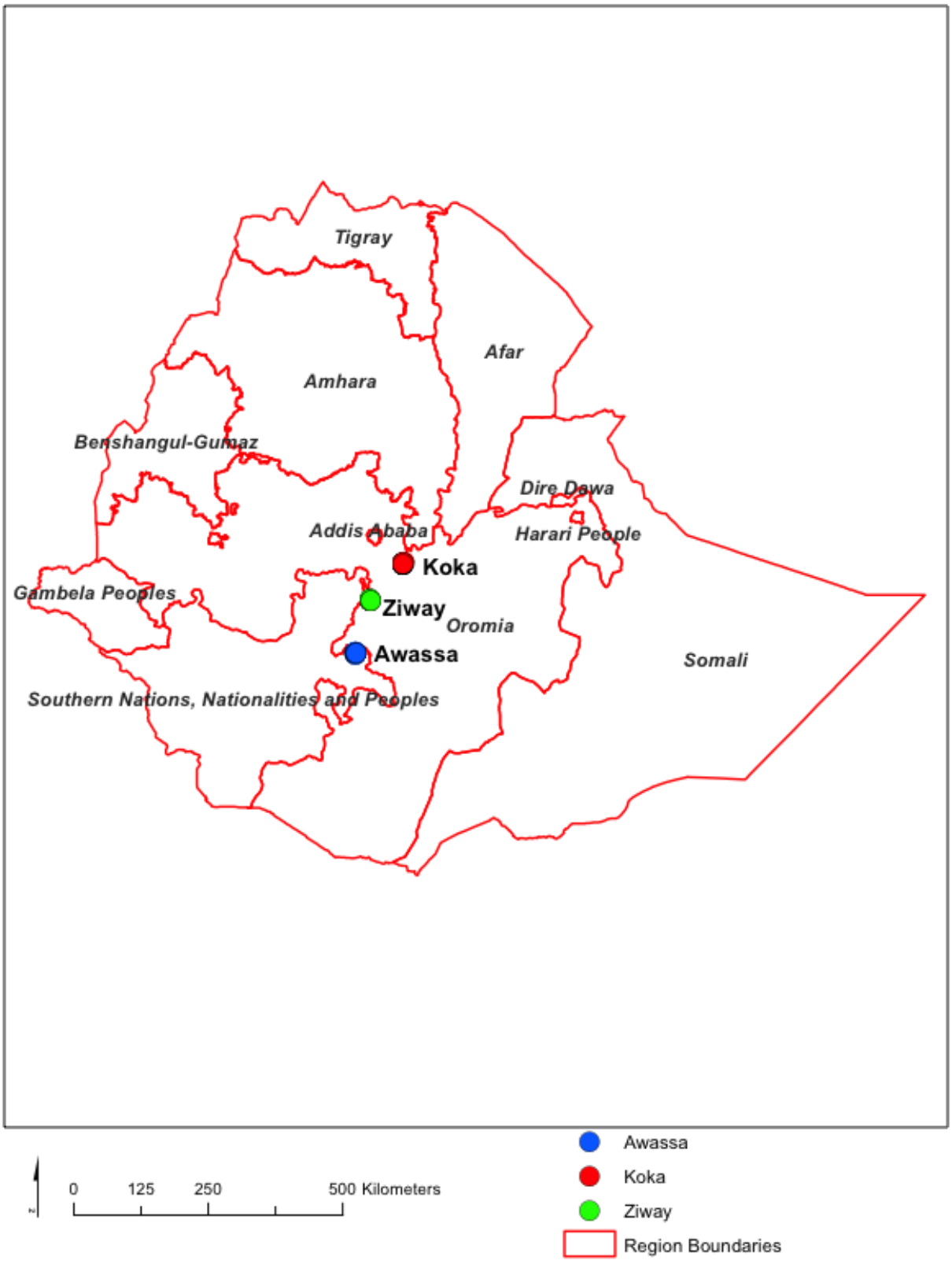

Figure 4.1 Map of case study locations, DIVA-GIS; Google Earth, 2011.

Table 4.1 Statistics of the three case study lakes, World Lake Database, 2010.

Lake	Surface Area (km^2)	Volume (km^3)	Max. Depth (m)	Mean Depth (m)	Lat.	Long.
Awassa	129	1.3	22	11	7°03′N	38°27′E
Koka	250	2.28	13	9.14	8°28′N	39°10′E
Ziway	485	1.1	9	2.5	7°54′N	38°45′E

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).

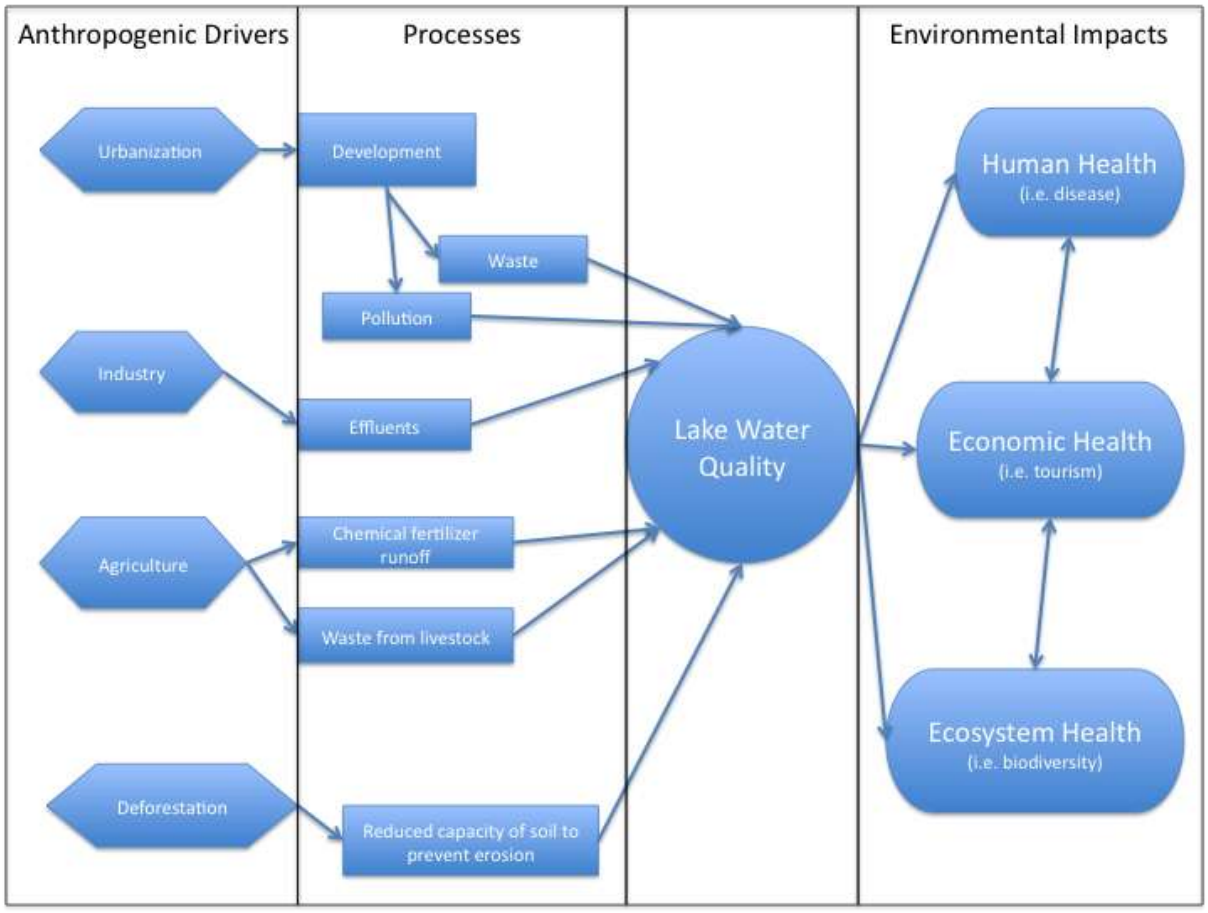

Figure 4.2 Major anthropogenic threats to lake water quality and their impacts, Biswas et al., 2004; Gregersen, 2007.

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.

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

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).

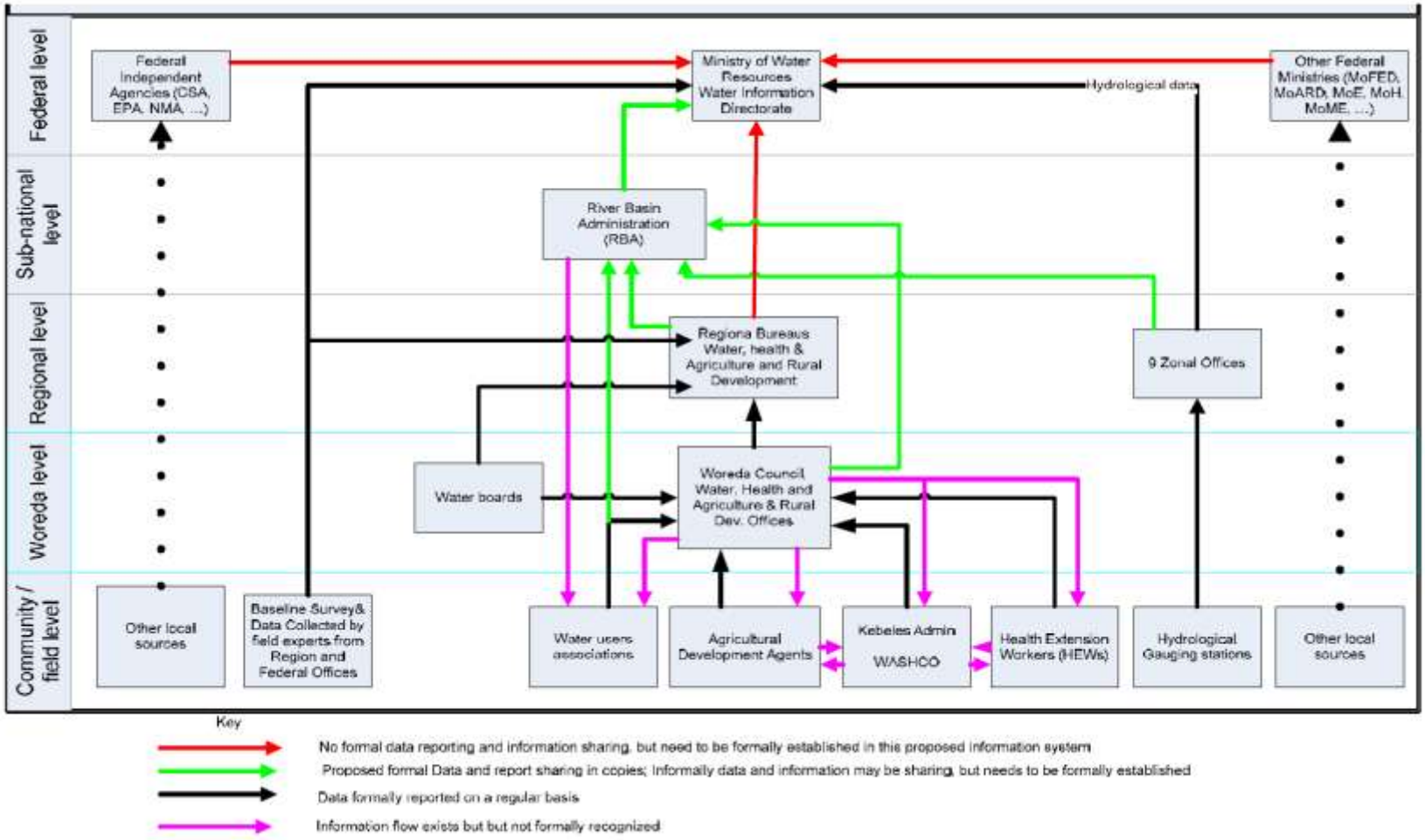

Figure 4.3 Inter-institutional informational flows at various levels of authority in water management, Alem et al., 2011.

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.

Lake	City	Region	Population	Altitude (m)	Distance to lake
Awassa	Awassa	SNNP	258,808	1,708	Near
Ziway	Ziway	Oromia	41,920	1,636	Near
Koka	Nazret	Oromia	220,212	1,590	Far

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

Lake	City	Airport	Near boundary	Δ Water level	Δ Salinity
Awassa	Awassa	Y	Y	rise	decrease
Ziway	Ziway	N	Y	drop	increase
Koka	Nazret	N	N	N/A	N/A

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 oppurtunities – 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.

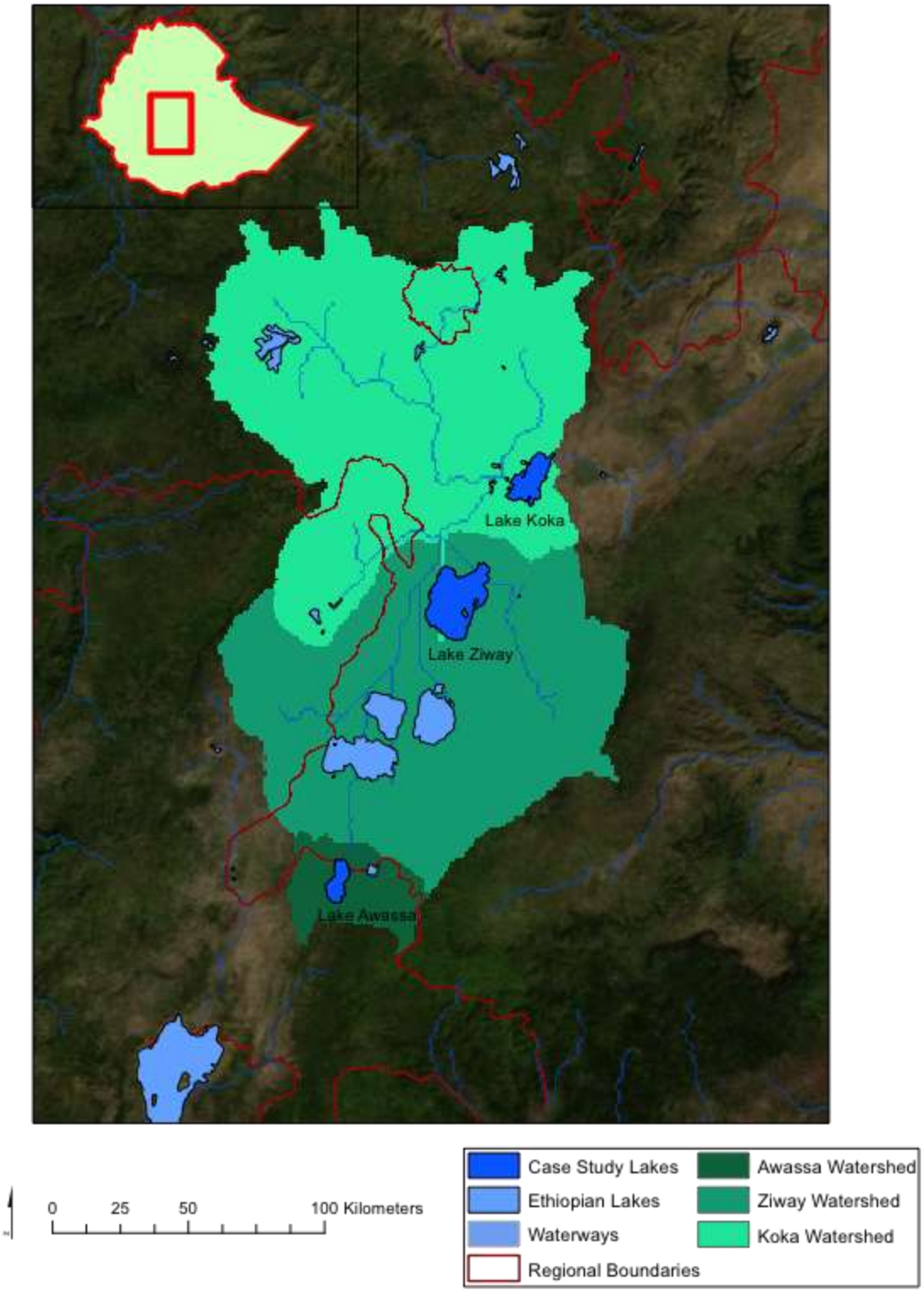

Figure 4.8 Map of case study lake watersheds, author calculations based on DIVA-GIS data.

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.

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Appendices

Appendix 4A

Table 4.A Key informant contact information.

Name	Title	Organization	Email Address	Phone #
	Director	Higher Education Strategy Center		
	Program Manager	Forum for Environment		
	Director	Concern for Environment		

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 record such as the paper presented
3.Dependency syendrom are the status of depending on some one for someting. 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 GENERAL VIEW OF THE WATER QUALITY ISSUES IN ETHIOPIAN RIFT VALLEY LAKES (ERVL).
THE LAST TWO PAPERS WILL ANSWER MANY OF YOUR QUESTIONS.
1. Elizabeth, K., Getachew, T., Taylor, W. D. and Zinabu Gebre-Mariam. (1992). Eutrophication of Lake Hayq in the Ethiopian Highlands. Journal of Plankton Research, 14(10): 1473-1482.
2. Zinabu, G.M. (1994). Long term changes in indices of chemical and productive status of a group of tropical Ethiopian lakes with differing exposure to human influence. Arch. Hydrobiol., 13 (1): 115-125.
3. Zinabu, G.-M (2002). The Ethiopian Rift Valley Lakes: Major Threats and Strategies for Conservation: In: Tudorancea, C. and Taylor, W. D. (eds.) - Ethiopian rift valley lakes . Backhuys publishers, Leiden.
4. Zinabu, G. -M, Kebede, E and Zerihun, D (2002). Long-term changes in the Chemical and Biological Features of Seven Ethiopian Rift Valley Lakes. Hydrobiologia, 477: 81 – 91.
2) What kind of data on water quality is collected in Ethiopia, and who collects this data?
THE ANSWERS TO THESE QUESTION CAN BE OBTIANED 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 POLICES (LIKE MANY OTHER POLICES) ORIGINATE FROM THE FEDERAL GOVERNMENT. HOWEVER REGIONS CAN MAKE CHANGES ON SUCH POLICES THAT ARE ISSUED BY THE FEDERAL GOVERNMENT. I DO NOT HAVE ANY INORMATION (AND I DONOT THINK THAT THERE IS ONE). DATA ON SUCH COMPARISIONS MAY NOT EXISIT 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.