WORKING PAPER 132

Institutional Settings and Livelihood Strategies in the Blue Nile Basin: Implications for Upstream/ Downstream Linkages

Amare Haileslassie, Fitsum Hagos, Everisto Mapedza, Claudia Sadoff, Seleshi Bekele Awulachew, Solomon Gebreselassie and Don Peden

IWMI International Water Management Institute

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Executive Summary

This report provides an overview of the range of key livelihoods and production systems in the Blue Nile Basin. It is highlighting their relative dependence on, and vulnerability to, water resources and water-related ecosystem services in the catchments. It also elucidates current water and land related policies and institutions. The objective of this report is mainly to synthesize and summarize existing knowledge and gaps on institution and policy so as to guide the envisaged in-depth research. In this executive summary key messages and findings in major topics will be presented.

- *Agriculture as the major source of livelihoods in the Blue Nile Basin*: Livelihood security in the Blue Nile Basin is strongly dependent on spatiotemporal water distribution and land management practices. Over 95% of the food producing sector, in upstream areas, is based on rainfed agriculture. Conversely, in the downstream areas (in Sudan), **t**he Blue Nile provides major irrigation developments. Gazira irrigation scheme alone represents about 50% of the irrigated area in Sudan. In production terms: 65% of cotton, 70% of wheat 32% of sorghum, 15% of groundnut, and 20% of vegetable production in Sudan come from this scheme. In general, water as a renewable natural resource sector is of particular importance because of the relatively high proportion of livelihoods that it supports in the Blue Nile Basin.

- *Production systems as manifestation of livelihoods diversity*: Since agriculture is an asset and activities are required as a means of living in the basin, the different livelihoods in the basin are manifested through farming systems and its subsystems. Those include: small grain cereal-based mixed farming systems of the upstream areas of the Northern Highlands (1,500 to 3,000 meters above sea level (masl) in Ethiopia); maize-based perennial crops in the South (upstream area of the Didesa sub-basin in Ethiopia); and maize-sorghum complex in the western lowland valleys (Dabus and Beles, upstream of the Dinder and Rahad sub-basins in Ethiopia). The maize-sorghum complex extends to Sudan where sorghum becomes a dominant crop (e.g., the rainfed semi-mechanized production and the irrigated sorghum production). Another dimension of the production systems, in the Blue Nile basin, is the pastoral and agropastoral systems in Sudan. The fact that the resource base, activities and the decision-making of farmers differ across production systems in the Nile basin implies the diversity in the challenges and opportunities for development.

- *Upstream/downstream linkages and prospects in land and water management:* Agriculture is a system hierarchy ranging from plots through farm watersheds through the production to a basin. For such a hierarchy operating with the same hydrological boundary (i.e., basin) water flows create intra- and inter-system linkages. Because of these linkages, changes in one part of a basin will affect water availability and attendant livelihoods and ecosystem health in other parts of the basin. Threats to these ‘co-dependent livelihoods’ arise from the new dimensions: population growth and food supply; poverty; agricultural intensification; environmental degradation; and water scarcity. The growing importance of land and water management arises from the pressure of ongoing population growth in the context of

constrained availability of agricultural land. For example, in upstream areas of the Blue Nile, the area of cultivable land per person is less than 2 hectares (ha) with low crop yield. As a result, a major part of the upstream area falls under the food deficit zone. To meet the livelihood demands of the community, future increases in agricultural production will have to be realized by raising yields on existing cultivation areas, rather than by expanding the area under cultivation. Sustainable increases in production and ecosystem health can be also maintained if those increases in yield could be associated with soil and water conservation (SWC), hydropower development, and water supply and sanitation. This will, obviously, put blue and green water management as a key element of those development scenarios. A Number of pertinent initiatives are, currently, reported in Ethiopia: irrigation projects in Tana sub-basin (e.g., Koga, Gumera, Rib and Megech); Tan-Beles, Karadobi, Mendia and Border hydropower projects; and a number of watershed management interventions (e.g., Koga, Jema, Rib and Gumera watersheds). In view of those new dimensions, it is important to explore the impacts of those interventions on the downstream areas and the role of institution and policies to harmonize and help achieve livelihood demands in both upstream and downstream regions.

- *Institutions and policy in the Blue Nile basin*: The organizational environment for land and water in the Nile Basin region is fairly well-defined. There are organizations with clear mandates, duties and responsibilities. The organizational settings have been organized in such a way that organizations that have to do with land and water, directly or indirectly, have been identified and given duties and responsibilities, by law, in order to execute their tasks appropriately. That said, however, there are important problems that have been identified in the organizational setting and some questions remain to be answered. Important policy gaps are identified as well. Some of the major problems pertinent to institutions in the Blue Nile Basin are: 1) disciplinary orientations rather than interdisciplinary orientations; 2) organizational instability; 3) inefficient organizational structure (due to understaffing, under equipping, lack of organizational units at the lowest possible levels like *Woredas*, and zones to cater to the needs of the sector); 4) lack of linkages and alliances between institutions; 5) problem of capacity (e.g., shortage of skilled manpower); inadequate office and workshop facilities; 6) limited funds/budget; 7) lack of effective cost recovery mechanisms; 8) lack of integrated information management systems; 9) insufficient public-NGO- private partnerships; 10) the focus of all these organizations is on surface water and groundwater, i.e. blue water; and 11) there is no transboundary organization.

- Considering the central importance of policy and institutional capacities to promote sustainable development has long been recognized. It is remarkable how little research has been done to understand how to support the new dimension of improved land and water management. In the Blue Nile, there are few case studies. We realized that institution and policy studies should apply rigorous comparative analysis and contextual case studies examining a representative range of success, failure, and intermediate cases. Research topics needing urgent attention are indicated in section 4, *Key Messages and the Way Forward*, of this report.

In general, it can be emphasized that the livelihood base of the community and land and water resources in the Blue Nile Basin are threatened. Interventions in upstream areas that aimed at improving the livelihoods of the local community will have an impact on the downstream region. Bringing a win-win scenario by upscaling promising land and water management technologies needs appropriate policy and institutional support, e.g., policy and institutions that can address the upstream/downstream interactions. Therefore, in-depth studies that can, ultimately, lead to a pragmatic policy recommendation are required.

1. SETTING THE SCENE

1.1. Project Rationale and Objective

The need for integrated water resources management to alleviate poverty and food insecurity, especially in semi-arid Africa, where over 80% of rural livelihoods depend on land and water resources, cannot be overemphasized. Recent strides in sustainable resource management have recognized the need for a broad based, integrated approach that coordinates the activities of people dependent on a common resource-base to achieve resource-use efficiency, equity and sustainability. In the Nile Basin, water from the Ethiopian Highlands, particularly from the Blue Nile (known as Abbay in Ethiopia), has historically benefited downstream people in Sudan and Egypt in different ways: agriculture, livestock, industry and electrical power. However, such free benefits are now threatened due to dramatically changing land, water and livestock management practices upstream. High population pressure, lack of alternative livelihood opportunities and the slow pace of rural development are inducing deforestation, overgrazing, land degradation and declining agricultural productivity. Poor water and land management in upstream uses reduces both the potential runoff yields and the quality of water reaching downstream areas. The result is a vicious cycle of poverty and food insecurity for over 14 million poverty-stricken people within the catchment, and for millions of downstream users, including those across international borders. It is widely recognized that improved water management in the Abbay Basin will significantly increase water availability for various stakeholders within the catchment. This will help alleviate the impacts of natural catastrophes such as droughts and reduce conflicts among stakeholders dependent on the Nile.

The Abbay is one of the least planned and managed sub-basins of the Nile, making poverty alleviation and food security a daunting challenge. About two thirds of the area of this densely populated basin falls in the highlands and, hence, receive fairly high levels of rainfall of 800 to 2,200 millimeters (mm) yr^{-1}. However, it is erratic in terms of both spatial and temporal distribution, with dry spells that significantly reduce crop yields and sometimes lead to total crop failures. The impacts of droughts on the people and their livestock in the area can be catastrophic. The population located in the downstream part of the Blue Nile, is entirely dependent on the river water for supplementary irrigation. Canal and reservoir siltation is a major problem and results in major cutoff areas, exacerbating socioeconomic burdens on the poor riparian farmers.

Solutions lie in improving agricultural practices and conserving water at all levels by all stakeholders, both within Ethiopia and amongst downstream communities dependent on the Nile. Though well-known in principle, the technologies required for overcoming the poor and extreme distribution of water resources are not applied because of poor adaptation to the local conditions, unavailability of capital, institutional constraints and inadequate scientific knowledge from a systems perspective. Proposed by diverse stakeholders, this study *hypothesizes* that with increased scientific knowledge of the hydrological, hydraulic, watershed, and institutional processes of the Blue Nile in Ethiopia (Abbay), constraints to upscaling management practices and promising technologies within the catchment can be overcome, resulting in significant positive benefits (win-win) for both upstream and downstream communities, reducing win-lose scenarios.

Two consortia of collaborative and partner institutions will be established to carryout different functions of the project. An investigation group will lead the implementation and a consultative group will help guide the research direction and knowledge sharing. The specific objectives of the project are as follows:

1. Identify major water, land and livestock management constraints and opportunities in the Abbay Catchment, as well as impacts of current and future water, land and livestock management interventions within the catchment and downstream.
2. Adapt and apply existing hydrological, watershed, and economic models that can be used to estimate such impacts both basin-wide and locally in selected communities, including their costs and benefits, and identify 'best-bet' interventions.
3. Create a better overview of 'best-bet' management practices and interventions, and the hydrological and socioeconomic conditions for upscaling them. These will include practices and interventions for improved land and water management (including some that have been previously tried), and measures for assessing their impacts on poverty and rates of land degradation. The economic component will further seek to identify policies, institutional arrangements (including property rights to land and water and transboundary issues), and investment strategies required to scale-up identified practices and water management options, and assess implications for equity, poverty reduction and long-term food security.
4. Build capacity of research partners, NGOs, community leaders and policymakers, through collaboration with local institutions and universities to facilitate student research, stakeholder consultation, facilitation and engagement of stakeholders in dialogues on resource management issues and innovative approaches, as well as generating knowledge for planners and policymakers.

1.2. A Focus on Upstream/Downstream Linkages

While a great deal of research effort has been put into water and land management options in Ethiopia, this effort is unique in its focus on recognizing and then structuring interventions to account for upstream/downstream impacts. This project takes a holistic basin-wide view and develops those interventions that alleviate poverty while at the same time maximize benefits and minimize harm to downstream stakeholders. Seen another way, the focus is on those interventions that are most effective in alleviating poverty from a basin perspective, rather than those focusing on a limited project area that might miss simple opportunities to leverage gains or mitigate harm to downstream stakeholders. The importance of these upstream-downstream linkages are clear both within Ethiopia, where the fragility of the landscape and the vulnerability of the population must be considered downstream of any intervention, and across borders into Sudan and even Egypt, where impacts may arise as a result of changing land and water management practices in upstream areas.[1]

These linkages are likely to be seen most directly through changes in river flows, sedimentation and water quality. The project, therefore, seeks interventions that either minimize changes in river flows, or, better yet, makes changes in river flows that are positive downstream – for example, where possible, moderating floods and droughts, ensuring adequate environmental flows and facilitating navigation. Similarly, with regard to changes in sedimentation and water quality, the project seeks poverty alleviating land and water management interventions that will not degrade

[1] This project will focus on the impact of physical changes made upstream, on stakeholders downstream. In fact, downstream water management changes can impact upstream stakeholders as well. Principles of international water law and broader customary law give weight to established water uses. Therefore, the use and development of water downstream can contribute to the establishment of rights to that water, which might reduce the options for upstream users to develop that same water later. In this context, while upstream abstraction of water leaves less water physically in the system for downstream users, downstream abstractions of water can be seen, in a legal sense, to leave less available water in the system for upstream users to develop. These less direct downstream-upstream impacts will not be addressed in this project.

downstream water quality and sedimentation, but would ideally enhance it, for example, through erosion control, restoration of wetlands, or effluent controls.

1.3. Green and Blue – An Important Distinction

To clarify upstream-downstream impacts it is helpful to distinguish between 'green' and 'blue' water (Figure 1). Green water is defined in the Molden (2007) as soil moisture from rainfall, while blue water is the water found in rivers, wetlands, lakes and groundwater. Interventions in green water management and blue water management will have different implications downstream.

It is frequently suggested that green water is a particularly promising focus for interventions that aim to use agricultural water upstream with minimal negative impacts downstream. But the question is, how far the sole management of green water helps to satisfy the dramatically increasing need for agricultural products in upstream areas?

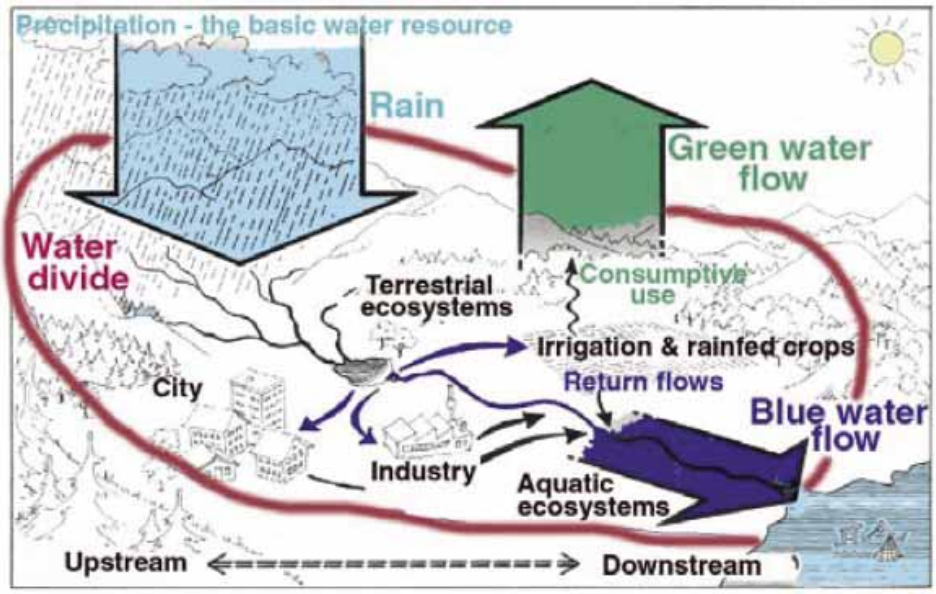

FIGURE 1. Links between upstream and downstream: A green/blue water perspective.

Blue water will, of course, be the focus for interventions that seek to regulate rivers, but they are also likely to be the focus for interventions that can maximize benefits downstream. Interventions in river regulation can protect all users from the threats of flood and drought, and can control sedimentation (Molden et al. 2007). These sorts of interventions are best conceived in a basin context where the full range of potential upstream and downstream impacts can be considered and weighed.

In the Blue Nile it is interesting to note that if Ethiopia, at some time in the future, develops the cascade of potential hydropower sites that have been identified (one of which is at Kara Dobi Dam), it will be in the interest of Ethiopia to maximize the productivity of green water in agriculture, so that the greatest possible volume of blue water can be run through the Kara Dobi site and downstream to harness hydropower in cascade systems up to the border. On the other hand, it will also be in the interest of Sudan and Egypt, as it reduces sediment load, to even out flow during flood and drought, so that water is more controlled and available without the effect of significant evaporation losses. This would align very closely the individual priorities of upstream Ethiopia, with downstream Sudan and Egypt.

1.4. A Nested Approach

In terms of scale, the project takes a nested approach to analyzing the challenges of land and water management, looking at a range of scales starting from the local perspective and aggregating up through to the international perspective. It considers interventions and upstream-downstream impacts at the community level, sub-catchment, basin and international level as appropriate. Each level of analysis will involve different physical dynamics, stakeholders, policy and institutions, and, therefore, options for intervention. Where relevant, it will also look at the interactions between these levels.

2. POLICY AND INSTITUTIONAL STUDIES COMPONENT

The Policy and Institutional Studies component of this project was developed in recognition of the fact that every intervention is implemented in a unique context where not only physical factors, but also institutions and policies, will influence its impact. To develop successful interventions it is, therefore, important to understand the context in which these interventions are to be implemented.

This component will determine the role of institutions and related support services in promoting or discouraging improved land, livestock and water management within the sub-basin and communities downstream. It will deepen the understanding of the socioeconomic, institutional and policy issues highlighted in the other two components of the project (Watershed Management and Water Allocation), and where possible a gender-disaggregated overview of these important issues and trends in the catchment.

2.1. The Role of Policies and Institutions

The influence of policies and institutions on the success or failure of interventions can be seen in many ways – on poverty and equity impacts, in implementation, and in the sustainability of interventions. Interventions designed to alleviate poverty and enhance growth fail for a variety of reasons, many of which are related to the policies and broader social institutions that determine an individual's access to resources and the distribution of the benefits of publicly-financed interventions. While an intervention may be designed to target the poor, in practice, the poor (and particularly, the poorest and women) may be effectively barred from participating or may not receive the full share of benefits intended for them. Reasons for this disenfranchisement can range from the formal, such as requirements regarding landholdings or counterpart inputs, to the informal or customary practices that effectively redistribute opportunities and benefits within a community or household.

Policies and institutions are critical for the implementation of interventions, as they create an environment and incentives that can either enable or undermine them. Policies such as agricultural subsidies and institutions such as land ownership determine the landscape within which production decisions, and, hence, land and water management practices, are considered. Even broader issues such as trade and exchange rate policies will affect the incentives for adoption of particular practices, and can be obstacles to implementing change. In addition to shaping incentives, policies and institutions can be seen as mechanisms for implementing interventions. Water pricing, river basin organizations, and payments for environmental services are all examples of policy and institutional mechanisms for implementing change in land and water management practices.

Finally, for all of these reasons, supportive policies and institutions are essential for sustained changes in land and water management. If the broader policy and institutional context is not aligned with the change, it is likely that practices will revert when the project ends.

2.2. Policy and Institutional Interventions

Policies and institutions can align incentives and create an enabling environment for improved land and water management. In this sense, policy and institutional reforms in themselves can be designed as interventions to promote enhanced land and water management broadly (i.e., to promote water conservation of investment in land management). In addition, where specific behavioral changes (i.e., specific crops or technologies) are being promoted as interventions, it is important to look at the relevant policy and institutional incentives that might be needed to support that change. In these cases, policy and institutional reforms can be designed as an integral part of specific interventions that might, for example, include investments of some sort.

To focus the efforts of this research, a rapid assessment was undertaken based on existing published and grey literature. This was complemented by broad stakeholder consultations and together the information will provide the basis for selecting and defining topics for a detailed study.

3. RAPID ASSESSMENT: THE PROCESS AND RESULTS

This Rapid Assessment (RA) was undertaken to launch a stakeholder consultation process and help identify researchable issues and frame a detailed work plan for the Policy and Institutional Studies component of the Upstream-Downstream Project. The RA has identified a range of stakeholders. Several of these stakeholders were contacted at the launch of the Rapid Assessment and provided important materials that were used in its production. Upon its completion, a workshop was held with the broadest possible range of stakeholders to discuss the issues presented, to 'reality check' the document, and to provide additional input that will be used along with the RA document to design the detailed analytical framework of this project component. Particular attention was paid to the following during both the stakeholder consultation and research team discussions:

- What is the role of agriculture in terms of the livelihoods of the community in the basin? What are the different production systems in the basin and what are the implications in terms of upstream-downstream linkages? Sedimentation is a pressing upstream/downstream concern in the Blue Nile for agriculture, hydropower and even municipal water supplies. How are policies and institutions contributing to this challenge, or how could they be used as part of a solution? Are current institutions or policies creating incentives for poor land and water management, and in particular, a lack of awareness of upstream-downstream impacts?
- What are the costs and benefits of environmental services and trade-offs? How do people perceive those benefits and costs of environmental services? What are the mechanisms for Payment for Environmental Services (PES)?
- The lack of transboundary institutions appears to be an important gap arising from this analysis. Is such an institution needed? How might it ensure greater upstream-downstream equity?

The following section provides an overview of the results focusing on key livelihoods and production systems in the Blue Nile Basin, highlighting their relative dependence on, and vulnerability to, water resources and water-related ecosystem services in the catchment, as well as current water and land utilization methods.

3.1. Farming Systems in the Blue Nile Basin: Examining Implications for Upstream and Downstream Linkages

The Blue Nile Basin (called the Abay upstream in Ethiopia) covers approximately 0.31 million square kilometers (km^2) (ENTRO 2006a). Its source, the Gish Abay, is in the Ethiopian Plateau from which it flows northward into Lake Tana. From Lake Tana it exits from the southeastern corner and cuts a deep gorge first south then westwards. Along the way it is joined by a number of tributaries (e.g., Beles, Dinder) emerging from a range of different landscapes and climatic zones in Ethiopia (MoWR 1998a). In the downstream areas the river flows across wide clay plains of unconsolidated sediments that might have been delivered by flood and deposited there over time.

Different farming systems in the basin have evolved in response to these diverse landscapes and climatic zones, and the attendant human decision dynamics are responding changing livelihood opportunities (Westphal 1975; Dixon et al. 2001; Malcolm et al. 2001). In Ethiopia, many studies on farming systems recognized only mixed agriculture in the highlands and pastoralism in the lowland areas (e.g., Getahun 1980). In contrast, Westphal (1975) recognized several factors such as land use, vegetation covers, and different land and water management practices. Westphal's (1975) approaches help to capture the diverse water and land related livelihoods of the farming communities upstream and downstream in the basin. Using similar approaches, but focusing on a cereal-based mixed farming system, Haileslassie et al. (2007) identified three distinct subsystems: *rice-based cash crops* (downstream); *teff-millet*; and *wheat-barley* and *barley-potato* (upstream) systems in the Gumera watershed (Blue Nile Basin, Ethiopia).

In this review, we attempt to follow a similar approach but focus on the basin scale on major farming systems and associated subsystems (Figure 2). We focus on cropping systems; specifically, small grain cereal-based mixed farming systems and maize-sorghum-perennial complexes and their associated subsystems. We then focus on water management practices (rainfed systems and irrigated systems).

3.1.1. Small grain[2] cereal-based mixed[3] farming systems

Small grain cereal-based mixed farming systems cover major parts of the upstream areas of the Northern Highlands (1,500 to 3,000 masl[4]) in Ethiopia and farming systems of similar crop composition, water management and cropping intensity is not reported in Sudan. Subsystems (hereafter called systems) in this region can be further categorized by specific cropping patterns; we look at *wheat-barley* and *teff-based cereals*. Systems can also be categorized by rainfall regimes, which support either double or single cropping (MoWR 1998c; Westphal 1975; Bourn 2002).

[2] Small grain cereals refer to: teff, wheat, barley and oats

[3] Mixed farming refers to: complementary and competitive association of crop and livestock

[4] masl - meters above sea level

a) The wheat-barley system

Wheat-barley systems are typical of subsistence farming and mainly occupy the upstream, upper altitude ranges above 2,500 masl, such as the Beshilo, Durame and Middle Abay sub-basins. The system is invariably rainfed agriculture, drawing only on green water resources. The wheat-barley system is characterized by land fragmentation and a shortage of arable land. For example, an average farm size of 1.3 ha (only for the Amhara region) is reported by ENTRO (2006b). It is also very common to see pulses (e.g., horsebean, pea) and potatoes as components of this system. The importance of these crops increase with increasing altitude (Haileslassie et al. 2007). In steep slope areas, where altitude allows, some maize and sorghum cultivation is also reported. Communal grazing lands are one of the important land uses in the wheat-barley system. In most parts of the wheat-barley system over-stocking and closely related overgrazing of those land use units are frequently reported. Such land management practices are criticized for its contribution to increased runoff erosion and sedimentations (low water productivity). It also becomes evident that farmers are focusing a niche approach for farmland management. For example, the fertilizer inputs vary between crops and fields (home and distant fields). This has implications for the quantity of biomass produced and the related process of water productivity.

Livestock are well integrated into the crop production system, with complementary/competitive interactions between crop and livestock enterprises. They are complementary in that livestock are used for nutrient recycling and sources of traction power, while crop production provides residues for animal feed. But, at the same time, livestock and crop production compete for space and thus drive land use change. Haileslassie et al. (2006b) reported that, in this system (e.g., in Gumera watershed), farmers lack cash crops and livestock play an important role to overcome the cash constraints of households. There are few alternative income opportunities (e.g., non-farm employment) and thus farmers prefer to have more small ruminants (e.g., sheep) for frequent off-take.

Depending on the rainfall pattern, the *wheat-barley system* can be classified as single or double cropping. Multiple cropping areas are usually on the higher elevations and confined to the mountain ranges separating the Tekeze, Awash and the Blue Nile basins. In those areas there is a bimodal distribution of rainfall and farmers can produce two harvests per year.

Delayed and early withdrawal of rain (in both the short and long rainy seasons) is one of the major production constraints of the wheat-barley system. Equally important are the farmers' lack of capital and know-how regarding the productive use of green water, e.g., improved biomass yield, water harvesting and soil moisture conservation. The low crop and livestock water productivity values (US$0.5 m^{-3}) in this upstream area, suggested by Haileslassie et al. (2007), testify to this phenomenon. According to these authors there is a very close and positive relationship between water productivity and the level of asset endowment and access of farm households, which suggests that poverty reduction must be one of the major areas of intervention to enhance the water productivity of crop and livestock enterprises. Similarly, downstream in Sudan, decisions to adopt sustainable land management technologies depend on the asset endowments of households. This is particularly of relevance in areas of shifting cultivation and the need for labor for frequent clearing to access land of better fertility as well as for weeding (ENTRO 2006c).

High population pressures and attendant livestock density and cultivation on steep slopes have resulted in severe soil erosion and land degradation (Mwendera et al. 1997), which is another major challenge in the farming system. For example, erosion rates ranging between 25-84 Mg ha-1 yr-1 are reported for the Gumera watershed (Haileslassie et al. 2006a). This can also be viewed in terms of the cost of maintaining soil fertility (on-site effects on upstream areas) and nutrient inflow and soil fertility enrichments in the downstream areas (off-site effects). In both cases, the consequences

are already seen in the form of low soil fertility and crop yields upstream, and sedimentation of canals and irrigation infrastructures in downstream areas (ENTRO 2006a; SMEC 2007). At the local level, such disruptions in ecosystem services are also frequently reported (IFAD 2002). In most cases, according to ENTRO (2006b), there are permanent grain deficits in this upstream farming system (ranging between 240 and 580 kilograms (kg) of grain per family).

b) Teff[5] based cereal farming

This is one of the dominant systems in the upstream areas at 1,500 to 2,300 masl, for example, in the Beshilo, Durame and Tana sub-basins (ENTRO 2006b; MoWR 1998c). Teff can withstand waterlogging and is, thus, a dominant crop for flatlands and vertisols. Where soils are better drained, maize and sorghum are also cultivated extensively (Bourn 2002). Depending on the biophysical settings, farmers tend to adopt different crop combination strategies, such as a *teff-maize-sorghum complex* or a *teff-wheat-sorghum* complex. In this system, pulses (e.g., chickpea and rough pea) and oil crops (e.g., niger seeds) are important cash crops. Teff is a principal staple food and also a cash crop in some areas.

Teff systems are rainfed and, therefore, like in *barley-wheat systems*, green water management is important. The productivity of crops in this farming system is higher than in the *wheat-barley* system, but very low compared to the global average. According to ENTRO (2006b), *teff-based cereal* farmers (on average) produce a surplus over subsistence requirements. Despite the claimed surplus productivity of those areas, the investment capacity of farmers to enhance green water productivity is limited and most likely the sustainability of ecosystem services is questionable under current practices (ENTRO 2006b; SMEC 2007).

The livestock system is fully integrated, but with different herd structures and composition as compared to *wheat-barley* systems. For example, the major purpose of livestock in *teff-based cereal* farming is draft power. This is closely related to the relatively bigger landholding size that requires sufficient traction power. Average farm sizes ranging between 2.07 (in Western Amhara) and 1.26 ha (in Eastern Amhara) have been reported (ENTRO 2006b). Scarcity in livestock feed is a major problem in *teff-based cereal farming* and crop residues are, therefore, an important source of livestock feed (MoA 2002).

The major challenges to crop production in this system are erosion and soil nutrient depletion, driven by land use changes. Haileslassie et al. (2005), for example, reported very strong nitrogen depletion (>120 kg N ha^{-1} yr^{-1}) for cereal-based farming systems in Ethiopia. In contrast to the generalized notion of the Ethiopian Highlands as a source, and the downstream areas (e.g., Sudanese plains) as a sink for sediment, localized sediment redistribution within and between different systems are reported (Haileslassie et al. 2006a). For example, sediment flux to Lake Tana, which is located in a *teff-based cereal farming* system, has been estimated to be 10 x 10^6 m^3 $yr.^{-1}$. Assuming a trap efficiency of 50%, the Lake will lose 6% of its effective storage within 100 years (MoWR 1998a). Recent studies by SMEC (2007) give a higher estimate on the amount of sediment load into Lake Tana: the total annual sediment load from the upper catchments is estimated at 9.61 million tonnes yr^{-1}. The average annual outflow from Lake Tana (at Bahr Dar) carries an average annual sediment load of 1.04 million tonnes yr^{-1}. This mean 8.57 million tonnes of sediment will settle annually in the Lake and wetlands.

[5] Teff is a fine stemmed tufted annual grass and the grains are used as the main ingredient in Ethiopian traditional flat bread called *injera.*

3.1.2. Maize-sorghum-perennials complex

This farming system covers a very large area located in the western and southern parts of the Blue Nile Basin. The system consists of both intensive farming of *maize-based perennial crops* in the south, upstream of the Didesa sub-basin in Ethiopia; and extensive farming of *maize-sorghum complex* in the western lowland valleys of Dabus and Beles, upstream of the Dinder and Rahad sub-basins in Ethiopia. The *maize-sorghum complex* extends to Sudan where sorghum becomes a dominant crop (e.g., the rainfed semi-mechanized farms).

An important segment of the *maize-based perennial* is the *maize-wheat; sorghum-teff-maize; maize-enset* and *maize-teff-coffee* subsystems. In the following section we focus only on the two major systems: *maize-based perennial* and *maize-sorghum complex systems.*

a) Maize-sorghum complex of the western lowlands*:*

This farming system is practiced in the western and northwestern valleys of Dabus, Beles and Dinder-Rahad sub-basins (MoWR 1998c; ENTRO 2006b). The major soils are leached Acrisols and Nitosols of low inherent fertility on upslope areas and vertisols in the lower plain of Sudan. In this system there are segments of sedentary smallholder farmers, shifting cultivators and semi-mechanized rainfed farming. The major crops produced in this farming system are sorghum, maize and millet. Sorghum becomes dominant with decreasing rainfall (e.g., in Sudan). In some areas sesame, groundnut, cotton and ginger are produced as cash crops. The topography is almost flat in most parts with very few areas of sloping and undulating land. Compared to other upstream areas, the population in this farming system is sparse (0-10 person km^{-2}) and problems of soil erosion are not apparent (ENTRO 2006b; MoWR 1998b; MoWR 1998c).

Owing to poor land and crop management, the yield in this system is low compared to the national average, and as a result there is scope for improvement in green water productivity. Slash and burn is the major land management practice for smallholders in this system (sorghum and shifting cultivation in Ethiopia by the Berta, Komo and Mao people, south of the Abay River), and plowing is limited to recently settled highlanders in the Ethiopian part. Most often plots are cultivated for one or two years and then farmers move to new plots. This could be accounted for soil fertility depletion (as the results of minimum fertilizer inputs).

Semi-mechanization of the cropland management is reported in this system (e.g., in the Sudan part). It was developed under the auspices of the Government of Sudan as a mechanized crop production scheme in 1945. Land is leased by the State to individual investors, whereby each individual is allotted “a farm.” These schemes are managed by both the private and government sectors. Within the Abay Blue Nile Basin in Sudan there are approximately 73.13 million ha of large- to medium-scale semi-mechanized farms (ENTRO 2006a).

There is also traditional rainfed cultivation (~ 474,282 ha) in this part of Sudan. The main difference between the mechanized and traditional cultivation systems is the scale of operation and the use of modern agricultural machineries. Additionally, the traditional cultivation uses simple tools, depends on family labor and is generally limited to subsistence production. Landholding in traditional rainfed farming ranges between 4 and 6 ha (ENTRO 2006c) which likely reflects the poor workability of clay soil and the need for more labor inputs. Families that are better-off hire labor and/or tractors to cultivate more land area. Mechanized cultivation, on the other hand, creates large farms, usually between 400 and 600 ha. Sorghum yields in the traditional crop sector have declined in both systems, and are currently at about 0.4 tonnes/ha, down from about 0.9 tonnes/ha in the 1970s. This can be

accounted for by low inputs, soil fertility depletion and shortening of fallow periods. In general, this suggests low crop water productivity and unsustainable land and water management.

Sometimes, rotation of sorghum, sesame and fallow with or without cotton are practiced, but often a piece of land is cropped with sorghum until the land loses its fertility and is then abandoned completely. In the semi-mechanization segment of the *Maize-sorghum complex*, the entire farm operations are not mechanized. Activities like harvesting of some crops are managed manually. Flat landscapes, a lack of drainage lines over extensive areas and the dominance of vertisols characterize this system. The rainfall ranges between 500-750 mm yr^{-1} and this is the only rainfed based crop production in the downstream areas of the Blue Nile. In contrast to upstream areas in Ethiopia practicing *small grain cereal farming systems*, erosion and high population pressures are not reported in this system.

Like farmers in the *teff* and *barley-wheat* systems, farmers in *maize-sorghum complex*, are also dependent on rainfed farming. While there is significant irrigable land in these areas, irrigation is limited and on a small-scale (particularly in Ethiopia). In addition, no significant efforts have been made to enhance the capacity of farmers to increase green water productivity (e.g., soil moisture conservation and increased crop productivity).

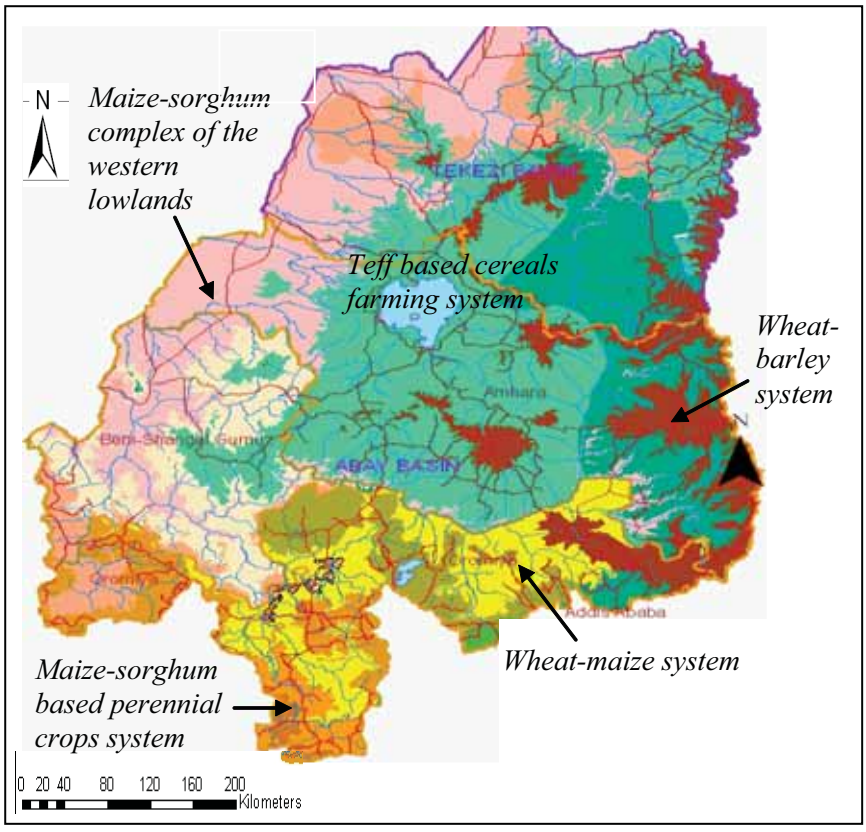

FIGURE 2. Farming systems in the upper parts of the Blue Nile Basin.

Despite surplus feed in major parts of this system, livestock are less integrated into this crop production system (MoA 2002). This could be accounted for by the low intensity of the production system and also the prevalence of the tsetse fly in the region (e.g., valleys of Didesa) (Bourn 2002). Other production limitations include the inaccessibility of the area and lack of know-how of farmers. However, in response to the rapid population growth and settlement (from *small grain cereal-based farming*) in the Ethiopian parts, this system is evolving into a mixed crop livestock system (MoWR 1998c). For example, a number of settlers have started using oxen for draft power and producing livestock as part of their livelihood strategies. Some mechanized rainfed farming is also emerging.

b) Maize-sorghum based perennial crops

This system is located entirely in the Ethiopian Highlands and encompasses diverse cropping patterns that can be categorized with major variants: *maize-wheat; sorghum-teff-maize; maize-enset* and *maize-teff-coffee* (ENTRO 2006b; Bourn 2002; MoWR 1998c).

In general, the *maize-sorghum-based perennial system* is characterized by perennial crops such as coffee, enset[6], khat and some fruit trees. Coffee and khat are major cash crops, while maize, sorghum, and enset are the staple foods in this system. Cultivation of root and tuber crops is also frequently reported (Bourn 2002). Considerable variation is seen in the relative importance of enset as a staple food compared to other tubers, root crops and cereals (Bourn 2002). In some parts of the basin (e.g., the Jima zone) enset is virtually the only food crop, while in other parts (e.g., Illubabor, West Shewa and West Wellega, and the Upper Dhidessa Valley) enset is only a minor source and cereals are the major food source. This system is known for its high calorie production per unit area.

The growing period is the longest in this part of the basin and it ranges from 240 to 365 days. Rainfall in this area is also reported to be the highest in Ethiopia (2,200 mm yr^{-1}). Like elsewhere in upstream areas of the basin, this system is rainfed and, therefore, green water management is important for improvements in livelihoods.

As suggested by MoWR (1998c), about 13 semi-mechanized and state-owned rainfed farms are registered in this farming system. These farms were first established to takeover the large private commercial farms expropriated at the time of land reform in 1975. The total area covered with annual crops and perennials was 36,754 ha (in 1995) and the major focus was on food crops such as maize. Given its potential, this level of investment was arguably too small. In these upstream areas, the majorities of farmers are smallholders and are still dependent on age-old traditional plowing methods. This is a likely consequence of factors such as the dominant landscape, population pressures, land fragmentation and the fact that commodities, rather than cash crops, are produced.

Following changes in the Ethiopian Government and policies after 1991, there was growing interest in investment in mechanized rainfed agriculture, but the priority remained food crop cultivation. As a result, water productivity in financial terms has remained very low. Investment in large and medium-scale mechanized irrigation farming is also quite limited, with the sole example being the Finchaa sugar plantation.

Although livestock is typically integrated into crop production in this system, hoe culture is reported in some areas of this farming system, mainly enset and other root crop cultivation. It is also practiced in khat and coffee cultures when intercropping is required. The tsetse fly is a challenge for the livestock sector (Bourn 2002).

[6] Enset (*Ensete ventricosum*), sometimes referred to as 'false banana', is a long-leaved, banana like perennial plant which is used for food, fodder and fiber in parts of the Central Highlands and in major parts of Southern Ethiopia.

Though localized erosion problems are reported, compared to the *small grain cereal systems*, the problem is less severe. This system is found primarily in high forested areas in the country and is sparsely populated compared to the *small grain cereal systems*. Under such perennial-annual integrated systems, a positive soil nutrient balance is reported (e.g., Haileslassie et al. 2005). However, in addition to low coffee yields (0.53 Mg ha^{-1} where research recommends 0.6-2.3 Mg ha^{-1} yr^{-1}), coffee berry disease, poor management and fluctuations in the international markets are major production constraints. Seasonal labor shortages during the coffee harvest are also frequently reported. Thus, farmers usually hire casual labor, mostly landless farmers and farmers who move from the other areas (e.g., *small grain cereal system*) for this purpose.

3.1.3. Irrigated sorghum farming in Sudan

In contrast to upstream areas, irrigation in downstream areas, in Sudan, are an important component of the agricultural sector (Figure 3). Irrigation contributes more than 50% of the total value of agricultural production and provides employment for more than 80% of the population (FAO 2000). As these schemes are distributed across the downstream regions of the Blue Nile and its tributaries, they can be designated as a farming system. In this system, in addition to sorghum (the major crop) and wheat, cash crops such as cotton and groundnut are produced. Annually, there are sizeable volumes of these commodities for domestic consumption and export. Poor crop performance, and by implication low physical water productivity (kg of yield m^{-3}), characterizes this system and, therefore, all schemes have been subsidized by the federal government in Sudan.

Several studies (ENTRO 2006c) reported that irrigation canals and reservoirs in these systems are major sinks of sediment that has been delivered from upstream areas in Ethiopia where *small grain cereal-based mixed farming* is practiced. These irrigation systems are, therefore, highly capital-intensive, requiring regular maintenance and desiltation. According to ENTRO (2006c), the social and economic infrastructure associated with these large-scale irrigation schemes has accentuated the substantial geographical disparities associated with the unequal natural resource endowment among states. Gezira State alone produces more than 50% of irrigated agricultural output, including 90% of the nation's cotton and almost half of its wheat.

3.1.4. Irrigated vegetables and cash crop farming in Ethiopia

Irrigated farming has a long history in Ethiopia and is usually operated on a small-scale. Small-scale irrigation of fruits and vegetables (onion, potato, garlic, carrot and cabbage) invariably complements the livelihoods of rainfed smallholders, by providing households with cash income. According to MoWR (1998c) and MoWR (2007), small-scale irrigation is integrated into most farming systems (e.g., *small grain cereal-based mixed farming systems*) and is not considered an independent system. Despite the huge areas of potential irrigable land in the Ethiopian part of the Blue Nile Basin (~600,000 ha), neither medium nor large-scale irrigated farms are widely seen, with the exception of the Finchaa Sugarcane production.

In 1998, 9,300 ha of medium-scale irrigation developments and 31,480 ha of small-scale traditional diversions were reported in Ethiopia. Today, these figures could be higher as a result of IFAD-supported efforts to improve traditional irrigation in Ethiopia (IFAD 2007), and current efforts by the Government of Ethiopia (GoE) and NGOs supporting the development of small-scale irrigation. There are also a few medium and large-scale irrigation schemes under construction (e.g., Koga) and under study (e.g., Rib and Gumera). IFAD (2006) and IFAD (2007) reported that the productivity of irrigated crops in Ethiopia is below both potential and global averages, despite the

important role it plays in improving the livelihoods of farmers. This low productivity is mainly associated with shortages of vegetable seed, market/infrastructure and farmers' know-how. Like rainfed farmers, irrigated farmers are reluctant to apply agricultural inputs such as fertilizer and pesticides. This is associated with the low investment capacity and the risk mitigation strategies of farmers. The repercussion is low water productivity and water shortages. This in turn leads to local and potential international conflict (IFAD 2002).

3.1.5. Pastoralist and agro-pastoralist in Sudan

As suggested in ENTRO (2006c) a substantial proportion of the population in the Blue Nile live and work on the large irrigation schemes and on semi-mechanized farms. In the past many of them followed pastoralist and agro-pastoralist livelihoods, but for one reason or other they lost their livestock and became sedentarized.

Despite changes related to frequent drought and expansion of large-scale farms, there are a number of people who retain their original way of life. For example, the Rufa'a al-Hoi is an Arab speaking Muslim nomadic people with sheep, cattle and camels. Following losses of many of their animals due to the 1984 drought, an increasing number of sedentarization of Rufa'a al-Hoi people is reported. Deteriorating the power of the Rufa'a al-Hoi through the introduction of the federal structure has also significantly contributed to this transition of the system. A study also suggests occasional conflict between different pastoralist groups. For example, Kenana (are also Arab speaking pastoralists) usually comes into conflict with the northern Badiya group of Rufa'a el-Hoi along the Blue Nile. Major problems in those pastoral areas are a lack of drinking water supply for livestock. It is also noted that in such a system water supply and feed availability are not synchronized and, thus, lead to either overgrazing (in available drinking water areas) or underutilization of animal feed (in areas where there is no drinking water).

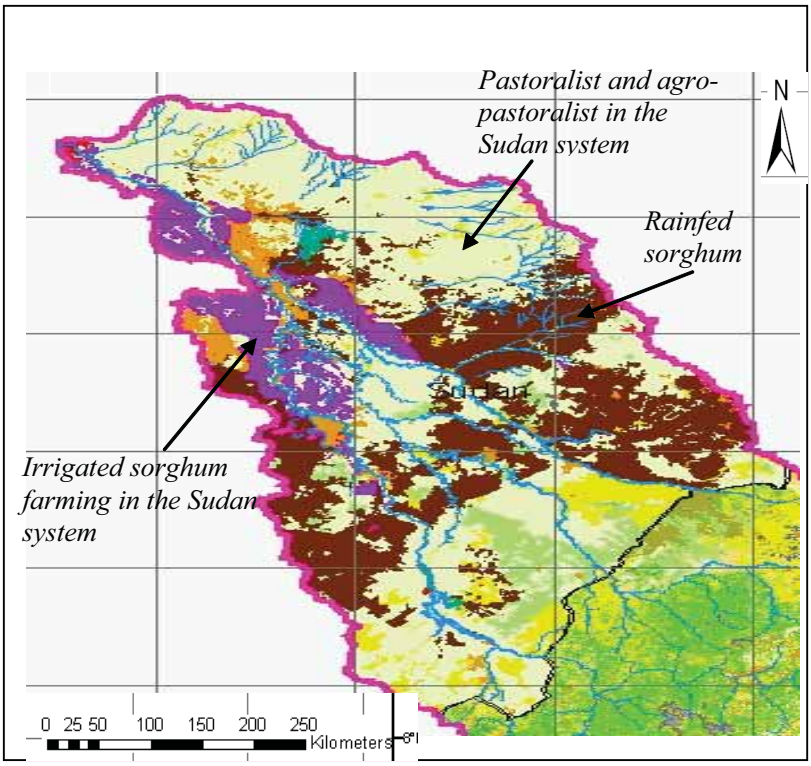

FIGURE 3. Farming systems in the downstream parts of the Blue Nile Basin.

3.2. Key Livelihood and Socioeconomic Characteristics: Land and Water Management Perspective

The Blue Nile Basin can be broadly characterized as having a high level of poverty, relatively low levels of access to water and modern energy, and a high degree of dependence on agriculture and water-related ecosystem services.

3.2.1. Population in the Blue Nile Basin: Dynamics and some demographic characteristics

Basin-wide data on population dynamics (both in space and time) are inadequate. A recent review by ENTRO (2006a) estimates the total population of the Blue Nile Basin at 22.9 million, with the majority of the population (80%) living in rural areas. Of the basin's total population, the highest proportion (71%) lives in upstream areas (Ethiopia). There are also apparent differences in urban-rural distribution. For example, more than 90% of the total population in the Ethiopian Blue Nile lives in rural areas, while in Sudan this figure is less (70%).

Differences are also reported across the basin in terms of key demographic characteristics such as rural population growth rates. For example, in downstream areas rural population growth ranged between 3.6-4%, while for the upstream areas these figures had a lower value (2.43-2.56%). Growth rate figures for upstream areas are fairly comparable with the overall Ethiopian rural population growth rates. The downstream areas also showed stronger growth rates in urban population (25.2-86.7% in Sudan, the highest value is for Khartoum). By age, the largest group in the basin is the under 15-year category, with notable differences across upstream and downstream regimes (e.g., 36-44% in Sudan and 43-45% in Ethiopia). BoFED (2006) reported a proportion of 44, 53 and 3.5% for age groups <14, 15-64 and >65, respectively, in the Amhara region. This indicates the potential need for space and attendant land use change in the basin. The current state of land degradation is usually ascribed to high population density in upstream areas (FAO 2000; Awulachew 2006).

3.2.2. Agriculture and water: The key livelihood in the Blue Nile Basin

In Ethiopia, basin specific data on the contribution of agriculture to the Gross Domestic Product (GDP) is very scarce. But according to MoFED (2006) and FAO (2000), the national economy remains heavily dependent on agriculture and it accounted for about 56% of the GDP in 1996. Data from the last 10 years indicate a steady decline in this share which reached 47% in 2006. From the different agricultural sub-sectors, crop production takes the most significant share (30%) of the national GDP, followed by animal farming (12%). The share of forestry and fishing is relatively small (5%). Coffee exports account, usually, for more than 65% of foreign exchange earnings, while processed and semi-processed hides and skin are the second most important foreign exchange earners.

Region specific data shows a higher share of agriculture in GDP. For example, for Amhara, the agricultural sector contributed about 58% to regional GDP in 2005 (BoFED 2006). For the Oromiya region, in 2006, this was about 60%. In view of very few industries and service enterprises operating in the upstream areas of the Blue Nile Basin (Ethiopia), this higher level of contribution of agriculture to GDP could be reasonable. As parts of the basin are in the major coffee growing areas, the share of agriculture in foreign export earnings could also be expected to be higher.

In Sudan, 80% of the people depend directly on their natural environment for their livelihoods and survival, and agriculture is the mainstay of the economy. As suggested by ENTRO (2006c) and FAO (2000), it contributes about 37% of GDP and 15% of the exports and provides a source

of livelihood for about 70% of the population. But this share is declining and Awulachew (Forthcoming) suggested a share less than 60% (Figure 2).

Like the upstream areas the contribution of agriculture to GDP has a tendency to decline. Contrastingly, during the last 5 years, the share of the oil sector has developed from almost nil to more than 11% of the GDP.

However, from both sets of data it can be seen that agriculture is the mainstay of the basin's economy and more than 80% of the population earn their source of livelihood from agricultural sectors and attendant water management (Figure 4). Agriculture is a system hierarchy ranging from plots through farm watershed to the basin (Malcolm 2001). For such a hierarchy operating with the same hydrological boundary (i.e., basin) water flows create intra- and inter-system linkages. Because of these linkages, changes in one part of a basin will affect both water availability and ecosystem health in other parts of the basin. So, paying adequate attention to hydrological–ecological linkages and dependencies (e.g., more than 80% of the population are living from agriculture) is one way to approach sustainable water management.

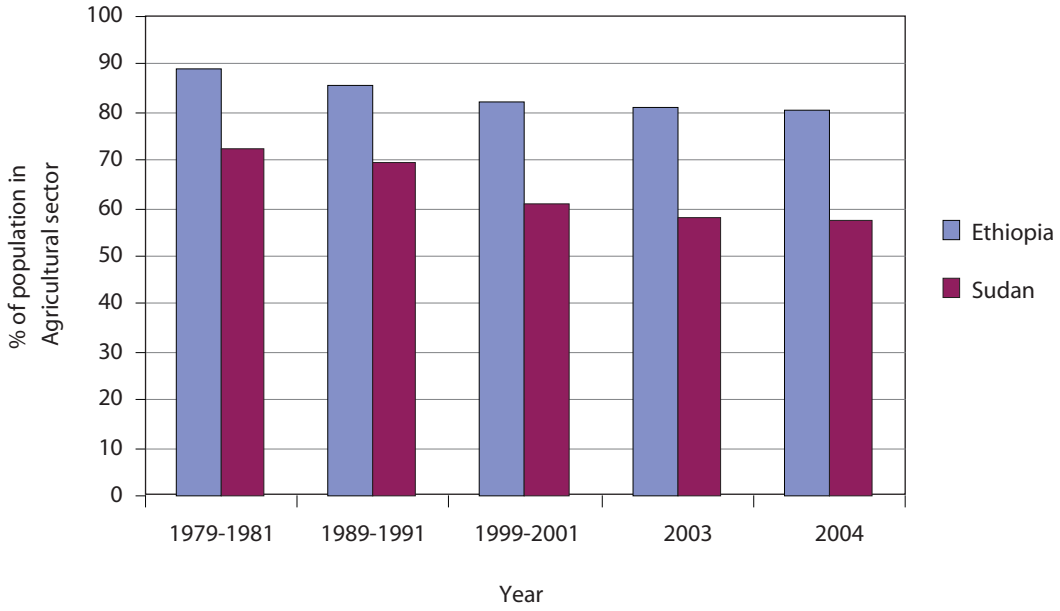

FIGURE 4. Proportion of total agricultural population in the Blue Nile, including forestry and fisheries (analysis based on FAO, statistical yearbook 2004 data) (*Source:* Awulachew Forthcoming).

3.2.3. Level of poverty and vulnerability to disruption of water-related ecosystem services

According to MoFED (2002), the proportion of the population below the poverty line in Ethiopia is 44%. This value is high compared to the Africa standard (FAO 2000). Basin specific data indicating the level of poverty are scarce. But estimates for the regional states (in the basin) are fairly comparable with this national trend although of a lesser magnitude (ENTRO 2006b). For example, using a basket of food items sufficient to provide 2,200 kcals adult^{-1} day^{-1} and considering a non-food component, the poverty line represents ETB 1,070 (according to 1995/96 prices). Accordingly, 55% the population in the Benishangul Gumz region (i.e., *maize-sorghum complex of the western lowlands*) live below the poverty line. Oromiya (38%) and Amhara (32%) regional states have a lower share of population living below the poverty line. According to ENTRO (2006b),

for the last 10 years the proportion of the rural population living below the poverty line has dropped, while that of the urban population has increased steadily (in Ethiopia).

For the downstream areas (in Sudan) directly comparable poverty line data are lacking. As reported in ENTRO (2006c), the percentage of the population living below the poverty line is higher than in Ethiopia. For example, in Gederafi state a range of 41-60% is reported. The difference in proportion of the population living with poverty across upstream and downstream regions of the basin could, however, be ascribed to the methods used in determining the poverty line.

The question is: how does this poverty level relate to the capacity of communities to invest in the conservation and management of ecosystems, to what degree is the community vulnerable to the disruption of water delivery and water-related ecosystem services, and how significantly will disruptions in upstream areas affect the downstream areas. According to Brady and Weil (2002), ecosystem services are fundamental to life. Nevertheless, there is real evidence suggesting that those services are severely threatened in the Blue Nile Basin. The major drivers are growth in the scale of human enterprise and a mismatch between short-term needs and long-term societal well-being (FAO 2000). The effects are already sensed in different farming systems of the Blue Nile Basin, in general. For example, the regulation services of the ecosystem (in terms of soil erosion) are disrupted and, hence, in addition to the common water resources, countries in the Blue Nile Basin are linked by the problems of soil erosion in upstream areas and sedimentation in downstream areas (Mason 2003).

Both erosion and localized sedimentation are a major threat in upstream areas (Ethiopia), whilst sedimentation is a major challenge in downstream areas (e.g., Sudan). In Ethiopia, average erosion rates from small catchments (between 100 and 3,000 ha) vary from 2 megagrams (Mg) ha^{-1} yr^{-1} on grassland in Maybar, to 70 Mg ha^{-1} yr^{-1} in the Simen Mountains in North Gonder, and 110 Mg ha^{-1} yr^{-1} in Anjeni (Herweg and Ludi 1999). ENTRO (2006b) also reported erosion as high as 100 Mg ha^{-1} yr^{-1}. The problem is mainly in the *small grain cereal-based farming systems.*

Both on-site and off-site impacts of erosion are widely recognized. On-site there is serious nutrient depletion, and farmers have very low capacity to replenish the lost nutrients using fertilizers. For example, the application of 16-28 kg of fertilizer ha^{-1} yr^{-1} that is currently applied in upstream areas does not match with the magnitude of nutrients depleted under cereals in Amhara (79 kg N ha^{-1} yr^{-1}) and Oromiya (99 kg N ha^{-1} yr^{-1}) regions (BoFED 2006; Haileslassie et al. 2005; FAO 2000). Household energy needs strongly compete for the organic sources of nutrients (e.g., manure and crop residues).

Yield loss and low productivity of grain and animal feed and are all observed results of erosion. For example, a yield loss of wheat is equivalent to 46 US$ ha^{-1} yr^{-1} in areas of low soil loss and 544 US$ ha^{-1} yr^{-1} in areas of high soil loss. At the national scale (in 1994) a loss of US$106 million or about 3% of agricultural GDP was estimated. In the Amhara region the annual reduction in grain production, as the results of soil losses on cultivated land for the year 2007, was estimated at 0.1 million tonnes of grain (BoFED 2006).

Soil erosion has strong implications not only to the abovementioned provision of ecosystem services (e.g., food, fiber and fuel), but also on the status of green water productivity in upstream areas, in general. The challenge is the low capacity of farmers to replenish those losses and in turn diminish their vulnerability to the impacts. Haileslassie et al. (2007) also reported such chains of: poverty, land degradation, low investment in natural resources and vulnerability to these effects. According to those authors, soil nutrient depletion and farmers to replenish the lost nutrients are strongly related to the degree of resource endowments of the farmers (i.e., level of poverty).

The off-site impacts on the livelihoods of communities are mainly claimed in the downstream areas, despite important observations regarding the local redistribution of sediments (i.e.,

sedimentation of wetlands, farmlands and water bodies) at micro-scale in upstream areas (Haileslassie et al. 2006a). For example, annual fish production from Lake Tana is estimated at 1,000 tonnes and recent reports indicate a reduction in fish catch. This could be closely related to sedimentation of the lake shore (vegetated areas) which some fish species such as Tilapia prefer for breeding. This trend has affected the livelihoods of the Woyto fishermen who, for example, are forced to go fishing further off the shore. SMEC (2007) also reported that sedimentation and seasonal decreases in the lake level affect the livelihoods of communities living from the water transport sector and tourists guidance.

ENTRO (2006c) reported that sedimentation has become a major factor in the design and operation of structures in the Blue Nile Basin (in Sudan). In general, the sediment load of the Blue Nile Basin is estimated at 140 million Mg yr^{-1}. A major part of this volume arrives during the flood months of June to October, which is confirmed by silt concentration measurements. In spite of the measures taken to alleviate sedimentation effects, nearly all the dead storage of some of the dams (e.g., Roseires) has been filled and the live storage is depleting gradually. The cost of silt removal from canals and irrigation infrastructure takes as high as 50% of a scheme's management cost. This has strong implications for water conveyance efficiencies and net-water productivity in the downstream areas. The impact of water pollution (e.g., sedimentation) on downstream fishery resources and the livelihoods of the community in Sudan can also be realized. For example, the Nile Basin, in general, contributes significantly to the total nationwide fish production. Of this, the reservoirs behind the Roseires and Sennar dams on the Blue Nile have an important share.

3.2.4. Water supply and sanitation

Coverage of water supply and sanitation services in Ethiopia is among the lowest in the world (MoWR 2007). According to official figures, 31% of households have access to safe water, and 18% of households have access to sanitation facilities. In rural areas, only 12% of the population has access to improved water supply, and a mere 7% of the population has access to adequate sanitation services. Basin specific data are not available. For the Amhara region, estimates are fairly comparable with the national figure. For example, people who have access to protected wells or spring water and tap water (both urban and rural) are only about 40% (BoFED 2006).

Between 1995 and 2006, an extraordinary 300% increase in potable water coverage was recorded in the Amhara region. For other regions in the basin (e.g., Beneishangul Gumuz) water supply coverage is about 46% in rural and 66% in urban areas. In Oromiya the coverage is of a similar magnitude (e.g., 40% for rural and 87% for urban (MoWR 2007). However, those figures show inconsistencies. For example, according to ENTRO (2006c), the majority (63-78%) of the population in the basin use water from unprotected wells, springs, rivers, lakes and ponds. Access to safe water downstream is also a major problem where service coverage is less than that of the upstream areas.

An equally important dimension is the poor water supply to livestock. This, obviously, contradicts with the fact that livestock are major components of the livelihoods of smallholders both in upstream and downstream areas in the basin. Basin-wide quantitative data on livestock populations and the status of water supply are lacking. According to MoWR (1998c), the total number of cattle in the Abay Basin account for 40% of the national herd, followed by equines which are 33% of the national equine population. The sheep population is 24% of the total sheep in the country. An insignificant number of camels are also found in the basin. In Sudan (in 1998), livestock production comprised 40% of agricultural GDP. In view of these facts the livestock sector has an important role in the livelihoods of the communities in the basin. But the livestock sector in both the upstream and downstream areas share one common problem: access to water during major parts of the year is

variable and livestock suffer from its shortage. In most instances the quality of available water is poor and is a major source of parasitic infestation to animals. The fact that human and animals consume water from the same sources in most rural areas, also poses a major threat to public health.

In general, such low levels of access to safe water have social and economic implications. Increased incidences of water-borne diseases such as diarrhea and dysentery; water-washed diseases such as trachoma and scabies; water-based diseases such as schistosomiasis; and water-related insect vectors including malaria are reported most often. It also becomes evident that livestock water productivity in the basin is low (Haileslassie et al. 2007) and this can be partly related to the poor drinking water supply. The impact is multifaceted: low labor inputs for soil and water conservation and low livestock and crop water productivity combine to contribute to the sheer strength of the poverty trap and unsustainable water uses.

3.2.5. Access to electricity and energy

In general, plant biomass is the major source of household energy in rural areas of Ethiopia. In the Ethiopian Blue Nile Basin, MoWR (1998d) estimated per capita energy consumption is 12.8 giga-joules (GJ). Of this total, the share of modern fuel is only 2.3%, while the bulk of energy (97%) comes from woody and non-woody biomass: fuelwood, dung, agricultural residues and charcoal. Despite the continuing rural electrification efforts, recent household surveys in the different states in the basin testify that the share of plant biomass energy sources is still significantly the highest. For example, more than 90% of the households (especially in Oromiya and Benishangul-Gumuz regions) claimed to use biomass as household energy sources (ENTRO 2006b). Similar trends of dependency on woody biomass for household energy are reported in downstream areas of the Nile Basin (Sudan). For example, ENTRO (2006c) suggested large-scale commercial charcoal production as a major cause of land degradation.

The most central challenge of using the woody biomass as energy sources is that the demand by far exceeds the sustainable growth of standing stock (MoWR 1998a; MoA 2002). Aggregated basin-wide demand supply studies indicate that, the sustainable growth covers only 27% of the demand while the difference is supplied from exploitation of the standing stock.

A significant proportion of households also use dung (e.g., 27.7% in Amhara, 57% in Oromiya regional states). The use of dung and agricultural residues depends on the availability of woody biomass and thus considerably varies with time and space. In areas with a severe fuelwood shortage (e.g., major parts of *small grain cereal-based farming systems*) the share of residues and dung is significantly higher.

The use of residues and manure breaches the ‘closed’ plant nutrient cycles in the agroecosystem. Those processes steer the land degradation (e.g., erosion) and low crop and livestock water productivity processes in upstream areas, and lead to conflicts in water uses (both locally and internationally). ENTRO (2006b) reported that the major portion of residues on farms is bunt in downstream areas, which may account for the temporal decrease in yield of semi-mechanized farms.

3.2.6. Households’ division of labor in agricultural activities: Implications for water management

Numerous studies suggest that, in Ethiopia, major investment decisions about agricultural activities are invariably the right of the males. MoWR (1998c), however, suggests that the division of authority and household labor for agriculture varies across the different farming systems and cultural settings in upstream areas. For example, in South Wollo, land management decisions in the household are

made by men and women equally. They decide together about the organization of labor: when to plough, sow, weed or harvest. It also became evident that those decision-making exercises depend on the local economic situation: men must take their wife's advice into consideration when the situation is tense. In general, in the *small grain cereal-based farming systems*, women's participation in agricultural labor is high, and the size of the harvest depends on the combined labor of the entire family. Interestingly, the role of women in increasing water productivity through weeding, organic fertilizer application and participating in community soil and water conservation is highly recognized. In households, women play the major role when it comes to activities related to water and sanitation. Thus, they are often at higher risk of exposure to waterborne diseases. Washing clothes, bathing children, and drawing water from surface sources increases the risk of rural women's exposure to disease-ridden water (Jabbar et al. 2000).

3.3. Progress and Prospects on Water and Land Management: Striving to Improve Livelihoods in a Changing World

The challenge of land and water management in Ethiopia is great – and great efforts have been, and are being, made to meet this challenge. This section looks at the range of interventions that have been undertaken to enhance sustainable land and water management in the Blue Nile. It will look at both successful and failed interventions to provide insight for focusing detailed research efforts. Interventions will be characterized and described with an eye to whether they could be replicable, scalable and sustainable (environmentally, socially and economically).

3.3.1. Watershed management focused interventions

In Ethiopia, watershed management activities started following persistent degradation of natural resources that had a negative impact on the livelihoods of households and the scale of conservation activities as a whole has increased dramatically since the 1973-74 droughts (MoWR 1998a; Tafesse 2006). Numerous studies have evaluated the pre-1991 watershed management activities that shaped the very large soil and water conservation programs implemented during that time (e.g., Rahmato 2003; Tafesse 2006). According to these sources, the 1975 Rural Land Reform Act and the subsequent formation of peasant associations provided the means of mobilizing labor for conservation activities. The World Food Programme (WFP), and Community Forest and Soil Conservation Department (CFSCD) of the Ministry of Agriculture (MoA) were the key actors responsible for providing food for work, and planning and overseeing the conservation projects, respectively.

As the impacts of soil degradation and drought were mainly sensed in the *small grain cereal farming systems* (e.g., the eastern part of the Abay basins), some of the focus areas were located in those parts of the country (Tafesse 2006). In 1980, the MoA and WFP began implementing a land rehabilitation project with Food for Work (FFW) being the major component to implement project activities (Project ETH 2488). The formulation of Project ETH 2488 marked the beginning of large-scale soil and water conservation and land rehabilitation programs linked to watershed development in Ethiopia. This project has passed four phases between 1980 and 2002, until it acquired its new name, MERET, in 2003 (Tafesse 2006).

At the very beginning, the approaches to soil and water conservation were 'top-down', communities were not consulted and the required degree of awareness was not created (ENTRO 2006b). The scale of operation was also large and there were no systematic attempts to address upstream-downstream linkages as the watershed was not a planning unit (Tafesse 2006). Soil and water conservation interventions are also critically criticized for treating the symptoms of land

degradation rather than its causes (Tafesse 2006). The outcome is that most of the structures and trees planted were damaged during the change in the socialist regime in 1991.

In the latter phase of soil and water conservation activities, a number of institutional and technical reforms were made. For example, the new approach uses local level participatory planning as its main tool. The community is in control of decisions regarding development options to implement. The focus is on productivity enhancement (to increase the willingness of farmers to adopt) and small watersheds (200-500 ha) are the planning units (Lakew Desta et al. 2005). But the upstream-downstream linkages have not been deeply explored yet and 'open grazing' systems remain one of the major challenges for its implementation (IFAD 1997; IFAD 2002; Tafesse 2006).

Soil conservation works within the Abay Basin have been carried out, largely under the auspices of the Ministry of Agriculture and often in association with the WFP, and as part of the nationwide program. Various Non-Governmental Organizations (NGOs) have also worked at a community level. Focus areas are South Gondar, North Gondar, and North Wello (*small grain cereal-based mixed farming systems*). Obtaining reliable and comprehensive data on these activities, however, is often difficult. According to MoWR (1998a), construction of check dams, cutoff drains, hillside terraces, soil bunds, stone bunds and rural roads were some of the major soil conservation activities. It is also reported that figures are inconsistent and sometimes inflated. For example, it was only between 1995 and 1997 that more than 52,000 kilometers (km) of check dams and more than 3,000 km of cutoff drains were said to have been constructed in South Gondar, North Gondar and North Wello.

Recently, the practice of rehabilitation of degraded land through area enclosure is emerging, for example, in the Koga project. The practice involves enclosing the area from any uses, and undertaking tree planting and physical soil and water conservation (e.g., Betru 2004). Once the vegetation is rehabilitated farmers are allowed to collect grass for their livestock using cut and carry systems (Tafesse 2006). The rural land administration and land use proclamation of the Amhara regional state also encourages lands with a slope greater than 60% to be put under this practice, and number of success stories are also reported elsewhere (e.g., Adigudom Valley (Tafesse 2006)).

Soil and water conservation efforts in the basin are not only limited to physical interventions (Tafesse 2006). The Soil Conservation Research Project (SCRP) has been in operation for a number of years with seven research locations throughout the country. Two of those locations fall within the Abay Basin: at Andit Tid in North Shewa and Anjeni in West Gojam. Another location is in Illubabor near Metu, just southwest of the basin, and a fourth location at Maybar, in Wello, southeast of Dessie and just outside the Abay Basin (Tafesse 2006). Most of the research activities were focusing on quantification of the magnitude of erosion and some technology testing. For example, soil conservation experiments in the Anjeni area, Gojam research unit, indicated that on plots of 28% slope, soil loss was reduced from 161 tonnes $ha^{-1}yr^{-1}$ under traditional use to 145 t $ha^{-1}yr^{-1}$ with graded bunds and 137 t $ha^{-1}yr^{-1}$ with Fanya-juu (Werner 1986).

Many irrigation projects financed by donors and the GoE have also made watershed management a top priority (e.g., IFAD Special Country Program II and ADB (African Development Bank)-supported Koga large-scale irrigation projects (IFAD 1997)).

Despite the effort put in during these past decades, the magnitude of the problem has not been fully addressed (Tafesse 2006). Basin-scale impacts of these interventions are not visible yet, while the problems have been realized at international scale and, thus, have attracted the interest of the Nile Basin Initiative (ENTRO 2006b). ENTRO is undertaking a fast-track watershed project and detailed planning studies are progressing in three major watersheds of the Blue Nile Basin: Rib, Jema and Gumera. The overriding regional significance of these projects will be erosion control leading to improved soil and water conservation, rehabilitation of degraded land, decreased siltation and sedimentation in downstream river/reservoir reaches. This will increase reservoir life, improve

hydropower production and irrigation efficiency, as well as protecting critical aquatic habitats (e.g., Lake Tana). A second important regional benefit will be an overall increase in land and water productivity and reduced water use conflicts.

A very closely related activity in Sudan is the conservation efforts in Dendir Park. The Park has an area of 896,000 ha and is a source of water and fodder during the dry season for the livestock of pastoralists in the area. It is, however, frequently suggested that due to the lack of water and fodder in the traditional dry season areas, the pastoralists have no option but to encroach into the park.

3.3.2. Irrigation

a) Large and medium scale irrigation

MoWR (1998c) estimated potentially irrigable land in the Abay Basin in Ethiopia at more than 500,000 ha (medium and large-scale) and 100,000 ha (small-scale irrigation). In 1998, it was reported that only 9,300 ha of medium-scale and 31,480 ha of small-scale irrigation had been developed (MoWR 1998c). In response to increasing population and concerns of food insecurity, the Government of Ethiopia commenced the implementation of irrigation projects in the Blue Nile Basin. The Koga Irrigation Project, which is under construction, is one of those initiatives. It includes watershed management, irrigation development, and capacity building components. The command area of irrigation covers about 7,000 ha and will benefit 12,000 farmers. The Koga project is planned to be managed by the community and when fully operational the principles of cost recovery will be implemented (MoWR 2007).

Additionally, the Tana-Beles area had been identified by the Government of Ethiopia as a growth pole area where complementary investments are being grouped to stimulate integrated development and accelerated growth. Numerous large-scale irrigation projects have been initiated (e.g., Irib, Gumera, Megech, Gilgel Abay and Jema) (MoWR 2007; SMEC 2007). All of these schemes are located in the *teff-based mixed farming systems* around Lake Tana. In most cases, the upstream areas of those schemes are degraded and watershed management is reported to be a priority. For example, sediment delivery on those schemes is estimated at 0.47-2 million Mg yr^{-1} and a major part of the sediment is dropped into Lake Tana. This also means on-site losses of Nitrogen fertilizer ranging between 146-8,745 Mg yr^{-1} (assuming 0.3% of N in the soil). The process will, obviously, affect the aquatic ecosystem and the livelihoods of the local community dependent upon fishing in Lake Tana (SMEC 2007; Haileslassie et al. 2006a). Beyond irrigation development, in some of those schemes, there will also be hydropower generation. As the downstream areas of those projects are normally over-flooded (e.g., Gumera and Rib (SMEC 2007)) during the main rainy season, implementation of those projects is also anticipated to regulate the water level of Lake Tana and the periodic flooding.

The Blue Nile provides major irrigation development in Sudan. A good example is the Rosari Reservoir (located at 650 km upstream from Khartoum and 105 downstream from the border of Ethiopia) which regulates water for the downstream Gazira schemes. The Gazira schemes cover a total of 798,000 ha and are considered to be the largest irrigated agricultural schemes at the global scale. According to the same author this scheme represents 50% of the irrigated area in the country. In production terms 65% of cotton, 70% of wheat, 32% of sorghum, 15% of groundnut, and 20% of vegetable productions in Sudan come from this scheme.

This tremendous contribution, of the scheme, to the community's livelihood and national economy is threatened by sedimentation of canals, reservoirs and the command areas. For example, the

reservoir capacity of the Rosary Dam is currently reduced by 38%. Deposition of silt on irrigable land reduced the water infiltration capacity of the soil. In addition to significant impact on the yield, deposition of fine sediment has resulted in a change in cropping pattern: i.e., increasing land cover by sorghum and a proportional decrease in other land use types (e.g., cotton, wheat).

In view of those facts it is apparent that Sudan's national economy is highly dependent on blue water management. Literature suggests the protection of upstream areas and generating better information on upstream/downstream linkages. But data on interventions to mitigate those impacts and the projected irrigation development are very scarce. Irrigable land in these downstream areas is also huge. To exploit this potential shortage of water is a challenge and data on future expansion specific to Blue Nile Basin could be found while preparing this report.

b) Small-scale and traditional irrigation

In Ethiopia, small-scale irrigation schemes are generally considered to be command areas of about 200 ha or less (Wondimkun and Tefera 2006). The development of small-scale irrigation in the basin showed a steady development in the last 10 years. Between 2001 and 2006, in the Amhara region alone, irrigated land was reported to have increased by about 195% (BoFED 2006). Implementation of these small-scale irrigation schemes was the responsibility of Co-SAERAR (Commission for Sustainable Agriculture and Environmental Rehabilitation in the Amhara Region) and the Water Resource Development Bureau. Small-scale irrigation schemes are managed by the community.

The development of those small-scale schemes are partly financed through the IFAD loan and grant support since February 1999 (through the Special Country Program Phase II (SCPII)), and the project is implemented by the GoE. The program approach is driven by problems in the community: focusing primarily on transforming traditional irrigation practices into modern smallholder-managed irrigation schemes. The SCPII is implemented partly in the Abay Basin (e.g., Gumera, Gota Chan, Irza and Bebeks schemes) with the overarching project objectives of improving food security and incomes amongst the poor rural households by enhancing their resilience to drought, through intensification, diversification and commercialization of smallholder agriculture (IFAD 2002). The project has four components: agricultural support service; soil and water conservation; support to rural women's vegetable gardens; and production of vegetable seeds (IFAD 1997).

In conclusion, the total area under small-scale irrigation (only in the Amhara region) is about 75,785 ha in 2001 and this has showed a steady increase in both yield and area coverage. The yield per unit area also showed a 28% growth (in the Amhara region). Compared to the reports by Wondimkun and Tefera (2006) these figures are high. These authors suggested that the total 6,219 small-scale irrigation scheme, which covers a total of 76,131 ha of irrigated land, exists in the region.

Despite a number of good achievements, it is frequently reported that sedimentation of canals, shortages of water, and inefficient water conveyance are a challenge to its sustainability (IFAD 2002). In general, the fact that beneficiaries of small-scale irrigation own the physical infrastructure and the social organizations; the schemes are independent of external support for sustainability; small-scale irrigation schemes are labor intensive; less environmental impact (e.g., does not require big dam construction) makes the small-scale irrigation to be one of the techniques for water management in the Blue Nile Basin (Awulachew 2006). Despite efforts for increasing coverage of irrigation, the performance of small-scale irrigation in Ethiopia is a question. A number of schemes have failed which has been attributed to various factors related to technical, social, marketing, and institutional aspects. Awulachew et al. (Forthcoming) discuss the causes of failures of irrigated agriculture in Ethiopia.

3.3.3. Water harvesting

One of the main pillars of the food security strategy of the GoE is the development and implementation of water harvesting schemes mainly in the drought prone and chronically drought affected areas of the country. In 2002, the Federal Government allocated ETB 100 million for food security programs to the regions, and in 2003 the amount budgeted was ETB 1 billion. Much of this money is used by the regions for water harvesting (construction of household ponds and cisterns) with directions from and assistances by the Federal Ministry of Agriculture (MoA 2002). As mentioned in Ayele et al. (2006), the major objectives of the water harvesting program were to: increase agricultural land productivity through double cropping; increase yields of rainfed farming and minimize the risk of crop failure in drought prone areas; and supply drinking water for human and animal consumption. Structurally, these ponds are planned at a household level and have a water holding capacity ranging between 60-140 cubic meters (m^3). The cost varies considerably depending on the type of lining material used (plastic, clay, cement or unlined ponds). For example, Ayele et al. (2006) reported the cost of cement lined water harvesting structures ranging between US$111 and US$326. It is also reported that the major portion of harvested water is used for vegetable farming but marketing of those products remained a challenge.

Basin-wide comprehensive data on the magnitude and success of this intervention is lacking, but regional scale reports indicate how widely spread this intervention was. For example, according to Wondimkun and Tefera (2006), a total of 14,976 household water harvesting structures were counted in the Amhara region in 2004. Of this, 87% were based on runoff while the remainder were hand-dug wells. During this inventory, according to the authors, only 22% of the water harvesting structures were functional.

According to Rämi (2003), in the year 2002, the ponds and tanks were implemented free of charge for the beneficiaries who only had to contribute their own labor, usually paid for in the form of food for work. In 2003, there was a plan to collect 15% of the material cost from beneficiaries, probably from the credits that are to be repaid after one or two planting seasons. Numerous positive experiences of water harvesting interventions have been reported (Ayele et al. 2006). For example, more than 68% (mean value for different regions) of sampled farmers involved in water harvesting claimed visible impacts of water harvesting interventions on their livelihoods and improvement in food security (Ayele et al. 2006). In the course of implementation, it also becomes evident that groundwater recharging and trapping sediments that would otherwise have affected the downstream areas are important environmental impacts of the water harvesting interventions.

On the other hand, the water harvesting intervention is also criticized as being ambitious and not well planned. Leakage, collapsing, lack of catchments, lack of skilled labor for proper implementation, shortage of construction materials, poor site selection and prevalence of malaria were some of the major drawbacks reported (Awulachew 2006; Ayele et al. 2006).

In view of the pressing need to improve the well-being of communities dependent upon water and land-based livelihoods, water harvesting is the cheapest and most accessible approach. For example, if we consider a farm household having a hectare of land at a locality with 1,000 mm of annual rainfall, this farm has free access to about 10,000 m^3 of water. A rough calculation indicates that this quantity of water is a surplus for a farm household's needs. The question is how to capture and manage this resource without having a significant impact on the system's (upstream/downstream) hydrology. Water harvesting and green water management are one of those options widely practiced across the world and, therefore, lessons must be drawn from the current water harvesting efforts and the means of upscaling should be explored. Indeed, it is a new solution in an old package.

In Sudan, it is obvious that the low rainfall in the area commands the need for water harvesting. This could be for supplemental irrigation or water supply for livestock production.

3.3.4. Energy and hydropower

Both Ethiopia and Sudan use traditional and modern energy sources. Most of the energy comes from the traditional sources such as biomass but a certain proportion comes from oil, fuel and electricity.

The per capita electricity consumption in Ethiopia and Sudan (in 2004) is 25.4 KWh and 71.3 KWh, respectively (Awulachew Forthcoming). The overall energy use per capita in Ethiopia is low compared to 512 kWH in India, 1,012 kWH in Jordan and 7,795 kWH in the USA.

Electricity in Ethiopia is available from the Interconnected System (ICS) or from several Self Contained Systems (SCS) (MoWR 1998d). Ethiopia not only has a very low energy per capita but also most of this is in the form of biomass. The economically exploitable hydropower potential is reckoned at 30,000 MW, whereas the actually developed capacity is only 667 MW (Beyene and Abebe 2006). As a result, only urban areas have access to electricity. Low coverage and poor quality of power also cause heavy economic losses. For instance, during the drought of 2002-03, it is estimated that each day without the electricity service reduced the GDP by up to 15%.

The Ethiopian power sector is dominated by the state-owned Ethiopian Electric and Power Corporation (EEPCo), which controls generation, transmission and distribution in the country. In 2001, the EEPCo laid out a number of targets that were to be reached by the end of 2006: to increase power generation capacity from 327 MW to 647 MW and to increase the number of electrified towns from 458 to 651. Part of this plan included the Tis Abay II hydroelectric power plant which is located on the Abay River, some 32 km downstream of Lake Tana (Tis Issat Water Falls 73 MW installed capacity producing a firm energy of 359 GWH yearly). Additionally, the Finchaa scheme in the west of the country is being expanded.

More recently the GoE has awarded Salini Costruttori a turnkey contract for the Beles project on the River Beles close to Lake Tana. Construction has started to convey water from Lake Tana to the Beles Catchment through a 12 km long tunnel with an inner diameter of 7.1 m. The multi-purpose objective of this inter-basin transfer is to use the elevation difference for the generation of hydropower (460 MW installed capacity) and to use the water for irrigation in the Beles area (123,000 ha) (SMEC 2007). A number of other hydropower projects are also under detailed studies (e.g., Karadobi, Mendeya and Border).

The GoE is planning to increase the figure of electricity coverage to 32%. As part of this plan the construction of a 400 kv Bahir Dar-Debremarkos-Addis Ababa, 230 kv Tekeze-Endaselassie-Humera, 230 kv Bedele-Mettu and 230 kv Fincha'a-Gedo-Gefersa transmission stations and line installations are among the projects recently launched.

In Sudan, the flow of the Blue Nile shows very high seasonal variation. As a result, two storage dams Sennar and Roseires were constructed across the river to provide irrigation water during the flow periods. The two dams also provide about half of the total electric energy of the country through hydropower generation. The potential for generation of more power in this part of the basin is low. Accumulation of silt at powerhouse intake coupled with the floating trash during the flood season restricts power generation to a large extent, and a severe shortage in electricity in the national grid is witnessed. The National Electricity Company (NEC) is responsible for electricity generation, transmission and distribution in Sudan. Recently, NEC signed a MOU on power System Interconnection with the Ethiopian Electric and Power Corporation (EEPCO).

3.4. Inventory of Key Organizations

Institutions are a combination of polices and objectives: laws, rules and regulations; organizations, their bylaws and core values; operational plans and procedures; incentive mechanisms; accountability mechanisms; and norms, traditions, practices and customs (Bandaragoda 2000). 'Institutions' in this study is defined broadly to include not only formal organizations, but also informal organizations, laws, customs and social practices that influence people's behavior in a society or economy. Organizations can be defined as "structures of recognized and accepted roles" (Merry 1993; referenced in Bandaragoda 2000). Organizations are groups of individuals with defined roles and bound by some common purpose and some rules and procedures to achieve set objectives (Bandaragoda 2000). The institutional framework for water resources management in a river basin context consists of established rules, norms, practices and organizations that provide a structure to human actions related to water management (Bandaragoda 2000). Saleth and Dinar (1999a; 1999b) classified water management institutions into three main components: water polices, water laws and water administration. In this section, we begin by providing an inventory of the range of formal organizations that provide context for land and water management decisions.

3.4.1. Legal Framework in the Abay Blue Nile

In this section, we will briefly outline the legal framework in both Ethiopia and Sudan; first, on the overall legal framework in Ethiopia and then on the legal framework in Sudan. Following years of centralism, Ethiopia has shifted into a far more decentralized system since 1992. A turning point was the establishment of the regional governments in that year. The regional governments have legislative, executive and judicial powers with respect to all matters within their geographical jurisdiction except for specific matters that remain under the authority of the Federal Government. The process of regionalization created nine regions, largely along ethnic lines, with power and administrative issues decentralized to these regional states. The constitution of the country gives prominence to the role of the Federal State with particular mandate to enact laws for land and water management. Article 51 of the Federal Constitution states that the Federal level is entrusted with those waters linking two or more regional states and those with an outlet outside the national territory (FDRE 1995). The regional states have the power to administer and manage land and water within their boundaries, and may issue laws for this purpose, provided they are consistent with federal laws.

The constitution also clearly indicates the possibility of delegating federal powers and functions to the regional states or to any body, when necessary and relevant. Typical of this is the administration of rural lands, where the Federal Government through its proclamation of Federal Rural Land Administration and Use (no. 456/1997), while establishing the general framework of land ownership, stipulates that regions should come up with detailed regulations on rural land administration and use (FDRE 1997a; Article 17/1).

The process just outlined indicates that the Federal State, although the most important, is not the only organ which would be in charge of "determining and administering the utilization of the land and water" but rather that there is a hierarchy in the roles between the federal and regional states. The central question one should address is: how best are federal and regional states cooperating and coordinating for sustainable land and water management interventions?

Similarly, in the past five years Sudan has embarked on a policy of administrative decentralization. According to the Local Government Act of 2003, Sudan is under federal rule with 26 States. Each State is governed by a Wali (Governor) with 7 to 10 State Ministers, 4 to 5

Commissioners for the different provinces, and a number of localities. Each State has complete administrative and fiscal autonomy and its own State Legislative Assembly for legislative matters of the State (FAO 2008). Each State is divided into a number of Localities (*Mahaliyat*). The aim of decentralization is to improve the delivery of basic social services and address the severe spatial disparities in access to education, health, water, agricultural extension and other government services (ENTRO 2006c).

According to ENTRO (2006c), decentralization and concomitant capacity building is envisaged to be undertaken over two phases: Phase I (2005–2007) and Phase II (2008–2011). Priorities in the local government will be:

- Enhancing management capacity by empowering suitable structures to lead reform;
- A broad consultation on organizational structures;
- Developing a comprehensive strategy for institutional arrangements, policies and guidelines for public services and training;
- Improving systems and practices of local public-private partnerships in service delivery;
- Support to locality development planning;
- Improving locality information systems;
- Establishing locality monitoring systems;
- Promoting civil society participation in planning and organization of government activities; and
- Mobilizing local revenue generation for State and Local Government.

3.5. Organizations in the Abay Blue Nile Basin

In this section, we present the organizations that have an important role in the management of land and water resources. These organizations are found at different levels: transboundary, basin, national, regional and local scales. First, on organizations operating in Ethiopia.

3.5.1. The Nile Basin Initiative and Eastern Nile Technical Regional Office (ENTRO)

The Nile Basin Initiative (NBI) was launched in 1999 by the council of ministers of the Nile Basin countries (Burundi, DRC, Egypt, Ethiopia, Kenya, Rwanda, Sudan, Tanzania and Uganda). This initiative provides an agreed basin-wide framework to fight poverty and promote socioeconomic development in the Nile Basin. The NBI is a transitional arrangement pending the establishment of a new and permanent legal and institutional framework. The Nile countries are presently engaged in negotiation on the issue. The initiative began with a participatory process of dialogue that resulted in the riparian states agreeing on a Shared Vision to "achieve sustainable socioeconomic development through the equitable utilization of, and benefit from, the common Nile Basin water resources" (NBI 2001a). It also led to the development of a Shared Vision Program (SVP) and Strategic Action Program (SAP) that aim to translate this vision into concrete activities and projects (NBI 2001a).

The mission of the SVP is the creation of a "coordination mechanism and an enabling environment to realize the shared vision through action on the ground" (Council of Ministers of Water Affairs of the Nile Basin States 2001). At the sub-basin level, the Eastern Nile Subsidiary

Action Program (ENSAP) and The Nile Equatorial Lakes Subsidiary Action Program (NELSAP) have been initiated by groups of riparian countries for their mutual benefit. Of particular interest here is The Eastern Nile Subsidiary Action Program (ENSAP), which is an investment program under the Nile Basin Initiative involving Ethiopia, Sudan and Egypt, which seeks to *"develop the water resources of the Eastern Nile Basin in a sustainable and equitable way to ensure prosperity, security and peace for all its people* (NBI 2001b)*."* The ENSAP is coordinated by Eastern Nile Technical Regional Office (ENTRO) based in Ethiopia.

Important to note here is that the focus of the NBI and its Shared Vision includes environmental sustainability, trade promotion, efficient water allocations, and organization and capacity building. The governing principles for water allocation are equitable utilization, no significant harm, and cooperation, although balancing these principles may prove challenging.

3.5.2. Basin level organizations in Ethiopia

In Ethiopia, the National Water Policy calls for the establishment of basin-level institutions. According to MoWR (1999: p.13), the major goal of establishing Basin Authorities is to ensure "efficient, successful and sustainable joint management of the water resources of the basins through concerted efforts of the relevant stakeholders". The policy document envisages the establishment of river basin organizations (RBOs) phase by phase. The establishment of river basin councils and authorities is considered as one of the main instruments to implement integrated water resources management through river basin plans and effective and sustainable joint management by relevant stakeholders.

Today the Awash Basin Water Resources Management Authority is the only existing basin authority in Ethiopia (but not located in the Abay Blue Nile basin), after being re-established in 1998 (FDRE 1998). Other River Basin Authorities are expected to be established. However, so far the government has issued a proclamation for the establishment of River Basin Councils and Authorities (FDRE 2007). Based on this proclamation, River Basin High Councils and Authorities shall be established by regulations to be issued by the Council of Ministers (Article 3(1)). When it is deemed necessary, the proclamation stipulates, two or more river basins may be put under the jurisdiction of a single Basin High Council and Authority**.** The foreseen establishment of the Abay Basin Authority seems to be the most eminent one in the Abay Blue Nile.

There is an ongoing effort to establish a river basin authority for the Abay, which is the major sub-basin of the Nile. An institutional study undertaken for an Abay River Basin Organization (RBO) pointed to the need for: (1) networking between water related actors, (2) coordination of their water related activities, plans and projects, (3) a sound knowledge of water resources, water uses and of their interactions, and (4) a power to administer water resources in the basin. The legal basis for establishing the river basin authority is laid pending the enactment of establishment regulations to be issued by the council of ministers (proclamation No. 534/2007, Article 3(1)).

3.5.3. National level organizations in Ethiopia

In Ethiopia, the roles and responsibilities for water management at the federal level are promulgated through the Definition of Powers and Duties of the Executive Organs of the Federal Democratic Republic of Ethiopia Proclamation No. 471/2005 (FDRE 2005). Accordingly, the organizations/ ministries that currently exist at the federal level and are directly or indirectly involved in the development and management of land and water resources include: Ministry of Water Resources; Ministry of Agriculture and Rural Development; Ministry of Health; Ministry of Energy and Mines;

Ministry of Federal Affairs; Environmental Protection Authority; and other affiliated authorities and agencies. A brief description of the roles of the most important organizations in relation to land and water management is given below.

3.5.3.1. Ministry of Water Resources

The Ministry of Water Resources (MoWR) in Ethiopia was established by proclamation No. 4/ 1995. The powers and duties of MoWR are described in the establishment proclamation 4/95 and Definition of Powers and Duties proclamation No. 471/2005. These include inter alia:

- Undertake basin studies and determine the country's potential for groundwater and surface water resources in terms of volume and quality, and facilitate their utilization;
- Determine conditions and methods required for the optimum and equitable allocation and utilization of water bodies that flow across or lie between more than one regional state among various uses and the regional states;
- Undertake studies and negotiations of treaties pertaining to the utilization of boundary and transboundary water bodies, and follow up the implementation of same;
- Cause the carrying out of study, design and construction work to promote the expansion of medium and large irrigation dams;
- Issue permits and regulate the construction and operation of water works relating to water bodies;
- Administer dams and hydraulic structures constructed using the federal budget unless they are entrusted to the authority of other relevant bodies; and
- Ensure the provision of meteorological services, etc.

Currently there are also organizations affiliated to the Ministry of Water Resources such as the Meteorological Service Agency, the Awash Basin Water Resource Management Agency and specialized public enterprises engaged in the study, design, supervision and construction of water related activities like the Water Works Design and Supervision Enterprise and the Water Resource Development Fund, some of whose responsibilities and tasks will be elaborated below.

3.5.3.2. Water Resources Development Fund in Ethiopia

The proclamation for the Establishment of the Water Resources Development Fund, Proclamation No. 268/2002 (FDRE 2002b) and its Administration describes the objectives of the Fund as: "to promote self-sufficiency in the provision of reliable and sustainable water supply and sanitation, and to make a contribution towards attaining food self-sufficiency by expanding irrigation development by the provision of loans to these sectors on the basis of cost recovery". The sources of the Fund will be through foreign bi- and multi-lateral grants, loans and government budget allocations. It is clear from the above that the Fund is, therefore, the institution that will be instrumental in carrying out the Water Sector Development Program and other national programs that would fall within the framework of the national strategy.

3.5.3.3. National Meteorological Services Agency in Ethiopia (NMSA)

NMSA was established in *1951 within the Civil Aviation Department and later as an autonomous government agency, named the National Meteorological Agency, by proclamation no. 201/1980 on 31st December 1980. The* NMSA *was again reorganized in 1994 and brought under MoWR.* The powers and duties of NMSA, especially those that have close relevance to water, include:

- Establish and operate a national network of meteorological stations designed to represent various climatic regions of Ethiopia and to satisfy the needs of various national development plans and activities;
- Collect all meteorological data and exchange meteorological data in accordance with international agreements to which Ethiopia is a party;
- Give advance warning on the adverse weather conditions;
- Disseminate advice and educational information through the mass media; and provide, upon request, meteorological services to any person;
- Control air pollution and maintain the natural balance of the air in the country and ensure the implementation of international agreements regarding meteorology, which are ratified by the Government; and
- Represent the government in any meeting, conference or seminar concerning meteorology.

3.5.3.4. Ministry of Agriculture and Rural Development (MoARD)

The Ministry of Agriculture and Rural Development (MoARD) was established in 2001 and is responsible for initiating agricultural and rural development policies; food security strategies and extension programs, and ensuring conducive environment for development; and supporting regions in expanding agricultural and rural development as well as monitoring the Food Security Program. According to Proclamation No. 471/2005, the MoARD has the following powers and duties related to rural development and natural resource management:

- Promote the expansion of extension and training services provided to peasants and pastoralists as well as private investors to improve the productivity of the agricultural sector;
- Devise and facilitate the implementation of a strategy for the protection of natural resources through sustained agricultural development;
- Build capacity for the supply, distribution and marketing of agricultural inputs, and ensure the supply of same;
- Ensure the creation of an export market for agricultural products through market-led agricultural development and a competitive marketing system;
- Ensure the implementation of the food security program and the proper carrying out of disaster prevention and preparedness activities;
- In cooperation with the concerned organs, create conducive conditions for the expansion of rural development infrastructure;
- Ensure the creation of enabling environment for the expansion of cooperatives and the provision of credit facilities to peasants and pastoralists;

- Monitor events affecting agricultural production and set up an early warning system;
- Establish and direct training establishments that assist the acceleration of agricultural development and the improvement of rural technology; and
- Ensure the proper carrying out of agricultural research and conservation of biodiversity.

So far, overarching strategies such as the Agriculture Development Led Industrialization (ADLI) strategy, the Rural Development Strategy, Commercialization of the Smallholder Agriculture, etc., were developed at the Federal Government level, through the Ministry of Agriculture and Rural Development.

3.5.3.5. Ministry of Mines and Energy (MME)

The MME has a direct role in water resources development. According to Proclamation No. 471/ 2005, the MME has the following relevant powers and duties:

- Promote the development of mining and energy;
- Undertake studies concerning the development and utilization of energy; and
- Promote the growth and expansion of the country's supply of electric energy.

Although there is no explicit mention of the role of the MME in water resources development, one of its affiliates, the Geological Survey of Ethiopia, is responsible for identifying groundwater potential of the country. Furthermore, it should be noted that while MoWR is given the mandate to supervise hydropower development, MME is the ministry responsible for the development of the energy sector.

3.5.3.6. Environmental Protection Authority (EPA)

The EPA is the government regulatory authority responsible for environmental protection in the country. The EPA aims at "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 needs of the present generation without compromising the ability of future generations to meet their own needs" (FDRE 1997b). This is envisaged to be achieved through:

- Development of enabling policy and regulatory frameworks;
- Preparation and implementation of proactive environmental management systems;
- Enforcement and compliance mechanisms and community empowerment;
- Improving education and awareness, and availing information and fostering participation in decision taking; and
- Identification and availing of environmentally sound technologies and best practices, and resource mobilization and channeling.

The government has defined the institutional framework, responsibilities and mandate for the implementation of the environmental policy (FDRE 2002c).

3.5.4. National level organizations in Sudan

In Sudan there are government bodies with responsibilities related to water. ENTRO (2006c) and NBI (2006) identified the following organizations.

3.5.4.1. The Ministry of Irrigation and Water Resources (MIWR)

The Ministry of Irrigation and Water Resources is responsible for setting national water resources policies, strategies and plans, the development of water resources to meet needs, monitoring of groundwater basins, and forging cooperation between the Nile Basin countries. It also contributes to environmentally sound socioeconomic development, for example, in large-scale irrigated agriculture schemes.

According to FAO (2008), the Federal Ministry has the following responsibilities:

- Satisfaction of the water requirements of the various users throughout the country;
- Water resources planning, management and development;
- International and regional cooperation concerning the shared water sources;
- Planning, design, execution, operation, and maintenance of the different irrigation schemes;
- Control of water abstraction;
- Construction of new irrigation works;
- Operation and maintenance of all large-scale irrigation structures and drinking water facilities; and
- Provision of the means for hydropower generation and protection of the water-related environment.

3.5.4.2. National Council for Water Resources (NCWR)

The NCWR is responsible for formulating common water resource polices and coordinating activities of which the Technical Water Resources Organ (TWRO), under the MIWR, is the executing arm (NBI 2006).

3.5.4.3. National Water Corporation (NWC) and State Drinking Water Corporation

Both corporations are responsible for water affairs including operation, maintenance and management of drinking water utilities.

3.5.4.4. Ground Water and Wadis Directorate (GWWD)

It is a directorate within the Ministry of Irrigation and Water Resources responsible for groundwater and *Wadis* resources in the Sudan.

3.5.4.5. Hydraulic Research Station (HRS)

This Station, which was established by the Ministry of Irrigation in 1975, conducts research on irrigation scheduling, water requirements of the major crops, and salt and weed management in the Gezira Scheme (Ageeb 1999).

3.5.4.6. The Ministry of Agriculture and Forests

The Ministry of Agriculture and Forests is responsible for agricultural development and natural resources planning and policies, and the National Drought and Desertification Control Unit (NDDCU) in this Ministry is designated as the national focal point (NFP) to the United Nations Convention to Combat Desertification (UNCCD). In 1989, the Forest National Corporation (FNC) replaced the old Forest Administration (that was established in 1902) to be responsible for the protection and management of forest resources in the country. The FNC is a semi-autonomous corporate body that is attached to the Ministry of Agriculture and Forests. It has a Board of Directors constituted by the Council of Ministers and 10 representatives from related institutions. As such, the FNC is entrusted with the role of protection and conservation of forest resources.

3.5.4.7. The Ministry of Environment and Tourism

In 1995, the Government also created the Ministry of Environment and Tourism, now the Ministry of Environment and Physical Development (MOEPD), to oversee overall environmental management and integrate environmental protection into national development strategies.

3.5.4.8. The Higher Council for Environment and Natural Resources (HCENR)

The council was established in 1992 as the central government organ co-coordinating efforts for sustainable development, use of natural resources and environmental protection. The Council includes a number of relevant ministries and places special emphasis on addressing degradation, resource depletion, and chronic pollution. A parliamentary committee on environment and natural resources was also established in 1992. The HCENR is chaired by the Minister of the Environment and Physical Development. The HCENR discharges its functions through a General Secretariat with the following mandates:

- Draft general policies for natural resource inventories and development to ensure the appropriate management of the resources and their conservation and sustainable use;
- Environment conservation in coordination with the appropriate authorities in the States;
- Coordinate the work of the Council Branches and all efforts in natural resource inventories and conservation, efforts for the sustainable development of the resources, and monitor changes in the natural resources;
- Specify areas subjected to depletion, desertification and pollution and decide on priorities for surveys and studies on natural resources;
- Make long-term plans for rational and the balanced use of natural resources and environment conservation, and follow-up the execution of the plan with the appropriate authorities;
- Periodically review legislation related to natural resources and the environment, make sure that laws are effective and introduce any necessary amendments to improve the laws;

- Establishment of branches in the different States to help the Council in performing its responsibilities;
- Encourage support and coordinate scientific research in all fields of the environment and natural resources; and
- Formulate a federal plan for environmental awareness and rational use of the natural resources, and try to incorporate environmental education in school curricula.

The HCENR is Sudan's outlet to the international environmental arena. It acts as the technical focal point for most of the environmental conventions that emerged from the Earth Summit in Rio de Janeiro (1992) namely: the Convention on Biological Diversity (CBD) and the United Nations Framework Convention on Climate Change (UNFCCC), in addition to the Convention on Persistent Organic Pollutants (POPs).

3.5.4.9. Organizations related to water management

There are many organizations in Sudan working on the management of water in specific schemes. To mention just a few: the Executive Unit of Merowe Dam project, the Executive Unit for heightening Roseries Dam, Kenana and Rehad Executive Corporation, Jongelei Canal Executive Authority, etc. (NBI 2006). Looking into the specific operation of particular schemes, for instance, the Gezira Scheme is managed on a vertically integrated basis by the semi-autonomous Sudan Gezira Board (SGB). The MIWR is responsible for managing the Sennar Dam on the Blue Nile and the upper reaches of the irrigation system, responding to requests for water delivery from SGB's field staff. Within the scheme, the SGB serves as landlord, operates and maintains the lower reaches of the irrigation system, and provides most of the inputs and services required by farmers to produce cotton, which is transported by the Board to its ginneries and sold on behalf of growers by the Sudan Cotton Company Limited. The SGB recovers the cost of advances made for inputs and services from the cotton sales before payment is made to the farmer. Tenants are wholly responsible for growing other crops in prescribed rotations with cotton (sorghum, groundnuts, forage, wheat and vegetables), making their own arrangements for input supplies and marketing.

By 2001, in the Gezira Scheme, Minor Canal Committees had been formed along the minor irrigation canals and representatives of each of these committees constituted the Irrigation Committee at the block level. In addition to the Irrigation Committee, a Financial Committee has been established that is coordinating the reimbursement of the seasonal credits, and arrangements for procurement of new inputs. The Irrigation Committee with representatives from each of the minor canal committees will be responsible for the operation and maintenance of the minor irrigation system, a task presently entrusted to the SGB, with the Ministry of Irrigation responsible for supplying the main system.

To address some of the problems facing irrigation management and development, the Government has formalized a policy framework that includes (FAO 2008):

- Transferring the operation and production of large- and medium-size irrigation schemes to the farmers and giving them full responsibility for water management on the irrigation system below the minor canal level through establishment of voluntary water users associations (WUAs);
- Fostering sustainable productivity of the large schemes through rehabilitation, combined with financial and institutional reform;

- Grouping, rehabilitating, and handing over the relatively small sized pump schemes in the Blue Nile and the White Nile. These schemes were originally established and run by the government. Recently, and in accordance with the economic reforms, these schemes were handed over to the private sector represented by individual farmers, cooperatives or private companies.

3.5.5. Regional and local level organizations in Ethiopia and Sudan

3.5.5.1. Regional level organizations

In Ethiopia, regional bureaus have been established with similar designations and responsibilities as the federal ministries described above. These Bureaus include Bureaus of Water Resources Development, Water, Energy and Mines, Irrigation Development Authority, Agriculture and Rural development, Health, and Water Works Construction Enterprises Commissions for Sustainable Agriculture and Environmental Rehabilitation[7]. The major regional water sector offices have the responsibility to manage resources on behalf of MoWR. They are also mandated to administer resources under their geographical jurisdiction. The Regional governments own and take full responsibility for supplying potable water to urban centers and rural areas as well[8]. At the local level, Woreda[9] Water Desks are responsible for planning, budgeting, implementing and monitoring and follow up of water projects and programs in their respective localities. These local water Desks report to a Woreda level government administrative body called the Desk for Rural Development, not directly to the regional water bureaus. The Rural Development Government Body, in turn, reports to the Woreda Council, the locally based highest authority. Urban Water Supply Utilities have traditionally been accountable to the regional water resource development bureaus. More recently, most of the regions have established autonomous water utilities that are accountable to designated and legally empowered boards.

Similarly, in Sudan each State is governed by a *Wali* (Governor) with 7 to 10 State Ministers, four to five Commissioners for the different provinces, and a number of localities. Each State has complete administrative and fiscal autonomy and its own State Legislative Assembly for legislative matters of the State (FAO 2008).

3.5.5.2. Local level organization: Water Users Association (WUA)

Water user associations (WUAs) are the most common local institutions engaged in water management at the level of the landscape or hydrological unit. WUAs could be defined as social units commonly organized by communities themselves for their own benefits of fair water distribution, improved water delivery and accounting. They are headed by a respected personality from within who carries different names in different countries and regions, leading the effective functioning of the irrigation operation services. In Sudan, they have the following key functions: operate and maintain irrigation systems within the WUA's command areas and distribute water among members based on established contracts; distribute water on a contract basis among those members and non-members within the command area; rehabilitate and improve irrigation schemes within the target area and carryout construction work as required; train WUA members to use advanced

[7] Responsibilities of these commissions were to promote irrigation development and environmental rehabilitation. These were restructured into the regional water bureaus after 2001.

[8] There is still the view that the role of regional bureaus is not well-defined (NBI 2006: p. 16).

[9] Woreda is the second smallest government administrative unit.

irrigation methods and ensure the use of new technologies; Take actions to improve land productivity and purchase water (pay water service costs) from a water supplier (Bashier 2006).

In Ethiopia, the role of WUA is commonly restricted to the distribution of water among members, rehabilitation and maintenance of secondary canals and addressing water related conflicts. WUA are sometimes threatened by parallel established government-supported cooperatives, which have broader operational scopes and have stronger links with government institutions. There are also Water and Sanitation (WATSAN) Committees responsible for the management of drinking water points, operational and maintenance of water points, and provides sanitation training to members.

In Sudan, there are also other local level traditional organizations such as community leaders and other community-based organizations that have an active role in the management of resources. Traditional leaders are generally elected from the same families and, thus, these positions are semi-hereditary. These systems play important roles at the local community level. Their responsibilities include: Land allocation and settlement of conflicts; protection of the common natural resources; organization of usage of natural resources; construction of fire lines; keeping order of security and organization of foreign tribes present in their areas; assigning nomadic routes; organization of communal public activities, e.g., pest and bush fire control and settlement of tribal disputes (ENTRO 2006c).

They have also well identified roles in relation to resource conservation and management. According to Elnour (referenced in ENTRO 2006c) the system of traditional management was supported by equity of use rights and social customs governing common property resources. This flexibility facilitated resource conservation particularly under dry conditions. Additionally, they play an important role in conflict resolution based on the indigenous mediation (*Judiyya*) system. The "*Judiyya*" is an established tradition in Sudan and can be initiated by a member of the local administration or a religious leader (*Fagir*) or a group consisting of representatives of all of them. They all represent mediating roles with the ultimate objective of reaching a consensus and peaceful settlement to their conflicts.

3.6. Inventory of Policies, Practices and Informal Institutions

As previously mentioned, the institutions that influence land and water management go well beyond the formal organizations listed above. Bandaragoda (2000: p. 19) identified five main external factors that could either be assessed as constraints or enabling situations that affect the management institutions in a river basin context. These include the overall political system, national economic policies, legal framework, socioeconomic environment and the physical resource base. Institutions governing river basin water management include the respective water policy and laws, water related organizations and water allocation practices. This section describes some of those key policies, practices and informal institutions in detail. Some derive from laws and regulations, others from customs, but all are relevant to the success or failure of interventions aimed at changing practices in land and water management. These 'institutions' in effect promote or discourage wise land and water management practices, and provide incentives for real poverty alleviation and sustained growth. Finally, they will be examined to see if they encourage, or discourage, consideration of upstream and downstream impacts.

3.6.1. Broader National Policies in Ethiopia

3.6.1.1. Agricultural and rural development policies and strategies

Agricultural and rural development policies and strategies was adopted by the government in March 2002. The most relevant principles of this policy and strategy are: improving farming skills; improving the supply, replication and dissemination of technologies; ensuring access to land and tenure security; resolving problems of drought-prone regions; improving the agricultural marketing systems; promoting rural finance; developing the rural energy sector and rural telecom facilities.

The strategy also known as *Agricultural Development Led Industrialization (ADLI)* aims to substantially raise agricultural production and productivity so as to enable agriculture to provide food security for the country and play a critical role in overall economic growth (FDRE 2001). The agricultural development program of the government aims at promoting sustainable management of natural resources and increasing agricultural production and fisheries and ensuring food security and nutrition for the population. The strategy is envisaged to have the following main objectives:

- Increase the food supply both quantitatively and qualitatively so that members of the sector will be adequately fed, while the population in other sectors will also be supplied with adequate food at affordable prices;
- Improve the quality of life of the rural population through the generation of higher incomes and reduction of poverty, promoting higher standards of nutrition and health, and greater equity in education and personal freedom;
- Increase and diversify the production of raw materials for industry and promote strong linkages with the industry sector;
- Increase and diversify the production for exports and maximize the country's foreign exchange earnings from agriculture; and
- Make agriculture the driving force for economic development so that dynamic growth in agricultural production raises incomes, which will be followed by increasing demand for products and services from the other sectors of the economy.

3.6.1.2. Macroeconomic policy

The macroeconomic policy of the government is a continuation of the policies started in 1994 by reorienting the budgetary resources towards poverty reducing sectors. The aim of the macroeconomic policies is to ensure an annual growth rate of 7% in the medium term, maintain stable prices and increase foreign exchange reserves to cover 4-5 months of import of goods and non-factor services. The policy also calls for strong revenue performance through tax reform programs, improving the monetary and financial sector reforms and capacity building and regulatory reforms to promote private sector development. The specific polices include:

According to MoFED (2006), the government's fiscal policy in the medium term is aimed at maintaining the deficit at a sustainable level while at the same time increasing spending in key sectors such as agriculture and food security, water and sanitation, education, health and HIV/AIDS, road construction and development of the power sector. The fiscal deficit is targeted to average 6.5% of GDP. On the revenue side, the government is determined to lay the foundation for strong revenue performance during the Plan for Accelerated and Sustained Development to End Poverty (PASDEP) period though appropriate tax reforms and capacity building measures (Ibid.).

The government's *Monetary policy* will continue to be geared towards maintaining price and exchange rate stability, with major objectives of containing inflation within single digits. The monetary program assumes a stable but slowly declining velocity. Broad money is, therefore, assumed to grow at a slightly higher rate than nominal GDP. The policy also gives emphasis to maintaining an adequate level of foreign reserves (MoFED 2006).

Liberalization of the financial sector is another ingredient of the macroeconomic policy of the government with the aim to enhance efficiency and competitiveness of the sector.

3.6.1.3. Plan for Accelerated and Sustained Development to End Poverty (PASDEP) (2005/062-2009/10)

The aim of the development plan is to lay out the directions for accelerated, sustained, and people-centered economic development as well as to pave the groundwork for the attainment of the Millennium Development Goals (MDGs) by 2015 (MoFED 2006). During the PASDEP period, Ethiopia is envisaged to build on the development strategies pursued under Sustainable Development and Poverty Reduction Program (SDPRP): expanding education, strengthening health service provisions, fighting HIV/AIDS, Food Security Program, capacity-building as well as decentralization (FDRE 2002a). It is also expected to continue to pursue the ADLI strategy, but with important enhancements to capture the private initiative of farmers and support the shifts to diversification and commercialization of agriculture (MoFED 2006).

One of the eight pillars of PASDEP, which has relevance to the development of water and land resources, is a push towards accelerated growth. The policy documents advocate that in order to eradicate the daunting poverty challenges faced by the country and to improve people's livelihoods, it is imperative to have an accelerated and sustained economic growth. The growth acceleration initiative possesses two main thrusts: commercialization of agriculture and accelerating private sector development. We briefly present the commercial thrust of the policy as it has relevance to land and water resources development.

The agricultural strategy of accelerating Market Based Agricultural Development is envisaged to revolve around an effort to support the intensification of marketable farm products -both for domestic and export markets, and by both small- and large-scale farmers. Elements of the strategy include the shift to high-value crops, promoting niche high-value export crops, a focus on selected high-potential areas, facilitate the commercialization of agriculture, supporting the development of large-scale commercial agriculture (where feasible), and better integration of farmers with markets - both locally and globally. The majority of these responses will have to come from the private sector, which includes millions of small farmers. To support this process a range of public investments and services is being developed by the government. The instruments to achieve this under PASDEP include: constructing farm-to-market roads; development of agricultural credit markets, specialized extension services for differentiated agricultural zones and types of commercial agriculture; the development of national business plans and tailored packages for specialized export crops (such as spices, cut flowers, fruits and vegetables); supporting small-scale irrigation and large-scale irrigation through multi-purpose dams; measures to improve land tenure security, and to make land available where feasible for large-scale commercial farming; reforms to improve the availability of fertilizer and seeds; and better-functioning agricultural markets for both inputs and outputs, and institutions, including improved value chains, information flows, quality and standards support, and cooperatives that strengthen the position of farmers in the market (MoFED 2006: p. 47).

In promoting agriculture development and commercialization the strategy envisages pursuing a Geographically Differentiated Strategy. The rationale behind this is that adoption of a single-handed

development strategy may not bring the best results as Ethiopia is characterized by differentiated ecological zones, varying landscape, and agricultural production practices. Accordingly, the strategy will take into consideration the varying geographical conditions in identifying development zones and to undertake appropriate activities suitable to the zones/areas. The challenge here is to design and promote tailor-made extensions and other support services that target the smallholder farmers.

3.6.1.4. Food Security Strategy (FSS)

Agriculture in Ethiopia heavily depends on rainfall where the pattern is of an erratic and unpredictable nature. For most smallholder farming and pastoral systems, rainfall is the major source of moisture for crop and livestock production. However, the frequency of drought has sharply increased recently, particularly in the 80s and 90s, i.e., every three to five years. Moreover, the vagaries of nature compounded to the limited development of the water resources of the country, has a serious effect on food production.

Since the country is dependent on agriculture, crop failure usually leads to household food deficits. The absence of off-farm income opportunities, and delayed food aid assistance, leads to asset depletion and increasing levels of destitution at household level. Over the last fifteen years this situation has resulted in the importing of 700,000 metric tonnes of food aid per annum to meet food needs.

To mitigate the food insecurity problem of the country the government embarked on the implementation of a food security program. Ethiopia's Food Security Strategy (FSS), first issued in November 1996, highlighted the government's plans to address the causes and effects of food insecurity in Ethiopia. The regional food security programs and projects were subsequently designed on the basis of that strategy. A revised strategy was developed in 2002. The development objective of the food security project was to build the resource base of poor rural households, increase their employment opportunities and incomes, reduce their real costs of food, and improve nutrition levels for their children under five years of age and pregnant and lactating mothers.

The project has four windows of finance - one of which is funds to communities of which one of the objectives is to invest in small-scale irrigation. The strategy targets mainly the chronically food insecure moisture deficit and pastoral areas of the country. A clearer focus on environmental rehabilitation as a measure to reverse land degradation and also as a source of income generation for food insecure households through a focus on biological measures marks a deviation from the 1996 strategy. Water harvesting and the introduction of high value crops, livestock and agroforestry development further constitutes the ingredients of the strategy. Institutional strengthening and capacity building is included as a central element of the strategy.

3.6.1.5. Productive Safety Net Program (PSNP)

The government has realized the presence of an urgent need to address the basic food needs of food insecure households via a productive safety net system financed through multi-year, predictable resources, rather than through a system dominated by emergency humanitarian aid (FDRE 2004). Moreover, the government seeks to shift the financing of the program from food aid to cash. On this basis, within the framework of the national Food Security Program (FSP), which emphasizes the three interrelated pillars of food availability, access to food, and utilization, the Ethiopian Government has decided to develop a new Productive Safety Net Program.

The Productive Safety Net Program is a key element of the government's poverty reduction strategies. The goals of the PSNP include (FDRE 2004):

- Reducing vulnerability and attaining food security for between 5-6 million chronically food insecure people by 2009;
- Reduce the number of Ethiopians suffering from extreme hunger, malnutrition, and poverty (MDG 1);
- Restore and rehabilitate the environment through soil and water conservation activities (MDG 7); and
- Build and maintain public infrastructure (e.g., rural roads) and enable smallholder farmers to take on economic activities with higher-risk but higher-return (e.g., adoption of higher yielding seeds requiring costly inputs).

Further, emphasis will be placed on promoting public work activities to address some of the underlying causes of food insecurity. In this line, water and soil conservation measures and access roads and other infrastructures are established through the PSNP.

The policies and strategies outlined above lay the foundation for economic growth through a pro-agriculture development strategy. The agricultural and food security strategies support agricultural growth through integrated efforts in SWC, water harvesting, extension and provision of support services (MoARD 2002).

3.6.2. Land and water related policies and guidelines

The Government of Ethiopia has also issued various policies, laws and regulations to improve the management of land and water. These belong to the class of formal institutions. We will briefly describe important land use related policies below, before we pass on to water related laws.

3.6.2.1. Land policies and guidelines

The latest legislation on land is the "Rural Land Administration Proclamation, No. 89/1997" issued in July 1997 (FDRE 1997a). In line with the constitution of Ethiopia, in this proclamation, land is declared the property of the state. Hence, it may not be sold or mortgaged. Peasants and pastoralists have only user rights. Holding rights are defined in the Federal Constitution (FDRE 1995) as "the right any peasant shall have to use rural land for agricultural purposes as well as to lease and, while the right remains in effect, bequeath it to his family member; and includes the right to acquire property thereon, by his labor or capital, and to sell, exchange and bequeath same" (Article 2 Sub-article 3). The state also has the ultimate power to enact laws about utilization and conservation of land. Article 51 of the constitution states that the Federal Government shall enact laws for the utilization and conservation of land and other natural resources (FDRE 1995). Article 52 also states that regional governments have the duty to administer land and other natural resources according to federal laws. Proclamation No. 89/1997 also vested regional governments with the power of land administration (defined as "the assignment of holding rights and the execution of distribution of holdings") (Article 2.6).

Following the 1997 federal proclamation, regional governments came up with their own proclamation on rural land administration. One example is the 1997 Rural Land Administration Proclamation in Tigray that prohibited further redistribution, except in cases where major public-led investments in infrastructure development (e.g., irrigation) were made or vacant land or wastelands were distributed to landless youth. By prohibiting further land redistribution, the state hopes that this will stop further land fragmentation (RNST 1997, 2005). The 1997 law also

formalized land-lease practices between farmers with contracts up to two years for traditional technology and up to 10 years for modern technology.

Furthermore, the regional proclamations paved the way for land titling, by issuing user certificates, to the land farmers received during the last land redistribution or through inheritance from their close kin. By doing so, the regional government hoped to boost farmers' sense of security, which, in turn, may encourage investment in erosion reducing and landing quality enhancing technologies without the state losing its right of ownership to land. Preliminary studies on the impact of land certification on tenure security, long-term investment and functioning of land markets indicate that they are having significant impacts on both accounts (Hagos 2007; Holden et al. 2007). Similar policies were also promulgated in all the major regions of Ethiopia (Deininger et al. 2007).

3.6.2.2. Integrated watershed management guidelines in Ethiopia (2005)

This guideline was developed with the intension of promoting and expanding participatory community watershed development in Ethiopia. This is an attempt to streamline the experiences of various actors (governmental organizations (GOs) and non-governmental organizations (NGOs)) in participatory watershed development, combined with the need to have a common and standardized, more effective approach to the country as a whole (Lakew Desta et al. 2005). The guideline aims to build upon existing community-based participatory watershed efforts to harmonize and consolidate planning procedures at the grassroots level. The intent is to provide development agents and communities with a workable and adaptable planning tool. Another objective of the guideline is to provide practical guidance on the correct selection of technologies under different conditions and their sequentially correct implementation (Lakew Desta et al. 2005).

3.6.3. Water related policies, laws and regulations in Ethiopia

The most important water related policies, strategies, regulations and guidelines in Ethiopia include:

- Water Resource Management Policy;
- Water Resources Management Proclamation and Regulation;
- National Water Sector Strategy and Water Sector Development Program;
- Irrigation Development Policy;
- Water Supply and Sanitation Policies;
- Health Sector Policy; and
- Energy Sector Policy.

The range of relevant policies points to the complexity of numerous institutional mandates relevant to water management. Each of these is briefly described below.

3.6.3.1. Federal water resources management policy

The Ethiopian Federal Water Resources Management Policy was issued in 1999. The stated goal of the policy was "to enhance and promote all national efforts towards the efficient, equitable and optimum utilization of the available water resources of the country for significant socioeconomic development on a sustainable basis" (MoWR 1999: p.1). The fundamental principles of the Ethiopian

Water Resources Management Policy were that (i) water is a natural endowment commonly owned by all the people of Ethiopia, (ii) every Ethiopian citizen shall have access to sufficient water of acceptable quality to satisfy basic human needs, (iii) water shall be recognized both as an economic and a social good, (iv) water resources development shall be underpinned on a rural-centered, decentralized management, participatory approach as well as an integrated framework, (v) management of water resources shall ensure social equity, economic efficiency, systems reliability and sustainability, and (vi) the participation of all stakeholders, user communities, specially that of women, shall be promoted in water management. The Policy has a series of highly relevant provisions, in particular, regarding the Integrated Water Resources Management (IWRM) approach. These include:

- Enhance the integrated and comprehensive management of water resources that avoids a fragmented approach;
- Recognize water as a scarce and vital socioeconomic resource and manage water resources on a strategic planning basis with long-term visions and sustainable objectives;
- Ensure that water resources management is compatible and integrated with other natural resources as well as river basin development plans and with the goals of other sectoral developments in health, mines, energy, agriculture, etc.;
- Recognize and adopt hydrologic boundaries or "basins" as the fundamental planning unit in the water resources management domain; and
- Promote and advocate institutional stability and continuity in water resources management and ensure smooth transition during times of change.

More specifically the document provides additional relevant provisions on the enabling environment:

- Promote appropriate linkage mechanisms for the coordination of water resources management activities between the federal and regional governments;
- Establish phase-by-phase basin authorities, for efficient, successful and sustainable joint management of the water resources of the basins through concerted efforts of relevant stakeholders;
- Create a conducive environment for the enhancement of linkages and partnerships between the federal and regional states on the basis of the constitution for the realization of efficient, sustainable and equitable water resources management; and
- Provide the legal basis for active and meaningful participation of all stakeholders.

The policy was developed giving due attention to general, crosscutting and sectoral issues. Inland water transportation, aquatic resources and tourism and recreation have been addressed under general policy. The issue of water allocation and apportionment, environment, watershed management, water resources protection and conservation, technology and engineering, water resources management information systems, monitoring, assessment and auditing, water cost and pricing (economics of water), groundwater resources, disasters, emergencies and public safety, transboundary water stakeholders, gender, research and development, water quality management and enabling environment have been dealt with under the umbrella of crosscutting issues. The sectoral part of the policy has incorporated specific issues in the area of water supply and sanitation, irrigation and hydropower.

An important point here is whether central ownership of these resources is compatible with decentralized management, which is advocated in the policy documents.

Although the issues addressed in the policy are equally important, the issue of water allocation, a basin development approach, integration of developments, water pricing, cost recovery, and water financing could be taken as key pillars for the future development and management of water resources. We present these issues briefly for closer scrutiny.

The Water Policy issued by the GoE also clarifies how water should be allocated and apportioned. Management of water resources is in accordance with a permit system for uses of irrigated agriculture, commercial animal rearing, industry, mining, urban water supply, etc.; while no permit is required for use of water by peasants, artisan miners, traditional fishermen, traditional irrigation, water mills and hand-dug wells. The supervising body (MoWR) is responsible for determining the allocation and manner of use of water resources among various uses and users; and for issuing directives to prevent inappropriate use and wastage of water. More specifically, the policy directs that:

- The basic minimum requirement for basic human and livestock needs as well as environmental needs has the highest priority in any water allocation plan;
- Water allocation gives the highest priority to water supply and sanitation, while apportioning the rest for uses and users that result in highest socioeconomic benefits;
- Encouragement of water allocation needs to be based on efficient use of water allocation, which is based on efficient use of water resources that harmonizes greater economic and social benefits;
- Water allocation shall be based on the basin, sub-basin, and other hydrological boundaries and take into consideration the needs of drought-prone areas;
- Adopting the principle that water allocations shall not be made on a permanent basis, but rather on a agreed time horizon that fits best with the socioeconomic development plans; and
- Priority is given, generally, to multi-purpose projects as compared to single purpose projects for optimum water utilization as well as for fair administration of water uses in reservoir operations.

The policy document underlines the importance of an *integrated approach* to water resources development for optimal utilization of the country's water resources. Integrated water resources management promotes the coordinated development and management of water, land and related resources to maximize economic and social welfare in an equitable and sustainable manner. The concept of IWRM is concerned with the management of water demand as well as water supply.

The Water Policy has also recognized and adopted hydrologic boundaries or "basins" as the fundamental planning unit and as the water resources management domain. It also indicates that water resources management needs to be compatible and integrated with other natural resources as well as river basin development plans and with goals of other sectoral developments in health, mines, energy, agriculture, etc. To this end, the river basin integrated development master plan studies have been carried out in six river basins: Abbay, Baro-Akobo, Gibie-Omo, Tekezie, Wabi Shebelle and Mereb Genale Dawa river basins. Presently, similar studies are being carried out in the Rift Valley River Basin. The master plan studies that have been carried out have applied the concept of IWRM in order to maximize the benefits from the natural resources of each basin including water resources.

Comprehensive potential projects in water supply, irrigation, hydropower, flood control, fisheries, recreation, navigation, industry, etc., have been identified. Priority for development of these projects has been set; and implementation of some have started.

With regard to *transboundary waters*, the policy explicitly calls to (i) study Ethiopia's stake and national development interests in the allocation and utilization of transboundary waters; (ii) promote the establishment of an integrated framework for joint utilization and equitable cooperation and agreements on transboundary waters; (iii) ascertain and promote Ethiopia's entitlement and use of transboundary waters based on accepted international norms and conventions endorsed by Ethiopia; and (iv) foster meaningful and mutually fair regional cooperation and agreements on the joint and efficient use of transboundary waters with riparian countries based on "equitable and reasonable" use principles; comply with those international covenants adopted by Ethiopia, and manage transboundary waters accordingly.

Further, the water resources management policy has given importance and recognition *to the value of water*. In the general objective of the policy, it is stated that the development of the water resources of the country is to be for economic and social benefits of the people on an equitable and sustainable basis. The fundamental principles of the policy have also highlighted the following, as regards to the value of water: "Water is a natural endowment commonly owned by all the peoples of Ethiopia. As far as conditions permit, every Ethiopian citizen shall have access to sufficient water of acceptable quality, to satisfy basic human needs".

In order to significantly contribute to development, water shall be recognized both as an economic and a social good; and the policy has clearly recognized the disadvantaged groups of the population by citing that, "although all water resources development ought to be based on the economic value of water, the provision of water supply services to the underprivileged sectors of the population, shall be ensured based on a special social strategy" (MoWR 1999). The most important role of water valuation relates to demand management and better allocation of water among the various uses. The value of water depends on its quantity, quality, location, access reliability and time of availability. Valuing water is linking the concern that water uses must be able to meet different social, economic and environmental functions. Priority in water allocation is given to human and animal consumption, followed by irrigation. The Water Policy provisions relating to water pricing include:

- To recognize that water is a natural resource with an economic value and ensure that fees are paid for services rendered;
- Recognize water as a vulnerable and scarce natural resource and promote and ensure that all pricing systems and mechanisms should be geared towards conservation, protection and efficient use of water as well as promote equity of access;
- Ensure that the price for water should be neither too high (and discourage water use) nor too low (and encourage abuses and over-use of water);
- Ensure that the basic human needs of water for disadvantaged rural communities, who cannot afford to pay for development of water systems, shall be borne by the government, as appropriate, in so far as the communities are able and willing to cover the operation and maintenance costs on their own; and
- Ensure that pricing for urban water supplies shall aim at full cost recovery and develop cross-subsidization strategies and promote credit services.

The water policy has specific stipulations pertaining to tariff setting, requiring that (i) tariff structures are site-specific and determined according to circumstances; (ii) rural tariff settings are based on the objective of recovering operation and maintenance costs while urban tariff structures are based on the basis of full cost recovery; (iii) tariff structures in water supply systems are based on equitable and practical guidelines and criteria; (iv) adopt a "social tariff" to enable poor communities to cover operation and maintenance costs; (v) establish progressive tariff rates, in urban water supplies, tied to consumption rates; and (vi) develop flat rate tariffs for communal services like hand pumps and public stand posts.

Furthermore, the Water Policy advocates that in financing water supply, efforts should be made to promote self-financing of programs and projects at the local level, ensure transparency and fairness in the management of water supply services so as to enhance readiness to pay and participation by the users and communities in the finance management of system, ensure responsibility and financial accountability in the management of water supply services, and promote the participation of local banks, other investors as well as popular and traditional self-help social associations (*Idir*, rural credit service, etc.) in the development of water supply through appropriate incentive mechanisms.

The Water Resources Management policy also stipulates the following provisions relevant to irrigation:

- Ensure that irrigation development is integrated with the country's socioeconomic development strategy and overall water sector development strategy, especially with regard to agricultural development led industrialization;
- Irrigation development strategies should promote socioeconomic development while ensuring participatory and sustainable development;
- Ensure that adequate resources are devoted to irrigation development particularly in capacity and institution building;
- Irrigation development should take the interest of the end users into account, particularly the rural women;
- Develop strategies for the development of small-, medium- and large-scale irrigations schemes to meet the country's food and raw material needs and foster economic development;
- Support traditional irrigation schemes to ensure improvements in water harvesting, delivery and water management efficiency;
- Protect irrigation water from pollution, reduce damage and maintain irrigation water quality;
- Develop water allocation mechanisms to ensure social equity, economic growth and environmental sustainability;
- Integrate appropriate water drainage service with irrigation development works;
- In areas where there is water shortage but the settlement pattern is not conducive; solicit the collaboration of regional and federal governments to support large-scale irrigation development.

The main actors in irrigation development are identified as: farmers, service cooperatives, governmental and non-governmental organizations and the local people who will live in and near the irrigation development. Participation of all of these stakeholders, as well as transparency and social equity in irrigation development, are priorities. With regard to financing, the irrigation water policy calls for the establishment of norms and procedures for financing sustainability and viability;

the promotion of credit facilities and bank loans; and appropriate cost recovery systems and mechanisms for all irrigation schemes.

The policy has also relevant provisions for *Water Supply and Sanitation*. The overall objective of the water supply and sanitation policy is to enhance the well-being and productivity of the Ethiopian people through the provision of adequate, reliable and clean water supply and sanitation services and to foster its tangible contribution to the economy by providing water supply services that meet the livestock, industry and the demands of other water users. Water supply priorities are outlined above. With regard to sanitation, the policy outlines the need to:

- Define and implement acceptable minimum sanitation facilities differentiated in urban and rural scenarios;
- Develop a collaborative and cooperative framework for the development of sanitation systems through definition of the responsibilities of the different governmental and other major stakeholders in sanitation at all levels;
- Develop and promote guidelines, rules and regulations, for the study, design, operation and maintenance for efficient, appropriate and sustainable sanitation services as well as to foster appropriate water saving sanitation services and utilization norms;
- Foster culturally and socially acceptable methods and facilities for sanitation;
- Promote the formulation of a housing construction and urban development policy that incorporates sanitation services;
- Promote the involvement of non-governmental organization, external support agencies and the private sector in sustainable sanitation programs;
- Develop standards for different types and levels of sanitation systems including both on-site and off-site, non-water dependent and water dependent systems;
- Promote research and development on low cost and suitable sanitation alternatives and encourage the participation of users in the development of sanitation systems;
- Manage the import of wastewater treatment technologies and materials through pertinent institutions; and
- Build capacity in terms of engineering, design, construction, operation and maintenance, etc., of sanitation systems.

Promote the fact that sanitation services are based on participation driven and responsive principles without compromising social equity.

3.6.3.2. Water resources management proclamation

The GoE has issued Proclamation No. 197/2000 for the management, protection and utilization of the country's water resources (FDRE 2000). It is designed to serve as the basic legislative framework of the country with respect to the management, planning, utilization and protection of water resources. The stated purpose of the proclamation is "to ensure that the water resources of the country are protected and deployed for the highest social and economic benefits of the people of Ethiopia; to follow-up and supervise that water resources are duly conserved; to ensure that harmful effects of water are prevented; and that the management of water resources are carried out properly" (Article 3). The basic thrust of these fundamental principles is that water resources management and

administration in the country should be based on the National Water Policy, the Integrated River Basin Master Plan (IRBMP) studies and the Water Resources Laws of the country.

According to the proclamation, the right to allocate and apportion water to all regional states regardless of their origin and location is best bestowed upon the legal jurisdiction of the Ministry of Water Resources in its capacity as supervisory body. The legal provisions in the proclamation, with regard to ownership of the resources and its allocation and apportionment, clearly show that the development, management, utilization and protection of all water resources in the country lies effectively in the hands of the Federal Government.

Regional states and local administrative bodies, without requiring any new law for water, are strictly obliged by law to implement the water policy and the water proclamation in accordance with set directives and guidelines to be provided by the Federal Ministry of Water Resources. Moreover, as for the constitution, this proclamation confirms the duality of management arrangements, i.e., surface water whenever linking two or more regions or being transboundary clearly pertains to the federal level. By default, it may be understood here again that management of groundwater and lakes are addressed by the legal provisions of regional states.

3.6.3.3. Water resources management regulations

Water Resources Management Regulations (MoWR 2004) have been prepared by the Ministry of Water Resources and approved on December 31, 2004. The contents of the regulation are those covered in the proclamation, but detailing the procedures as to how the various legal materials contained in the proclamation are to be made effective on the ground. In particular, the regulations present a further elaboration of the main requirements for the issuance of permits for different uses of water and the conditions for the issuance, as well as the level of water charge and procedure for licensing water operators.

The regulations do not delegate the regions to issue any water use/wastewater discharge permits within their own respective regions. The MoWR still retains the mandate to issue permits for a large bulk of the country's water resources, although it can delegate it further to any relevant body. This is also true for the collection of fees and water use charges. Therefore, waterworks developed by the regional states would see their fee collection performed by the MoWR. Furthermore, tariff rates are determined for different water uses at national level, without the intervention of regional states.

Several questions arise from this situation: Is the MoWR in a position to issue water permits and collect water charges at national scale? Or would it be more efficient to delegate parts of its mandate to regional water resources bureaus?

Regions have, in the meantime, developed regional water resources management policies and regulations. In 2002, for instance, the Oromiya Regional State issued a Regional Water Resources Policy. A draft regulation for the management of water resources has also already been prepared by that region. By and large, both the water resources policy and draft regulations for water resources management of the Oromiya Regional State are in line with and similar in their content to those issued by the Federal Government.

The main issue, as already mentioned, lies in the role of regions versus the Federal State. It is clear that "framework" laws (such as proclamations and policies) are clearly the mandate of the Federal Government. However, it is also necessary that the different administrative and political levels develop policymaking activities (such as specific regulations) applicable to their territorial level, as long as they bring value-added and abide by the federal laws and policies.

Here, the specific issue of groundwater arises first: the Regions could, for instance, issue permits for groundwater use, but, to be in line with IWRM Principles, federal and basin regulations must come first. Specific directives at the national scale for this specific (and sensitive) resource need to be developed following the Water Resources Management (WRM) regulations.

3.6.3.4. National water sector strategy and the Water Sector Development Program (2000)

The Ethiopian Water Sector Development Program (WSDP) is taken as an instrument to translate the Ethiopian Water Resources Management Policy into action. The 15-year Water Sector Development Program (WSDP) has five major components: Water Supply and Sewerage Program; Irrigation and Drainage Program; Hydropower Development Program; General Water Resources Program; and Institutions/Capacity Building Program. The strategy provides the framework, which contains ways and means of attaining the intended objectives. The goals and guiding principles will remain the same with that of the policy. The strategy sets the road map on how to make meaningful contributions towards improving the living standard and general socioeconomic well-being of the Ethiopian people. These objectives include:

- Realizing food self-sufficiency and food security;
- Extending water supply and sanitation coverage to large segments of the society;
- Generating additional hydropower and enhancing the contribution of water resources in attaining national development priorities; and
- Promoting the principles of integrated water resources management.

In view of the enormous water demand in the country, the WSDP has adopted the following water resource development priorities.

- Making clean drinking water available to the larger segments of the society, including water for sewerage purposes;
- Making water available for livestock in critical areas such as the pastoral areas;
- Expanding irrigated agriculture to the maximum possible extent and meeting hydropower generation capacity needs arising from electricity demand in the economic and social sectors; and
- Providing water for the industrial development.

Within the overall priority provided above, the highest priority has been given to the programs and projects, which:

- Are ongoing and their implementation is expected to continue during the period of the plan;
- Require rehabilitation and reactivation;
- Were started, but for some reason their implementation was discontinued;
- Have already been subject to appraisal and are already being considered for possible funding;
- Have been identified in master plan studies;
- Have been considered for capacity building;
- Are indicated in the Nile Basin Initiative and the Eastern Nile Subsidiary Action program.

3.6.3.4.1. Water Supply and Sanitation Program

As part of the Water Sector Development Program, the *Water Supply and Sanitation Program* (WSSP) has set targets to be achieved over the 15-year period of the program, which is divided into short-term (2002-2006), Medium-term (2007-2011) and long-term (2012-2016). At the end of the period of the program (2016) national water supply coverage is expected to hit a level of 76% from 31% in the base year of the program (2001). The settings of the targets are defined in line with the government's commitments for the Millennium Development Goals (MDGs). If set targets are achieved, the number of people without access to safe water will only be 24%. Urban water supply coverage is expected to grow to 98% at the end of the program period while rural water supply coverage is also expected to grow to 71% (MoFED 2006).

3.6.3.4.2. Irrigation Development Strategy

The Irrigation Development Program (IDP) (2005/06-2009/10) envisages the expansion of irrigation in the country by an additional 430,061 ha by the year 2010 (MoFED 2006). This will consist of mainly medium- and large-scale schemes. Accordingly, 39 significant irrigation projects are planned for implementation during the PASDEP period. These include the World Bank project around Tana (100,000 ha); Anger Negesso Project in Oromiya (49,563 ha); Humera project in Tigray (42,965 ha); Kessem Tendaho in Afar (90,000 ha); Upper Beles in Benishangul Gumz (53,000 ha); and Ilo-Uen Buldoho in Somali (32,000 ha). Most of these irrigation schemes will be community-managed schemes to be used by small-scale farmers. Exceptions are the schemes to be developed in the Awash Basin which will mainly involve expansion of the already existing large-scale schemes or the development of new schemes. About 90,000 ha of irrigation land will be developed in Kesem and Tendaho to grow sugarcane while there are planned expansions in the already existing sugar plantations. Overall, by the year 2010 there will be an additional 122,000 ha of irrigated land developed to grow sugarcane (ESDA 2007).

There are also parallel plans to develop 98,625 ha under small-scale irrigation by the regional governments (Atnafie 2007). The total extension to irrigated area by the year 2009/10 compared to 2005/2006 will be in the range of 528,686 ha.

3.6.3.4.3. Hydropower Development Program

The government plans to increase power supply by threefold over the coming five years. In total, generating capacity is to be increased from the existing 791 MW to about 2,218 MW by 2009/10. A major element of the program during the PASDEP period will be the launch of a large-scale rural electrification program, called the Universal Electrification Access Program (UEAP). Over 6,000 rural towns and villages are identified for electrification in all regions of the country (MoFED 2006: p. 137).

The *Hydropower Development Program* (HDP) within the WSDP has set targets for meeting local and export demand for electricity. The plan indicates the construction of the Gilgel Gibe-2 (420 MW), Tekeze (300 MW), the Beles (460 MW), Chemoga-Yeda (278 MW), Halele (96.4 MW), Werabesa (339.9 MW), Gilgel Gibe-3 (1,800 MW), Yayu Kesel (100 MW), and Gojeb (150 MW) stations (MoFED 2006: p. 138).

3.6.3.4.4. Implementation modalities of WSDP

Recognizing that WSDP is a national water plan, stakeholders including the public, private sector, NGOs, international development partners, and communities are anticipated to participate in the implementation of the program. To this end, the detailed implementation arrangements of the WSDP clearly address the roles of stakeholders. For example, government institutions such as the Federal Ministry of Water Resources and Regional Water Bureaus are to have the lead role during implementation of the program. Other federal and regional institutions are also expected to have significant roles. High profile decisions and policy reviews and issues concerning large investment projects are among the most important functions of the MoWR along with its partner federal institutions. Other functions are also inter-organizational collaboration and enhancing departmental and regional implementation capacities. Regional level Water Sector Bureaus and other relevant sector bureaus are assisting and coordinating activities of local level water desks, which are responsible for planning, budget preparation and implementing planned projects and activities. All stakeholders are provided with the Program Implementation Manual.

Currently, the private sector's role is not that strong. However, the government has continued to move forward in bringing on board private sector agencies to be involved in the all-rounded development of the Ethiopian water sector using various types of incentive mechanisms. Private consulting firms are growing up in the water sector. They have started working in association with foreign firms as well as taking the responsibility separately. Their scope of work includes study, design and supervision, and construction.

In the spirit of public-private partnerships, the private sector is seen as a service provider; while in the context of Ethiopia, resource ownership like land and water, remain with the state and the general public. Incentives mentioned in the WSDP documents are fiscal incentives in the form of tax holidays, access to land and water, concessional lending from commercial bank institutions, enhancing their technical capacities and management capabilities. The private sector on its part is expected to establish more efficient markets and bring in new investments to the sector.

Communities are expected to invest in the form of capital and labor as the case may be for some of the projects and programs that are covered in the WSDP document. Consistent with the ongoing decentralization process in the country, communities and local level *Woredas* (the smallest government administrative unit for planning, budgeting and implementation) are responsible bodies. Water Users Associations and other Water Committees and Water Boards are good examples of organizations that are very close to all Community-Based Organizations.

A number of NGOs are working in Ethiopia and continue to play an important role in water resources development. NGOs are generally involved in project identification, implementation and financing. Areas of interventions include, among others, rural water supply and sanitation development, irrigation and other water related developments, and poverty reduction and projects to improve health conditions. They are also expected to bring or mobilize more financial resources for WSDP implementation. NGOs are also involved in strengthening technical capacities of regions and localities; organize local communities and undertaking rehabilitation works.

In a similar manner, the role of the International Support Agencies such as the Bilateral and Multilateral Agencies will be mainly resource mobilization in the form of financial and technical assistance. To this end, the WSDP provides lending agencies and donors a comprehensive framework not only to select projects/programs for financing in accordance with their respective country financing strategies, but also to coordinate water sector activities in order to improve the efficiency and management of external assistance and loans.

Organs that are proposed to be established towards implementing WSDP using the implementation arrangements are: an Inter-Ministerial Steering Group; Federal Program Management Unit (FPMU); Regional Program Management Unit (RPMU); and Sub-Program level Teams under the FPMUs and RPMUs. These entities are not established as yet (NBI 2006).

3.6.3.5. Environmental policy

The Environmental Policy of Ethiopia (EPE), which was approved in April 1997, has an overall policy goal, which 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 needs of the present generation without compromising the ability of future generations to meet their own needs" (FDRE 1997b).

EPE emphasizes the need for arresting land degradation. In the sectoral environmental policies, human settlements, urban environment and environmental health are included within the following objectives:

- To ensure that improved environmental sanitation be placed highest on the federal and regional agenda for achieving sustainable urban development;
- To promote the construction of their own houses by individual families and create conducive conditions for communities and individual families to make improvements to their immediate habitats as well as to provide human and domestic waste disposal facilities;
- To recognize the importance of and help bring about behavioral change through education and public awareness of environmental sanitation problems in trying to achieve demand driven community-led sustainable use and maintenance of sanitation facilities;
- To bring about a sound partnership between the government and communities in the development of an integrated sanitation delivery system, and to the supplementary role of NGOs;
- To ensure that housing and sanitation technologies and regulatory standards are set at a level and cost that are within reach of the users and flexible enough to be adaptable to the very varied socioeconomic, epidemiological, climatic and physical site conditions which are found in urban areas;
- To give priority to waste collection services and to its safe disposal;
- to recognize the importance of adequate water supply as an important component in achieving a sustainable and healthy urban environment on the one hand, and to recognize the minimization of the need for water as an important factor in the choice of sanitation technologies on the other;
- To construct shared VIP latrines in the low income and very high density housing areas of Addis Ababa and the older towns with frequent emptying by tankers integrated with programs on user education, health and hygiene, with follow-up maintenance and cleaning, all implemented as a component of a broader urban environmental upgrading program including storm water drainage;

- To ensure the construction of family latrines in lower density urban and peri-urban areas as a conditionality of the house plot lease and to integrate this with health and hygiene awareness programs;
- To create conducive conditions for families, housing groups and communities to construct latrines and private entrepreneurs to undertake latrine emptying as well as waste collection and disposal services;
- To undertake studies which identify suitable sanitary landfill sites in the major cites and towns of Ethiopia; and
- To establish safe limits for the location of sanitary landfill sites in the vicinity of wells, bore holes and dams, and issue regulations to enforce them.

To this end the Ethiopian Environmental Protection Authority has drafted three major laws regarding the Establishment of Environmental Protection Organs (FDRE 2002c), which re-establishes and re-defines the functioning of an Environmental Protection Authority (EPA) as an autonomous Federal Government Organ, and further proclamations that define the Environmental Pollution Control (FDRE 2002e), and Environmental Impact Assessment practices (FDRE 2002d) in the country.

Environmental Organs Establishment Proclamation, Proclamation No. 295/2002, enacted in 2002, repealed the old Proclamation for the Establishment of the EPA, i.e., Proclamation No. 9/95. According to this proclamation, EPA is accountable to the Prime Minister. It has also established the Environmental Protection Council (EPC). EPC oversee EPA's activities, as well as the activities of sectoral agencies and environmental units with respect to environmental management. It also ensures coordination among sectoral ministries and agencies on environmental matters. The proclamation stipulates the mandatory need for the establishment of environmental organs by regions. Mandates of the regional environmental organs are to enable regions to coordinate the formulation, implementation, review and revision of regional conservation strategies; environmental monitoring, protection and regulation; ensure the implementation of federal environmental standards or, as may be appropriate, issue and implement their own no less stringent standards; and prepare reports on the respective state of the environment and sustainable development of their respective states and submit them to the Authority (FDRE 2002c: Article 15).

The EIA Proclamation No. 299/2002 empowered the EPA to prepare procedure, regulations, guidelines and standards to effectively implement and enforce EIA proclamation. Environmental guidelines are among the tools for facilitating the inclusion of environmental issues and principles of sustainable development into development proposals. To guide mainstreaming the principles of sustainability into sectoral projects and sectoral environmental impact assessment guidelines such as gridlines on agriculture, transport, industry, tannery and settlements have been prepared.

In addition to these, a general guideline for facilitating EIA in all sectors has been prepared (EPA 2003). The fundamental purpose of this guideline is to ensure that proponents, the government and all other interested and affected parties have the opportunity to participate meaningfully in the EIA process.

Although quite general, these laws, and particularly the "Environmental Pollution Control Proclamation" specifies clearly the function of law enforcement of the EPA and of the regional environmental agencies, in charge of taking administrative or legal measures (and fines and penalties) against a person violating the law and releasing any pollutant into the environment. As a result, the water pollution control is, therefore, the responsibility of these environmental agencies.

The question of a more integrated water legal framework (quantity and quality, resource use and pollution), in line with IWRM principles, is here again noticeable. There is already possible overlapping of responsibility between, on the one hand, the general and broad mandate of the EPA and Regional Environmental Bureaus or the Authority in the field of pollution control and the IWRM framework that promotes integration of all aspects of water resources on the other. If these two organizations work separately, this would lead to a clear duplication of effort and waste of resources. Therefore, on water quality monitoring, effluent standards, water pollution control and the EIA, the MoWR and the EPA should have an almost permanent collaboration platform. The collaboration platform is usually project-based where a national steering committee is established to oversee the planning and implementation of a project. The committee defines terms of reference for contractors/ consultants and evaluates the outputs thereof. Any water related project is, in principle, subject to the EIA based on EPA guidelines.

3.6.3.6. Health policy

The government's health policy takes into account population dynamics, food availability, acceptable living conditions and other requisites essential for health improvements. The present health policy arises from the fundamental principle that health constitutes physical, mental and social well-being for the enjoyment of life and for optimal productivity.

To realize these objectives, the government has established the Health Sector Development Program, which incorporates a 20-year health development strategy through a series of 5-year investment programs. This program calls for the decentralization of health services, development of preventable health care, capacity building within the heath service system, equitable access to health services, self-reliance, promotion of intersectoral activities and participation of the private sector, including non-governmental organizations and cooperation and collaboration with all countries, in general, and neighboring countries, in particular, and between regional and international organizations.

3.6.3.7. Energy sector policy

The new energy policy issued in May 1994 outlines the need to rely mainly on hydropower to increase the electricity supply but to take advantage of geothermal, solar, wind and other renewable energy resources wherever appropriate. It also calls for the need to encourage energy conservation in industry, transport and other energy using sectors to ensure that energy development is environmentally friendly; and to provide appropriate incentives to the private sector. The Ethiopia energy policy accords the following order of priority for the development of various energy resources (TGE 1994): i) Hydroelectricity development; ii) Oil and gas resources development; and iii) Traditional energy development through reforestation programs.

Hydropower development has been accorded highest recognition and priority in the development policies of both the water and energy sectors. The current policy of Ethiopia in water resources management has set the overall objective of hydropower development as being ‘’to enhance efficient and sustainable development of the water resources and meet the national energy demand as well as catering for external markets to earn foreign exchange" (MoWR 1999; p. 32). It is worth noting that the policy ensures "all processes of project preparation including surveys, reconnaissance and feasibility studies up to detail design of medium and large-scale hydropower projects shall be the responsibility of the water sector'' (MoWR 1999). This provision begs the question as to how the

main actors in energy provision (Ministry of Mines and Energy and Ethiopian Electric Light and Power Agency) are to behave in fulfilling their tasks.

3.6.4. Broader national policies in Sudan

3.6.4.1. The National Comprehensive Strategy (NCS)

Sudan's main objectives and priorities for sustainable development were spelled out in the National Comprehensive Strategy *(1992-2002)* which provided policy directions to all economic and social sectors. The NCS put food security, sustained agricultural development, efficient resource utilization, and yield enhancement on the top of the agenda (FAO 2008). The NCS incorporates the country's environmental strategy, which states clearly that environmental issues must be embodied in all development projects. Within the NCS, the government manages the economy through a series of three year rolling plans and annual budget processes. The NCS has also served as a key reference document and basis for sectoral policies and measures.

A key weakness of the NCS was the lack of coherence, as it was a result of the work of different sectoral teams without emphasis on horizontal and vertical integration (ENTRO 2006c).

3.6.4.2. National Poverty Reduction Strategy

In the Sudan, the National Poverty Reduction Strategy was developed under the coordination and leadership of the Ministry of Finance and National Economy. This strategy is part of the country's long-term strategic plan and seeks to involve all groups of Sudanese society.

The preliminary draft of the IPRSP was prepared in January 2004 with the participation of and contribution from a number of highly qualified national experts. The IPRSP is considered to be the main available document of the Government of Sudan for poverty reduction. It covers the 16 States of North Sudan for the period 2005-2007. The main objectives of the IPRSP are:

- Maintain economic stability; ensure political stability; and social stability.
- Environmental integrity; prove standards of living and assist in the flow of financial resources.

3.6.5. Water related policies, laws and regulations in Sudan

3.6.5.1. National Water Policy (NWP)

Sudan developed the first national water policy in 1992. Drawing on the lessons of implementing the policy, a multi-disciplinary and multi-sectoral committee was formed in 1999 to review, integrate and update the 1992 policy. A new policy was drafted in 2000 which awaits improvement by the National Water Resources Council before it is submitted to the appropriate executive and legislative institutions for endorsement (NBI 2006).

The draft policy document assesses the water situation in the country, existing policies and legislation and then provides the main policy principles and statements. These policy principles are considered under water resources, water utilization, water and environment, international issues, socioeconomic issues, disaster management, and institutions and capacity building. It also recommends the development of a strategic plan for the water sector. The objectives of the NWP are to:

- Review and adapt water policy to meet changing circumstances;
- Ensure that the water resources of Sudan are properly managed, protected and efficiently utilized for the benefit of all;
- Provide the basis for the ongoing development of water related regulations and legislation; and
- Strengthen and clarify the functions and responsibilities of water related institutions in both the public and private sectors of Sudan.

The most important principles and policy statements of the draft National Water Policy in 2000 include:

- Water is a scarce and valuable commodity which has to be equitably, economically and efficiently used;
- Access to water for basic human needs is the highest priority in the development of water resources;
- Development of water resources must be demand-driven and management should be undertaken at the lowest possible level;
- Development and management of water resources, and the operation and maintenance of water services must be economically sustainable through the recovery of costs from those who benefit;
- All water, including surface water and groundwater, form part of the hydrological cycle and should be managed in an integrated manner;
- Water resources management affects everybody and should be undertaken with the participation of relevant stakeholders;
- People are stakeholders for water use and the national government is custodian of all water in Sudan for the equitable benefit of all in the public interest;
- The gathering and management of accurate information for recording and ongoing monitoring of water resources is essential for the proper development, management and protection of water resources;
- The environment needs to be protected in order to ensure sustainable utilization for present and future generations;
- The development of water resources will be undertaken in order to maximize its benefits in the public interest whilst ensuring minimum adverse impacts on the environment; and
- Public institutional arrangements at federal and state levels will be integrated, accessible, efficient and transparent whilst avoiding duplication of functions and responsibilities.

One could note the similarity between the principles and policy statements of the water polices of the governments of Ethiopia and Sudan. Both policies seem to draw a lot from the Dublin Principles.

3.6.5.2. Environment Protection Act and Policy

In 2001, the Higher Council for Environment and Natural Resources (HCENR) in Sudan initiated the development of environmental regulations under the Environment Protection Act of 2001 which was issued through a presidential decree. It established guidelines and requirements for environmental impact assessments and environmental conservation frameworks.

The Environmental Protection Policy of 2001 requires that any new projects that are deemed to have an impact on the environment conduct an Environmental Impact Assessment (EIA). This must be done in order to obtain an Environmental Compliance Certificate (ECC) from the HCENR through the receipt of an Initial Environmental Impact Assessment (IEA) Report. This report should contain a mitigation plan or a description of the mitigation measures to be implemented to reduce the environmental impacts of the proposed project.

The EIA report is normally made available for viewing and feedback by interested and affected parties prior to the HCENR giving the go-ahead with the project. This legislation represents a major step in coordinating national developmental projects on an environmentally sustainable basis.

One could also draw a parallel between the Ethiopian and Sudanese environmental polices both in terms of policy goals and content besides coming into place around the same time.

3.7. Institutional Dynamics and Linkages

The institutions described above, both formal organizations and the range of other relevant institutions, all impact land and water management. The linkages and dynamics within and between these institutions are, therefore, part of the institutional context of this study. This section presents some of the key linkages, gaps and dynamics of the broad range of institutions in land and water management in the Abay Blue Nile Basin.

3.7.1. Key linkages between government organizations: Mandate gaps and overlaps, and information sharing

The organizational environment for land and water in the Abay Blue Nile Basin region is fairly well-defined. There are organizations with clear mandates, duties and responsibilities. The organizational settings have been organized in such a way that organizations that have to do with land and water, directly or indirectly, have been identified and given the duties and responsibilities, by law, in order to execute their tasks appropriately. The policies in place are also clear and similar in terms of the goals they strive to achieve and the suggested strategies and instruments to achieve these policy goals. This may imply that, although it may call for careful legal and policy scrutiny, there is a high level of consistency in policies and laws, at least on paper, in the Abay Blue Nile, contrary to claims of policy inconsistency and calls for policy harmonization. That said, however, there are important problems noticed in the organizational setting and some questions about the institutional arrangements that remain to be answered. Important policy gaps are identified as well.

- In Ethiopia, there are five federal and five main subsidiary organizations and at least the same number of regional bureaus/authorities working in the area of land and water; the same is true in Sudan. When we carefully look into the work portfolios of ministries in Ethiopia, there are overlaps in the mandate between the MoWR and the other federal ministries and agencies, particularly the MoARD, EPA, and the ministries of Health and Energy. For instance, the MoWR and MoARD both have responsibilities related to water

resources development, although the MoWR seems to focus on medium and large-scale works, and the MoARD seems to focus on small-scale irrigation and micro water harvesting. The broad areas of integrated natural resource management also fall into the mandates of these ministries and the environmental protection authorities/agencies. Moreover, the lines of responsibility between the MoWR and health and sanitation agencies at federal and regional levels between bureaus of water resources, urban water supply services, municipalities and health bureaus, with regard to sanitation services are overlapping and unclear. In this regard, the regional bureaus have almost similar mandates to the federal ministries and agencies. There are also other actors such as NGOs and the private sector working in the water sector. From the discussion above one could also draw similar conclusions, although information is scanty, about the institutional arrangement in Sudan. NBI (2006) reported that there are confusions in the mandates and responsibilities of the MIWR and agricultural corporations in the operation and maintenance (O&M) of minor canals, although the O&M of large canals is the responsibility of the Ministry of Irrigation and Water Resources (MIWR).

All of the above mentioned ministries and agencies have important roles to play in the development of water resources in an integrated manner. The critical questions are: to what extent these overlaps in mandates mean duplication of efforts and conflict of mandates. An equally important issue is - to what extent are these overlaps minimized through joint planning and coordination? Furthermore, who is responsible, mandated by law, for regulating that tasks and responsibilities are fulfilled by the responsible ministries and agencies? How the various mandates are integrated and are there mechanisms for coordinating these separate efforts? What specific linkages and information sharing mechanisms are in place to ensure institutional harmony and efficient information and resource flows? How are regional and federal government ministries and agencies linked? Some of the most important problems related to institutional arrangement of land and water related organizations in the Abay Blue Nile Basin include:

- Overlapping and conflicting roles and responsibilities: A high frequency of overlapping and conflicting roles and responsibilities between institutions existed (NBI 2006: p.3). NBI (2006) also identified poor inter-sectoral collaboration and control as one of problems related to roles and responsibilities of organizations. The organization of ministries, bureaus and departments seem to follow ‘disciplinary’ orientation while problems in the sector call for an interdisciplinary and integrated approach. In Ethiopia, for instance, various stakeholders are involved in the water sector activities. However, there is no structural and coordinated linkage among them, even between the two key institutions, i.e., Ministry of Water Resources and the Regional Water Bureaus (Gizaw 2004). Lack of coordination among the institutions involved in water and water related activities could lead to an inability to achieve the goals of the sector. Additionally, the stakeholders may not collectively drive some synergic benefit from being able to integrate their administrative efforts. Both, protective institutional responses and lack of effective coordinating mechanisms are featured as reasons (NBI 2006).
- Central versus local roles: Processes of decentralization were noted across the two countries as part of a wider political or administrative change. In the case of federal structures, in particular, concerns existed that roles and responsibilities between levels remained ill-defined and resulted in implementation inertia and even failure (NBI 2006).

- Organizational instability: the water sector and related organizations were marked by frequent restructuring and reorganization. This situation has certainly produced uncertainties, made capacity building difficult and has affected the political will to push for change.
- Management problems: explained by inefficient organizational structure, understaffing, under-equipping, lack of organizational units at the lowest possible levels like *Woredas* and zones to cater to the needs of the sector (Gizaw 2004).
- Problem of capacity: Shortage of skilled manpower is the critical issue of all sector organizations. NBI (2006) documented many challenges related to implementation within weak institutional environments were evident, with particular awareness of the need to build substantial capacity at decentralized levels (p.5). In both Ethiopia and Sudan there is a need for lower level capacity development (Ibid.).
- Limited funds/budget: Water sector development projects by their nature require a high level of investment. Lack of sufficient funding has imposed limits on the quantity and quality of outputs and services of the sector. Moreover, the lack of effective cost recovery mechanisms often inhibits the ability of organizations to sustain themselves and fulfill their mandates (Gizaw 2004; NBI 2006).
- Lack of integrated information management system: Various organizations keep and maintain a wide range of data to meet their purposes. However, the quality and coverage of the data maintained by each organization is at best lacking. The sector also lacks a centralized and integrated information management system. On top of this, there is a considerable weakness in keeping proper records of data and information at all levels of the regional water sector institutions. There is also a lack of standard procedures for gathering and storing of data and information. Data management is not done in a conducive way to enable data sharing, even at the country level. This will not enable effective coordination and institutional performance as water resources management is not knowledge-driven. A sound database about the physical, social, environmental, economic and institutional parameters at a basin scale is vital for an effective management of water resources at a basin scale and proper monitoring and evaluation of policy implementation. Lack of information sharing between the two countries is one of the problems usually cited as hampering cooperation. This will not be possible unless there is a harmonized data collection process. There is still a need for greater integration of regional issues in policy, including better regional sharing of information (NBI 2006). Legislative consistency is also another area that is suggested as needing further work in the future between countries in the Abay Blue Nile (NBI 2006). However, we believe that there is a lot of communality in policy than is usually presumed. Identifying the communalities and divergence in policies in the two countries is something that needs to be done first before calling for policy harmonization.
- Monitoring and evaluation: There is a lack of systematic monitoring and evaluation mechanisms for policy implementation (NBI 2006). In Ethiopia, for instance, the WSDP management arrangement is not in place, in spite of plans to establish the FPMU and the RPMU; hence, it is difficult to follow-up and monitor implementation.
- Insufficient public NGO-private partnerships: there is a lack of an effective approach to private sector and civil society involvement in policy implementation (NBI 2006). Linked to this was the problem of general low public awareness and weak stakeholder involvement

in policy and policy processes leaving potential beneficiaries in a position of ignorance (NBI 2006).

- Blue water focus: The focus of all these organizations is on surface water and groundwater, i.e., blue water. While rainwater is the major contributor to livelihoods in the basin, particularly in the Ethiopian Highlands, little attention is given to it in the policies and strategies and in the organizational arrangements of the water sector. Policies in both countries leave out rainwater management which has a great bearing in the sustenance of both surface water and groundwater (NBI 2006).
- Boundary definition: A critical constraint against effective river basin management is the commonly prevalent conflict between boundaries of river basins and those of political units (nations, regions, districts, etc.). Therefore, there is the need and the potential to establish viable and acceptable institutional mechanisms for shared management of water resources in the river basin. While the major rivers in the Abay Blue Nile are transboundary in nature, there are no transboundary organizations that are responsible for the management of water resources at a basin scale yet. However, the ground for the establishment of river basin organizations seems to be in the making.

3.7.2. Policy gaps: Where, for example, tradition and customs overwhelm policy

Lately, a lot of progress has been made in the organization of the water sector and in creating an institutional framework for good water management. In both Ethiopia and Sudan, there are existing policies under development and implementation that reflect global policy change or the widespread adoption of the IWRM principles (NBI 2006). Yet, there are still institutional gaps that need remedy.

One area that still calls for immediate action is the management of transboundary waters. While important progress has been made through the NBI and individual efforts of countries (e.g., promulgation of proclamation for the establishment of river basin organizations in Ethiopia), the riparian countries still could not come up with mechanisms for equitable and efficient distribution of the Nile water. Still old rules govern in the distribution of the Nile water, in general, and the Abay Blue Nile, in particular.

The Ethiopian and Sudanese water policies advocate for integrated water resources development, where the planning unit should be a river basin. Practices, however, deviate a lot form the written policy. Actual water development interventions follow a piecemeal approach. There is uncoordinated and unregulated harvesting of the groundwater and surface water resources of the countries. Adequate upstream and downstream considerations are also lacking in the implementation process. Mechanisms for cost and benefit sharing between upstream users (who cause the degradation and could control it if they have the incentive) and downstream users (who could gain more from improved management of land and water upstream and lose out due to poor management of the same) are not in place in the water policy of the two countries.

Furthermore, there is a discrepancy between the stipulations of the law and the practices in cost recovery. The laws indicate that water schemes, potable or irrigation, are expected to operate on a cost recovery basis. In Ethiopia, for instance, the policy stipulates that if these schemes are located in rural areas, they are expected to at least cover operation and maintenance costs of the scheme. However, practices throughout the Abay Blue Nile countries indicate that farmers are not made to pay for operation and maintenance. This encourages over-use of water and poor management of water structures.

While sustainable land management has a lot of bearing on water availability and quality, the water policy in Ethiopia does not consider land in relation to water resources development. The limited coordination between MoWR and MoARD also manifests in this. The situation in Sudan is not an exception in this respect.

While Ethiopian and Sudanese water development and environmental protection policies and laws recognize the need and importance of taking proper EIAs in pursuing any water related development interventions, traditional practices still dominate: environmental considerations are given limited consideration in water resources development. Furthermore, regulations on water resources management, pollution control, land use rights related to water, watershed development, environmental quality and pollution control standards are not effective or enacted because of enforcement capacity. This problem is identified as more serious in Sudan (NBI 2006).

3.7.3. Key dynamics within government organizations

As indicated in sections 3.7.1 and 3.7.2 there are serious problems in institutional arrangements and policy gaps in the water sector in the Abay Blue Nile. These manifest themselves in the duplicate and conflicting mandates, capacity limitations and enforcement problems and policy gaps. These problems limit not only the capacity of the organizations to meet their mandates adequately but also fail to respond to emerging issues such as climate change and associated problems of water scarcity and supply variability, flood damages, etc. Institutional efficacy is measured not only in meeting their daily work mandates but also in developing forward-looking solutions to emerging issues. This required developing appropriate policies and having adequate information to support decision-making. In fact, the Ethiopian Water Management Policy (MoWR 1999: p.10) calls for the establishment of a Water Resources Information Center (WRIC) and indeed to this effect the Ministry has now created a Data and Information and GIS Center (MoWR, UNESCO and GIRDC 2004).

However, while the water institutions in the Abay Blue Nile are mandated to collect and store relevant data to support decision-making, the data collection is at best inadequate and haphazard. In Ethiopia, for instance, the MoWR needs the collaboration of regional water bureaus and other relevant organizations to collect the data. In spite of the effort to establish the WRIC, there is no integrated information management system in place yet to enable information sharing and exchange between organizations and support timely policy decision-making. In the light of this, various organizations keep and maintain a wide range of data to meet their purposes. While the quality and coverage of the data maintained by each organization is generally weak, the sector also lacks a centralized and integrated information management system (MoWR, UNESCO and GIRDC 2004: p.75). On top of this, there is a considerable weakness at all levels of the regional water sector institutions in keeping proper records of data and information. There is also a lack of standard procedures for gathering and storing of data and information. Data management is not done in a way conducive to enable easy data sharing (ECWP 2005: p.25). This is more so at the basin scale, i.e., across countries.

Looking into the dynamics of the institutional setting in the Abay Blue Nile Basin, it is important to explore how far these institutions are effective in managing risks, i.e., water scarcity and climate change and associated vulnerabilities and environmental and health risks, and are adaptable to meet rising challenges. These may involve, among others, preparing an early warning system to detect impending disasters before they set in, or having mechanisms to respond to disasters once they happen. It may also involve developing institutions, for instance, disaster mitigation mechanisms and strategies.

In this regard, the MoWR in Ethiopia, through the NMSA, has an important early warning system function to play. Through meteorological forecasts the ministry prepares for unusual weather occurrences, such as flooding. But once disasters happen, they involve responses of various organizations, such as the Disaster Prevention and Preparedness Agency (DPPA), MoWR, etc.

The water sector and broader development strategies are expected to provide disaster mitigation mechanisms and strategies. However, these strategies assume that there is plenty of water potential to tap. Economic water scarcity is considered a greater challenge in Ethiopia than physical water scarcity. Climate change scenarios and their impact on water resources are hardly taken into account in the development of these strategies.

3.8. Benefit Sharing

Benefit sharing can be defined as any action designed to change the allocation of costs and benefits associated, in this case, with a change in land and water management. Those costs could be directly associated with the institutional or physical costs of the intervention (for example, watershed restoration or water storage development), or any other costs that the affected parties choose to include for consideration (for example, the building of roads or schools, or investment in alternative livelihoods). Benefit sharing can take place at the project level, at the basin or at the international level. Somewhat surprisingly, anecdotal evidence suggests that benefit sharing at the local level, for example, to compensate project-affected people, has generally proven more problematic than benefit sharing at the international level. This section presents examples of benefit sharing at different levels in the Blue Nile.

Within the water resource management and natural resource management arena, in general, there has been a global shift towards using various forms of incentives in order to reward environmental friendly practices. Debates in this respect have largely been at global and transboundary level with less focus on the provision of incentives at national or sub-national levels. PES has largely been formulated as part of the broader debate on climate change and how developing countries could be rewarded for afforestation, which contributes towards reduction of carbon emissions under the Kyoto Protocol. The scale for payments for watershed services has ranged from 5 families in Nicaragua on 13 hectares of land, to 15 million farmers on over 32 million hectares in China. Africa has largely been lagging behind in such innovative payment schemes (Porras and Grieg-Gran 2007). In the 2003 World Parks Congress for instance, the transboundary approach was promoted as ‘benefits beyond boundaries’ (*cf.* Wolmer 2003). Some researchers have commented that ‘Nature rarely notices political boundaries and hence the need to have integrated resource management which might stride across national boundaries (*cf.* Zbicz 1999). Benefit sharing is not uni-modal but it can take various configurations along a cooperation continuum which varies from communication and notification to joint investment (cf. Sadoff and Grey 2005).

Other international conventions that can take benefit sharing into account include the Convention on Biological Diversity (CBD), Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), Ramsar, and the Convention to Combat Desertification (CCD). Within the water resource management area, there has been a lot of theoretical and practical exploration of how incentives could be provided to promote good watershed management practices upstream which would benefit downstream water users. Focus has also been on the downstream water users to appreciate the positive impact of good watershed management on the water quality and quantity downstream and offering various forms of incentives to reward good practice upstream. Such benefit sharing through transfer of incentives promotes equity in terms of the costs and benefits associated

with good watershed management amongst the upstream and downstream water users. Ecosystem management affects the costs and benefits derived from such good practices (*cf.* IUCN 2000). Incentive measures have been recognized by a number of the biodiversity-related conventions as a key tool for achieving conservation and sustainable use (IUCN 2001).

In countries such as Mexico, governments have started offering incentives at local level. These are largely funded from donor funds but the intention is to, for instance, increase water levies on downstream urban water users which will be used to reward upstream farmers for maintaining the catchment areas afforested.

Within the Ethiopian context there are attempts to address this issue at both the local and transboundary levels. The examples to be used at local level include the Koga irrigation project, IFAD traditional irrigation and watershed management project. At the transboundary level, the Nile Basin Initiative (NBI)'s Socioeconomic Development and Benefit Sharing (SDBS) Project of the Shared Vision Program and the recent World Bank loans for irrigation in Ethiopia and Egypt, which were jointly approved as benefit sharing 'bundle' projects will be briefly outlined.

The upstream-downstream benefits can also apply within a watershed area. There are instances of localized sediment deposition – not the general model of sedimentation within Sudan and Egypt (Haileslassie et al. 2006a). Lake Tana's sediment deposition is generated within the Highlands of Ethiopia. Mason (2003) notes that sedimentation problems do not only have national impacts but also affects downstream countries such as Sudan and Egypt. This calls for an integrated approach for the Blue Nile River Basin that is implemented through various coordinated local activities. Below, we present examples of benefit sharing from the local and transnational experience.

3.8.1. The Koga irrigation project

The Federal Democratic Republic of Ethiopia received funding from the African Development Bank (ADB) for the Koga Irrigation and Watershed Management Project. This ADB-supported project involves a dam (21.5 m high, 1,860 m in length and 83.1 million cubic meters (Mm^3) volume) and a reservoir submerging 1,859 ha of grazing land. The project is in the Koga River Valley and is a large-scale project within the Amhara Region of the Blue Nile Basin. The project was implemented by Co-SAERAR. It has a command area of 7,000 ha within a 22,000 ha catchment with a reservoir area of 2,000 ha. The project involves two sites in the upper catchment and four sites in the lower catchment. The total cost of the project was US$37.84 million. Under the project, farmers would continue to grow crops that they normally grew, but the irrigation would help with predictable water resources availability which would increase the crop yields for the farmers and hence improve food security for the smallholders. The cultivated crops include potatoes, shallots, pepper and maize (Ministry of Water Resources Development Authority 1995). The project components are: (i) irrigation development, (ii) watershed management, (iii) capacity building, and (iv) project coordination and management.

According to the Wall Street Journal 'The Koga River project is being cast as a "confidence builder" to show that upstream uses don't necessarily hurt downstream populations. Ethiopian engineers calculate the Koga irrigation would use less than one-tenth of 1% of the Nile flow reaching the Ethiopia-Sudan border' (Wall Street Journal 2003).

The project goes beyond basic irrigation development through the integrated watershed management which will also focus on forestry, livestock, soil conservation, and water and sanitation throughout the 22,000 ha catchment area. The Koga Project is unique within Ethiopia in that it integrates forestry and soil management within an irrigation project. The Koga Project engaged the local farmers so that they could participate in both the planning and implementation of the Koga

Project. Even the choice of crops had to align with what the local farmers have always grown rather than imposing crop types. The approach is integrated watershed management, which aims to address the main challenge of sheet erosion in the Central Ethiopian Highlands and at the same time address the issues of food security, health, water and sanitation.

Irrigation projects in the past have largely entailed the forced removal of people from the flooded areas and the new irrigated lands. The Koga Scheme, covering a command area of 7,000 ha, is unique in that the downstream farmers who benefited from the irrigation scheme have been asked to compensate those who lost their land. According to the presentation by Rahmato (1999), 'In other cases, landholders in the irrigation area may be asked to share their land with some of the people displaced by the project in exchange for getting access to water'. Rahmato further states, 'On the other hand, irrigation could have adverse effects on some groups in the community or among the beneficiaries unless remedial measures are taken.' The Koga Project was key in identifying mechanisms of realigning the costs and benefits in order to ensure that those who bore the costs of the scheme were also able to share the benefits. The Koga Project is also encouraging afforestation and gully reclamation by the local communities who will then be allowed to collect grass for their livestock from the rehabilitated areas (*cf.* Tafesse 2006).

In health terms, water reservoirs tend to increase the incidences of diseases such as malaria and schistosomiasis. The Koga Project, therefore, included a health component which aimed at redressing the negative impacts caused by water reservoirs.

3.8.2. IFAD traditional irrigation

In 1994, the International Fund for Agricultural Development (IFAD) began Phase 1 support of the Southern Region Cooperatives Development and Credit Project (SOCODEP - Irrigation and Water Management) which was completed in 2005. IFAD also funded a scheme in the Abay Basin focusing on the Gumera, Gota Chan, Irza and Bebeks schemes. The scheme began in 1999 and its intention was to allow local communities to identify priorities for development in order to increase income earned and further enhance food security. It also aimed at enhancing the resilience of poor households to drought, and diversifying and commercializing their agricultural practices. Currently there are negotiations for further project funding for which IFAD will provide over US$60 million.

The project benefits farmers through building upon the existing traditional irrigation systems which contribute towards the reduction of poverty. The outcomes of the project include the benefits that accrue to the watershed and ecosystem services through better water and land use approaches, erosion and siltation reduction will also positively impact locally and further downstream. This irrigation and water management project also has an integrated approach through catchment management. The integration has mainly been implemented in Mumicha in Oromiya. The negative impact of increased sediment load, siltation of canals and night storage reservoirs are a major issue for some of the irrigation schemes. This has made downstream-upstream linkages an important aspect of planning in Oromiya (IFAD 2005). The four components of the IFAD project are: agricultural support service, soil and water conservation, support to rural women's gardens, and production of vegetable seeds.

The traditional irrigation schemes have benefited poor households and helped reduce land degradation by proposing locally-based solutions. They have also been operating at an appropriate scale for the local farmers with very little investment going into the construction of new water reservoirs (this report; Awulachew 2006). The benefits have been spread across the watershed by providing support towards soil and water conservation in the upstream areas in order to increase benefits in the downstream areas. Area enclosures and re-afforestation in some catchment areas

has meant that some farmers would lose out their grazing land. Increased fodder production has a time lag which delays some of the benefits for the upstream farmers. This negatively affected some farmers through reduction of livestock herd sizes (IFAD 2005). IFAD provided nurseries, seedlings, training and general catchment management advice. Such catchment management approaches combined with agricultural extension advice and funding for water harvesting, the upstream farmers have also benefited from the downstream traditional irrigation project. This has resulted in both the upstream and downstream farmers benefiting, creating a localized win-win situation. This scenario still faces challenges of promoting sustainable livelihoods in the densely populated highland areas. Area enclosures have to be matched by viable alternative sources for cultivation and grazing.

3.8.3. Transboundary

The concept of transboundary natural resources management is strongly related to 'bioregionalism', which views the world as consisting of contiguous but discrete 'bioregions' with the boundaries of each bioregion defined by nature rather than legislation or political expedience (*cf.* Wolmer 2003). According to Tessera (2006: 44), "The Nile River Basin in general hosts problems which call for regional or subregional cooperation". The severe erosion in the upper catchments of Tekeze/Atbara and Abbay/Blue Nile river basins has impacts downstream within and across political borders. Since river basin problems cut across political borders, cooperation across the Nile River Basin is necessary. In river basin management, absolute sovereignty does not work since transboundary cooperation is needed. Sudan, for instance, views upstream reservoirs in Ethiopia as being an efficient way to control floods and an efficient way to store water as it reduces loss of water through evaporation in either Sudan or Egypt which have higher temperatures compared to Ethiopia. The Wall Street Journal adds that, 'Engineers from both countries agree that dams in the cool and moist Ethiopian highlands, storing water in deep natural gorges, would lose far less water to evaporation than the Aswan Dam in the hot, dry Egyptian desert. They calculate the savings on evaporation could compensate for the amount of water Ethiopia proposes to use for irrigation' (Wall Street Journal 2003).

The Nile Basin Initiative is an attempt to promote an Integrated Water Resources Management approach within the Blue Nile River Basin. This is after the realization that sedimentation and siltation of dams and reservoirs downstream, is a function of upstream land uses. The increased frequency and magnitude of drought in the Ethiopian Highlands has also affected the quality and quantity of water downstream in Sudan and Egypt (cf. Tessera 2006). The impact of environmental degradation is forcing countries to cooperate in order to address 'common dangers' which cannot be effectively addressed without the cooperation of other countries. "It seems that the impacts of land degradation in the sub-basin can hardly be solved by any means other than cooperative watershed management" (Tessera 2006: 46). Silt accumulation in the Roseires Dam in Sudan is largely attributed to the upstream activities in the Ethiopian Highlands. The Atbara and Blue Nile are said to contribute 53% of seasonal waters but contribute 90% of the sediment in the Nile (Tessera 2006). Sedimentation is also negatively affecting the Sennar, Roseires and Aswan dams and the related irrigation schemes. Despite sedimentation being bad for most dams and water reservoirs, in Egypt, the building of the Aswan High Dam has further denied downstream farmers the rich silt which made the Nile valley very productive. This complicates assessment of costs and benefits of upstream/downstream water users within a river basin.

Downstream impacts of sedimentation include reduced benefits from irrigation, hydropower, navigation, water quality, water quantity, flood control, fishing, and recreation. Poor water quality will result in more expensive water purification methods such as the special filters for the Khartoum

water supply (Shapland 1997). Removal of sediment in Sudan's reservoirs and related irrigation schemes account for half of the operation and maintenance budget (*cf.* Ahmed 2000; Conway 2000). Sudan is further spending US$800 million in flood mitigation measures. If mechanisms could be put in place upstream which would result in the reduction of, say, the flood mitigation budget, Sudan may be willing to contribute financially towards sustainable upstream watershed management costs.

3.8.4. Nile Basin Initiative

Attempts at cooperation and benefit sharing within the Blue Nile Basin go back to the 1960s. The 1959 Water Sharing Agreement allocated the Nile waters as follows: Egypt 66%, Sudan 22% and surface evaporation and surface seepage at the High Aswan Dam at 12%. Ethiopia was not included in this water sharing agreement (FAO 2008).

In 1967, the Hydrometeorological Survey of the Equatorial Lakes (Hydromet) was launched with the support of the United Nations Development Programme (UNDP) and aimed at enhancing collection of hydrometeorological data. Hydromet operated until 1992. In 1993, the Technical Cooperation Commission for the Promotion and Development of the Nile Basin (TECCONILE) was formed and its intention was to promote development (World Bank 2005). In 1993, the Canadian International Development Agency (CIDA) funded 10 Nile 2002 conferences which aimed at promoting dialogue and cooperation within the Nile Basin. In 1995, CIDA supported the development of a Nile Basin action plan within the auspices of TECCONILE. In 1997, the Nile Basin Council of Ministers requested the World Bank to lead and coordinate their donor activities (World Bank 2005). In 1997, with UNDP support, the riparian countries also established a forum for dialogue on a 'Cooperative Framework' for the Nile Basin, with three representatives from each riparian country.

In February 1999, the Nile Basin Initiative (NBI) succeeded the TECCONILE. The NBI was spearheaded by the Council of Ministers of Water Affairs of the Nile Basin states (Nile Council of Ministers or Nile-COM). 'The NBI seeks to develop the river in a cooperative manner, share substantial socioeconomic benefits, and promote regional peace and security. The NBI started with a participatory process of dialogue among the riparian countries that resulted in their agreeing on a shared vision: to "achieve sustainable socioeconomic development through the equitable utilization of, and benefit from, the common Nile Basin water resources," and a Strategic Action Program to translate this vision into concrete activities and projects' (World Bank 2005).

The Nile Basin Initiative has embarked on the Shared Vision Programme (SVP). The SVP's mission is the creation of a "coordination mechanism and an enabling environment to realize the shared vision through action on the ground (Council of Ministers of Water Affairs of the Nile Basin States 2001)." In June 2001, there was a meeting with donors in Geneva where project proposal documents were presented to solicit funding for shared vision projects. The Nile Basin Trust Fund (NBTF) with support from the World Bank, Global Environment Facility, European Union (EU) Water Initiative, African Development Bank (ADB) and bilateral donors was setup to finance the SVP. The SVP projects and host countries are shown in Table 1 below.

TABLE 1. Shared Vision Program projects and project management unit locations.

Project PMU	Location
Confidence Building and Stakeholder Involvement	Uganda (NBI Secretariat)
Nile Basin Regional Power Trade	Tanzania
Efficient Water Use for Agricultural Production	Kenya
Nile Transboundary Environmental Action	Sudan
Water Resources Planning and Management	Ethiopia
Applied Training	Egypt
Socioeconomic Development and Benefit Sharing	Uganda

The SVP's Nile Basin Transboundary Environmental Action Project provides the strategic framework for the management of transboundary water and environmental challenges. 'The SVP is a multi-country, multi-sectoral, grant-funded program of collaborative action, exchange of experience, and analytical work that is intended to build a strong foundation for regional cooperation.' (World Bank 2005).

The Socioeconomic Development and Benefit Sharing Project aims to strengthen the Nile River Basin-wide socioeconomic cooperation and integration. This has US$9 million budgeted over 6 years. This project also offers an opportunity to incorporate some compensation arrangements for costs incurred upstream in improving benefits downstream.

The implementation of the SVP is complemented by the Subsidiary Action Programs (SAPs). The SAPs are premised on the subsidiarity principle which notes that actions and decisions are supposed to be taken at the lowest appropriate unit of governance. This has resulted in the creation of two SAP action plans: First, the Nile Equatorial Lakes Subsidiary Action Program (NELSAP) comprising Burundi, Kenya, Rwanda, Tanzania, Uganda, Democratic Republic of Congo, Sudan and Egypt; and Second, the Eastern Nile Subsidiary Action Programme (ENSAP) comprising Egypt, Ethiopia and Sudan have been formed (Tesfaye 2001).

The SAPs have 15 major projects covering water supply and sanitation, river regulation and flood management, irrigation and drainage, fisheries, hydropower, water hyacinth and weeds control. Governments identify local needs and actions whilst the SAP focuses on activities with transboundary implications. All the local and national level activities should integrate upward 'to form a basin-wide development' (NBI 2001a: 12). The intention is to come up with a win-win situation at basin level. This has seen the development of the Integrated Development Programme of the Eastern Nile (IDEN) which is also commonly referred to as the ENSAP Project (Tessera 2006).

In 2002, the Eastern Nile Technical Regional Office (ENTRO) was set up as an international organization based in Addis Ababa, Ethiopia. The Eastern Nile Subsidiary Action Programme (ENSAP) calls for cooperation within the Blue Nile River Basin. They have also identified hydraulic projects for which watershed management has been identified for fast-track preparation and implementation. The proposed projects under the Integrated Development of Eastern Nile (IDEN) are as follows:

- Eastern Nile Planning Model sub-project (fast-track);
- Baro-Akobo Multi-purpose Water Resources Development sub-project;
- Flood Preparedness and Early Warning sub-project (fast-track);
- Ethiopia-Sudan Transmission Interconnection sub-project (fast-track);
- Eastern Nile Power Trade Investment Program;

- Irrigation and Drainage sub-project;
- Watershed Management sub-project (fast track)

Four of the proposed projects have been setup for fast-track meaning that they will be given priority for implementation since they promote regional integration.

The vision of NBI sounds credible but its operationalization will determine its success or failure. Sharing of costs and benefits within the Blue Nile amongst the three ENSAP member countries will result in the overall improvement of the river basin and poverty alleviation in the member countries.

A 'Cooperative Framework' for the Nile has now been approved - the Nile Basin Council of Ministers (Nile–COM) (26 June 2007). If it is adopted and ratified by member countries it will become international law and serve to establish a Nile River Basin Commission (*http://www.Nilebasin.org*). The nine countries seem to be generally agreeable on most issues except on the issue of water allocation. Upstream countries like Ethiopia which uses about 1% of the Blue Nile water are thinking in terms of equity in water allocation, whereas downstream countries like Egypt are viewing the same issue in terms of 'no appreciable harm' to existing downstream water usage (Waterbury and Whittington 1998).

3.8.5. Egyptian-Ethiopian project bundle

The World Bank loan, one may argue, offers an opportunity for small-scale farmers to use their land more sustainably which will benefit both the upstream and downstream water users. In June 2007, the World Bank approved International Development Assistance loans for US$100 for Ethiopia to be used to 'help increase agricultural productivity, accelerate growth and reduce rural poverty in Ethiopia. …. Together with the Egypt West Delta project, the Ethiopia Irrigation and Drainage project is the first in a series of Nile investments under preparation, totaling more than $700 million' (World Bank 2007). This bundle of projects is said to demonstrate benefit sharing between Egypt and Ethiopia, and reflect the progress of cooperation and dialogue within the Nile River Basin.

3.9. Discussion

Whilst benefit sharing seems to have made significant strides theoretically, there are still a number of operational issues which need to be resolved by the Upstream-Downstream research project. Research findings in the Upstream-Downstream study have to be juxtaposed to the wealth of global experience on benefit sharing. Benefit sharing takes place at various scales and levels. In Ethiopia, for instance, it may vary from a small watershed project, to regional government, which may or may not coincide with hydrological zones, going up to the transboundary level where international law and conventions begin to apply.

Who benefits and who loses from benefit sharing – some studies from Latin America are beginning to caution that benefits can potentially accrue to the most powerful whilst not addressing the needs of the poor and female headed households. An understanding of the power relationships at different scales will help inform the structuring of benefit sharing.

How do you develop sustainable and targeted funding mechanisms which will be used to 'compensate' those bearing the costs of watershed management? Selling electricity at a cheaper price to the upstream country might benefit the country as a whole – but not the specific watershed community. This might result in poorly targeted incentives which might not reward the poor upstream

farmers who are bearing the cost of upstream river basin management. How are the payments going to be made? Should the reward only be for good management or also for actively improving the upstream areas within the river basin? Who pays and for what? (Porras and Grieg-Gran 2007). Most current watershed initiatives are largely funded by donors and non-governmental organizations.

Upstream-downstream cooperation delves into broader international relations and political economy issues. What makes transboundary basin level management successful? What is the power balance amongst the states that are involved (Hegemony, neo-hegemony or realisms in international cooperation)? Transboundary Basin Management in the Blue Nile seems to indicate power asymmetry that might be reflected in who shapes what is considered as 'knowledge'. Despite the establishment of ENTRO, 'scientific'[10] data still seem to be contested and hardly shared (although this could be improving). Confidence building and establishing trust will need to take place first before detailed discussions on benefit sharing (*cf.* Sadoff and Grey 2005).

Transboundary benefit sharing presents different benefit sharing matrices in which water allocation need not be the only potential benefit. It is possible to share benefits from water without sharing the actual water (*cf.* Sadoff and Grey 2005). Within the Blue Nile this is still a contested issue that needs to be resolved especially in light of the 1959 Water Sharing Agreement between Egypt and Sudan. Any transboundary river basin management has to be grounded within the specific political and historical settings rather than being an imposition of blueprint solutions (*cf.* Merrey et al. 2007).

Enabling policies and institutions should be in place to be able to monitor and enforce compliance. The institutions carrying out this exercise must have meaningful powers but also need to be accountable to the upstream and downstream water users with higher level institutions having oversight powers only. The upstream and downstream water users need to participate actively, not only in the first negotiation process, but they also need to participate in the fine-tuning of the benefit sharing arrangements over time.

Finally, benefit sharing is premised on the assumption that it's feasible to establish these costs and benefits. In most river basins good practices take a lot of time to produce results and this is further complicated by natural phenomenon such as climate change and changing rainfall patterns which also potentially contribute towards land degradation. Establishing causality in most river basins causes a lot of difficulties. 'Values' are also normative, and it largely depends on the specific contexts and communities and it might be difficult to have a common understanding across sub-national levels – let alone international boundaries. The water allocation and modeling components of this study will help provide evidence of the impact of upstream land use changes on the downstream users. Making such a linkage, would be a good starting point for beginning negotiations on benefit sharing. The Upstream-Downstream Project, therefore, has a good opportunity of contributing towards relevant benefit sharing mechanisms which are socially, politically and economically feasible within the Blue Nile River Basin context. This will, hopefully, result in the convergence of perceptions, priorities and agendas (*cf.* Sadoff and Grey 2005).

[10] Scientific data, especially concerning the Nile, can easily be politically 'tainted' in order to reflect the various country positions?

4. KEY MESSAGES AND THE WAY FORWARD

4.1. Key Messages

Livelihood security in the Blue Nile Basin is strongly dependent on agriculture and, thus, water as a renewable natural resource is of particular importance. The diverse farming systems in the basin are a reflection of divergent livelihood strategies designed by the local people in response to livelihood outcomes. As the livelihood activities, related to land and management, are operating within the same hydrological units, water flows and sediment transportation connect communities in the upstream and downstream regions. This also means that the livelihoods in the basin are co-dependent and anthropogenic intervention in the upper part of the basin can positively/negatively affect the communities in the downstream region.

It is realized that the growing importance of land and water management arises from the pressure of ongoing population growth in the context of constrained availability of agricultural land. To meet the livelihood demands of the agrarian community, future land and water related intervention will, obviously, put blue and green water management as a key element of those development scenarios. A number of pertinent initiatives are, currently, reported in Ethiopia: irrigation projects in Tana sub-basin (e.g., Koga, Gumera, Rib and Megech), Tan-Beles; Border and Kara-Dobi hydropower projects; and a number of watershed management interventions (e.g., Koga, Jema, Rib and Gumera watersheds).

To support those initiatives and bring about a win-win scenario for both upstream and downstream areas of the basin, the institutional environment for land and water in the Nile Basin region is fairly well-defined. There are, however, important problems noticed in the organizational setting and policy framework and, thus, those gaps must be addressed.

Despite a clear understanding of the role of policy and institutional capacities in promoting sustainable development, only little research has been done to understand how to support the new importance that institution and policy studies should apply rigorous comparative analysis and contextual case studies examining a representative range of success and, failure, and cases in between. The overall research gaps that need future attention include:

- Improved understanding of the institutional and policy context, and the constraints to and opportunities for improved water management at different scales;
- What are the determinants of rights of access and control over land and water resources, and livelihood strategies of different categories of people (including gender)? More specifically, how do policy, institutions and process influence people's access to different livelihood assets (e.g., human, physical, social, financial and natural capital)? How do policy and institutions impact (positive and/or negative) on people's response to shocks (e.g., drought or climate change), trends (e.g., degradation of land and shortage of water) and seasonality (seasonal availability of resources such as water)?
- How do people in different livelihood systems manage water and land; can the current policy, institution and processes effectively respond to the emerging issues (e.g., water shortage, land degradation, needs for international cooperation, upstream/downstream relations, and payment for ecosystem services)?
- What are the alternative ways for efficient water allocation mechanisms (allocation of water for different services, tradable water rights and water pricing)? What alternative water allocation mechanisms can be envisaged and what is the people's willingness to go for a given design?

- What are the values attached to various environmental costs and services by different users (beneficiaries) and types of services provided? To what extent can innovative benefit sharing designs (e.g., Payment for environmental Services) work to internalize upstream and downstream externalities?
- A crosscutting research topic of critical importance is how to promote greater attention to equity, including gender issues, poverty reduction, innovative ways of implementing integrated water supply systems at local level, scaling-up of new low cost small-scale water technologies and improvement in the productivity of the rainfed agriculture, and integration of ecosystem services and provision of other essential water services.

4.2. The Way Forward: In-depth Policy and Institutional Studies

4.2.1. Analytical framework formulation and detailed investigation sites selection

Based on the findings from this report, an analytical framework for in-depth analysis of institution and policy is formulated. In terms of scale it is suggested that the in-depth analysis takes a nested approach to explore the challenges of land and water management, looking at a range of scales starting from the local through sub-basin to the international. The following three major scales of analysis are selected*:*

- The local scale (community and selected watersheds (Koga and Gumera watershed in Ethiopia and Gazira scheme in Sudan);
- Sub-basin (Lake Tana sub-basin, as this the major development corridor in the upstream area);
- International scale (dams and hydropower interventions).

It considers interventions and upstream-downstream impacts at the community level, sub-catchments, basin and international level as appropriate. Each level of analysis will involve different physical dynamics, stakeholders, policy and institutions, and, therefore, options for intervention. Where relevant, it will also look at the interactions between these levels.

4.2.2. Research questions

a) Research questions at local scale:

i. Does the current institution and policy setup respond to marginal land and water management interventions?

ii. What are the promising land and water management practices and what are the upscaling strategies?

iii. What are the costs and benefits of the environmental services and what are the mechanisms for PES?

b) Research questions at the sub-basin/regional scale:

i. What are the current and envisaged changes in policies and institutional arrangements in regions within the Ethiopian Abay Blue Nile?

- Do existing and envisaged policies and institutions account for downstream and upstream linkages?
- Do they create an enabling environment for integrated water resources development?

ii. What are the ongoing and planned interventions in the regions of the Abay Blue Nile that have effects on downstream areas? What are the livelihood impacts of these interventions on the upstream population?

iii. What are the major components and potential economic trade-offs of interventions in the Tana-Beles Growth Corridor and what type of policy and institutional changes are called for to support these interventions?

iv. What are the major environmental problems, their causes, their costs and potential policy responses in the Tana Basin and Tana-Beles Growth Corridor?

c) Research questions at the international scale:

i. What are the policies and institutional settings in the two countries and what are the implications and gaps to address the upstream/downstream interactions?

ii. What are the costs and benefits of the environmental services and what are the mechanisms of payment for environmental services at international level (at the basin scale)?

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