WATER AND POVERTY LINKAGES IN AFRICA:

ETHIOPIA CASE STUDY

by

Alemu Asana Dowa, Stacey Noel, Gedion Shone, Jennie Barron, and John Soussan

SEI STOCKHOLM ENVIRONMENT INSTITUTE

SUMMARY

Water management can play a key role in poverty reduction across Africa, with potential multiple benefits for livelihoods and economic development. This potential is not being realised in many countries and innovative strategies for water management that focus more effectively on poverty reduction are needed. The African Development Bank commissioned Stockholm Environment Institute to conduct a study on water-poverty linkages. The study contains three country cases including this report from Ethiopia that provides more in-depth context relevant reflections on the national context of poverty-related water management.

Ethiopia faces a range of challenges in water management, with levels of service provision for water supply and sanitation that are amongst the lowest in the world, very low levels of irrigation development and challenges in areas such as hydropower development, disaster mitigation and ecosystems management. Despite these challenges, Ethiopia has huge water resources potentials: the key issue for the future is to identify the most effective strategies to unlock these potentials to meet national development objectives.

The key focal areas for a more effective water-poverty strategy for Ethiopia are, perhaps inevitably, rural water supply and sanitation and small-scale farming, most of which is dependent upon rainfall rather than irrigation. For water supplies, the key element of a strategy is to focus on local-level systems that fit the needs and potentials of individual communities. The potential of groundwater and of increasing local level rainwater harvesting and storage facilities are emphasised. For sanitation, the key is to assist households to meet their own needs through ensuring materials are available and affordable, combined with effective awareness raising and skills development.

For the agricultural sector, on which so many poor Ethiopians depend, the focus should be on improving on-farm water management, including rainwater capture and storage. This should be supported by the extensive development of small-scale irrigation where it is feasible, again based on more effective storage of rainwater and, in some parts of the country, groundwater utilisation. Poverty reduction in Ethiopia will fail unless the basic issues of poor food security, inadequate nutrition and low and insecure rural incomes are addressed. Improved water management can play a major role in meeting these challenges.

TABLE OF CONTENTS

LIST OF BOXES, TABLES, AND FIGURES

BOXES

TABLES

FIGURES

1. INTRODUCTION

Water is increasingly recognized as a major component in economic development and poverty reduction. Several recent papers[1] considering the importance of water in meeting the Millennium Development Goals (MDGs) have highlighted water's direct and indirect contribution to all of the goals and a majority of the targets, rather than just focusing on its central role in achieving the goal on environmental sustainability and the accompanying target on water supply and sanitation. This analysis illustrates the fact that water's interaction in the lives of the poor is complex in character and operates through multiple dimensions: improved livelihoods security, reduced health risks, reduced vulnerability, and pro-poor economic growth. Further, as well as its significance in poverty alleviation, investment in water infrastructure and management has a major impact on national economies[2]. Finally, there is increasing attention to the multiple values of water for society, including not only its importance in terms of ecosystem sustainability but also its cultural and social components.

This case study of water-poverty linkages in Ethiopia aims to reflect current issues in water, poverty and development at the local, regional, and national scale. Along with an analysis of policies and strategies, programmes and initiatives, and cross cutting issues, the report will present some on-going initiatives from a range of actors in water supply and sanitation, irrigation and agriculture, and ecosystems water management for development, among others. The Ethiopia case study represents one of three country analyses on water and poverty linkages; Senegal and Tanzania are the other two case studies. These country case studies seek to expand on themes and findings from a literature review on poverty and water with a geographic focus on Africa. Together, the country case studies and the literature review support an overall review on water and poverty linkages commissioned by the African Development Bank in December 2006.

2. COUNTRY BACKGROUND

Ethiopia, a landlocked country located in the horn of Africa, has an area of 1,104,000 km^2. It is a land of great geographical diversity: topographic features range from the highest peak at Ras Dashen 4,550 meters above sea level to the lowest depression part at 110 meters below ground level. The country is located within the tropics, and its physical conditions and variations in altitude have resulted in great diversity of terrain, climate, soil, flora and fauna.

Ethiopia has always maintained its independence and is one of the founders of United Nations; it also played a leading role in the establishment of the African Union.

[1] SIWI/UN Millenium Task Force on Water and Sanitation (2005). **Health, Dignity, and Development: What Will It Take?** SIWI, Stockholm, pp. 19-20; ADB, CIDA, DANIDA, EC, GTZ, Irish Aid, IUCN, SEI, Sida, SIWI, SDC, UNDP, UNEP and WHO (2006). **Linking poverty reduction and water management**. Poverty-Environment Partnership. UNDP, New York, pp. 20-22.

[2] For example, Sadoff and Gray (2006) examine the impact of hydrological variability on growth in Ethiopia and find it currently costs Ethiopia over one-third of its growth potential.

Currently, the country has a Federal System of Government, with political leaders elected every five years. Major changes in the administrative boundaries within the country have been made three times since the mid-1970s, and present-day Ethiopia is administratively structured into nine regional states[3].

With an estimated population of 71.3 million and an annual population growth rate of 1.8%[4], it is the third largest in Africa in terms of population, behind only Nigeria and Egypt. The people of Ethiopia altogether speak over 80 different languages, including 12 Semitic, 22 Cushitic, 18 Omotic and 18 Nilo-Saharan languages[5]. Approximately 85% of Ethiopians lived in rural areas. With a human development index of .371, Ethiopia is classified as a low human development country; the 2006 Human Development Report ranked it 170 out of 177 countries[6]. The wealth quintile distribution among regions shows large variations, with a relatively high percentage of population in the most urbanized regions in the highest wealth quintile, such as Addis Ababa (99%), Dire Dawa (66%) and Harari (65%). On the other hand, a significant proportion in the more rural and pastoral areas of the country such as in Somali (72%), Afar (67%) and Gambella (44%) are in the lowest wealth quintile[7]. Ethiopia's 2005 infant mortality rate was 79.7 per 1,000 births[8], and life expectancy at birth in 2005 for males was 50 and for females 53[9]. The maternal mortality ratio in 2000 was 850 per 100,000 live births[10]. In 2000, 17.3% of deaths of children under 5 in Ethiopia were due to diarrhoeal diseases[11].

Ethiopia has a gross national income per capita of US$160[12], with a GDP per capita, $PPP valuation (2005/06) is 794[13]. From 1974 to 1991, the country operated a central command economy under the socialist banner of the military (Derg) regime. Since then, Ethiopia has moved towards a market-oriented economy. The economy has managed a stellar growth rate of 8.9% in the 2004-2006 period; real GDP growth for 2007 is projected to be 6.3%[14]. Inflation stood at 15.1% in 2002-2003 but declined to 9% in 2003-2004 and 6.8% in 2004-2005. In 2003-2004, the total value of exports grew by

---

[3] Government of Ethiopia (2005). **Demographic and Health Survey**. Central Statistics Agency, Government of Ethiopia.
[4] World Bank (2007). http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/AFRICAEXT/ETHIOPIAEXTN/0,,menuPK:295955~pagePK:141132~piPK:141109~theSitePK:295930,00.html. Accessed June 2007.
[5] CSA (2005). **Demographic and Health Survey**
[6] UNDP (2006). **Human Development Report 2006.** UNDP, New York.
[7] Ibid.
[8] World Bank (2007). http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/AFRICAEXT/ETHIOPIAEXTN/0,,menuPK:295955~pagePK:141132~piPK:141109~theSitePK:295930,00.html. Accessed June 2007. www.worldbank.org. Accessed June 2007.
[9] WHO Statistical Information Service (2007). http://www.who.int/whosis/database/core . Accessed June 2007
[10] Ibid.
[11] Ibid.
[12] World Bank (2007). http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/AFRICAEXT/TANZANIAEXTN/0,,menuPK:287361~pagePK:141132~piPK:141109~theSitePK:258799,00.html . Accessed in June 2007.
[13] AfDB/OECD (2007). **African economic outlook 2004/2005: Ethiopia**. www.oecd.org/dev/aeo
[14] Ibid.

25.0%, and grew by 36.0% in 2004-2005. Agriculture represents the largest component of the country's GDP, at 47% (Figure 1), employing about 80% of the total population and accounting for about 90% of the exports. Coffee is the main export but other agricultural products are being introduced on international markets. Ethiopia is consequently experiencing a period of relative economic growth and stability and prospects are for this to continue in the near future. This presents opportunities for sustained development and a more positive investment climate than has existed for some decades.

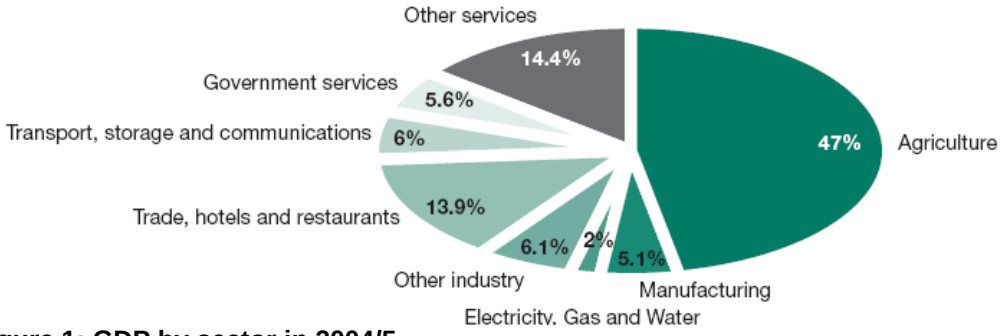

Figure 1: GDP by sector in 2004/5
Source: Source: AfDB/OECD, 2007

2.1 Progress towards the MDGs

Ethiopia's official MDG target for water supply coverage is 62%, and its target for sanitation coverage is 52%. As is the case for many other African countries, the data available on the existing situation is patchy and, at times contradictory, but there is little doubt that Ethiopia faces severe challenges in meeting these MDG targets as it started from one of the world's lowest levels of coverage in 1990, the base year for MDG assessment. The latest estimate on coverage rates for improved drinking water and improved sanitation[15] are given in Table 1.

Table 1: Ethiopia's progress towards meeting the MDG targets for water and sanitation

				IMPROVED DRINKING WATER COVERAGE						IMPROVED SANITATION COVERAGE		
	POPULATION			Total		Urban		Rural		Total (%)	Urb (%)	Rur (%)
YR	Total (mill)	Urb (%)	Rur (%)	Total (%)	HH conn.	Total (%)	HH conn.	Total (%)	HH conn.			
1990	51.0	13	87	23	0	81	2	15	0	3	13	2
2004	75.6	16	84	22	5	81	32	11	0	13	44	7

Source: WHO (2006).

[15] WHO's definition of improved drinking water is water drawn from the following sources: piped water into dwelling, plot or yard; public tap/standpipe; tubewell/borehole; protected dug well; protected spring; rainwater collection. Improved sanitation is: flush or pour–flush to a piped sewer system, septic tank, or pit latrine; ventilated improved pit latrine; pit latrine with slab; composting toilet.

The 2005 MDG Needs Assessment Report (MDG-NAR), which considers 'access to safe water'[16], estimates 2004 coverage at 39.4%, an increase from 31% in 2000. To reach the MDG, the sector's performance capacity would have to increase by a factor of 1.3 over current performance[17]. For sanitation, the MDG-NAR baseline was 2002/2003 coverage of 11.5%, from which the estimated required performance capacity increase over trend would have to be a factor of 12.7[18], a stark illustration of the challenges that Ethiopia faces with regard to sustainable sanitation.

The rate of progress towards the water and sanitation MDG targets is not unique: Ethiopia faces challenges in meeting all of the MDGs. As noted above, access to water and sanitation plays a role, either direct or indirect, in most of the MDG goals. Below is Ethiopia's progress to date in meeting those goals.

Photo by Stacey Noel

A farmer in Beset woreda *demonstrating his treadle pump, which he uses to access water from a rainwater catchment pond*

[16] Ethiopia's MDG Needs Assessment Synthesis Report states the MDG target is to halve the proportion of people without 'sustainable access to safe drinking water and basic sanitation', noting that 'estimates of access to water and sanitation differ across sources and definitions', p. 32. A further discussion of definitions for WSS is provided below in Section 3.3.

[17] WSP (2006). **Getting Africa on track to meet the MDGs on water and sanitation. a status overview of sixteen African countries**. WSP-Africa, Nairobi.

[18] Ibid.

Table 2: Indicators for Millennium Development Goals 1-6

Goal and indicator	1990	1995	2000	2001	2002	2003	2005
Goal 1: Eradicate extreme hunger and poverty (*2015 target: 1990 $1 a day poverty and malnutrition rates)*							
Population below $1 a day (%) [1]		31.3					
Population below minimum level of dietary energy consumption (%)					46.0		
Goal 2: Achieve universal primary education (*2015 target: net enrolment to 100)*							
Net primary enrollment ratio (% of relevant age group)	23.3			46.2	47.4		
Percentage of cohort reaching grade 5 (%)	18.3			58.7	61.5		
Youth literacy rate (% ages 15-24)					57.4		
Goal 3: Promote gender equality (*2005 target = education ratio to 100)*							
Ratio of girls to boys in primary and secondary education (%)	68.2			69.0	69.3		
Ratio of young literate females to males (% ages 15-24)					82.2		
Share of women employed in the nonagricultural sector (%)							
Proportion of seats held by women in national parliament (%)				8.0	8.0	8.0	
Goal 4: Reduce child mortality *(2015 target = reduce 1990 under 5 mortality by two-thirds)*							
Under 5 mortality rate (per 1,000)	204.0	192.0				169.0	
Infant mortality rate (per 1,000 live births)	131.0	1230.0				112.0	
Immunization, measles (% of children under 12 months)	38.0	38.0		52.0	52.0	52.0	
Goal 5: Improve maternal health *(2015 target = reduce 1990 maternal mortality by three-fourths)*							
Maternal mortality ratio (modeled estimate, per 100,000 live births)			850				
Births attended by skilled health staff (% of total)							6.0
Goal 6: Combat HIV/AIDS, malaria and other diseases *(2015 target = halt, and begin to reverse, AIDS, etc.)*							
Prevalence of HIV, female (% ages 15-24)				7.8			
Contraceptive prevalence rate (% of women ages 15-49)	4.3						
Number of children orphaned by HIV/AIDS				560.0 thousand		720.0 thousand	
Incidence of tuberculosis (per 100,000 people)	123.6	223.5		324.6	340.3	356.1	
Tuberculosis cases detected under DOTS (%)		16.2		34.8	35.8	36.3	

Source for Goals 1-4 and Goal 6: World Bank, 2007.
http://devdata.worldbank.org/idg/IDGProfile.asp?CCODE=SEN&CNAME=Senegal&SelectedCountry=SEN . Accessed May 2007.
Source for Goal 5: WHO, 2007
http://www.who.int/whosis . Accessed June 2007.
[1] World Bank's 2006 figure for incidence of poverty is 39%.
http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/AFRICAEXT/ETHIOPIAEXTN/0,,menuPK:295939~pagePK:141132~piPK:141107~theSitePK:295930,00.html

Ethiopia is one of the seven priority countries selected by the Millennium Project (MP) to prepare a scaled up investment plan for meeting its MDG targets in 2015. As part of this, the MP has worked with GoE on integrating the MDG targets into public policy and also assisted government officials in preparing assessments on sectoral requirements to achieve the MDGs.

2.2 Water as a priority in development

Ethiopia's Interim Poverty Reduction Strategy Paper, 2001/01 – 2002/03, consisted of four building blocks:

- Agricultural-Development-Led-Industrialization (ADLI).
- Judiciary and Civil Service Reform.
- Decentralization and Empowerment.
- Capacity Building in Public and Private Sectors.

In 2002, Ethiopia launched the Sustainable Development and Poverty Reduction Programme (SDPRP), which focused on agriculture, the main source of rural livelihoods. In the SDPRP, irrigation, water harvesting and agricultural research were considered to play a significant role in ensuring long-term food security[19]. Currently, Ethiopia is embarking on the second poverty reduction strategy, which is referred to as the Plan for Accelerated and Sustained Development to End Poverty (PASDEP), covering the years 2005-2010. The PASDEP carries forward important strategic directions pursued under previous poverty reduction strategies on human development, rural development, food security and capacity building, but at the same time it also embodies some bold new directions. It consists of eight strategic elements:

- Building implementation capacity, through strengthening democratic institutions, civil service reform, and building capacity at the *woreda* level.
- Accelerating economic growth through a 'massive push', through (i) commercialization of agriculture and (ii) accelerating private sector development.
- Addressing the population challenge, by increasing access to family planning services and emphasizing the importance of girls' education.
- Unleashing the potential of Ethiopia's women.
- Strengthening infrastructure, especially in terms of roads, water supply, power supply, and telecommunications.
- Investing human resource management, by focusing on education, health care, provision of WSS, nutrition, and housing.
- Managing risk and volatility at multiple levels: human, economic management, and national.
- Creating jobs, to remedy both under-employment and unemployment, with a focus on urban areas and Ethiopia's youth.

The GoE has developed the MDG Water Sub Sector Programme (2002-2016)[20], which is designed to meet the MDG plan for irrigation, water supply and sanitation. The programme's implementation has been classified into three timeframes, short (2002-2006), medium (2007-2011) and long term (2012-2016). The level of detail for each of

[19] Natea and Habtamu (2004). **Planning and implementation of irrigation projects in Ethiopia**. Sepembert,2004.
[20] Government of Ethiopia (2002). **Water Supply and Sanitation Program**. Ministry of Water Resources, June 2002.

the planning time horizons is different, with the short-term plan comparatively more detailed than the medium- and long-term plans. Due to the fact that there are ongoing projects at an advanced level of study and design, the short-term plan is descriptive in terms of physical targets and budgetary requirements. The medium-term plan will contain to some extent projects carried over from the previous term and thus will contain well-defined projects, while the plan covering the last five years will be indicative and general.[21]

Since the current government came to power in May 1991, the irrigation and WSS sub sectors have undergone a series of institutional reforms, both at the federal and regional levels, to accommodate a decentralization policy encouraging the transfer of powers down to the level of the *woredas*. This has included the sharing of manpower, equipment and facilities to empower and strengthen the *woredas* at the grassroots level. As a result of such operations, some institutions were separated, while others merged together. A discussion of the two sectors is given below noting, where relevant, policies related to these reforms.

The GoE has given very high priority to the water sector, which is reflected in the accelerated rate of achievement in recent years. However, little has been done to stimulate the involvement and capacity building of the private sector, which could potentially play into accelerating the development of irrigation, water supply and sanitation.

Irrigation development policy and strategy

As indicated above, programmes are organized according to time periods, with an extremely ambitious plan for the expansion of the irrigated area over the next decade. The GoE objectives for the different scales of irrigation are given below in Table 3.

Table 3: GoE targets for irrigation expansion by scale and timeframe

Description	Small-scale schemes (ha)	Large and medium-scale schemes (ha)	Total Area (ha)
Short-term development First 5 years (2002-2006)	40,319	13,044	53,363
Medium-term development Second 5 years (2007-2012)	40,348	39,701	80,049
Long-term development Third 5 years (2012-2016)	46,471	94,729	141,200
Total Area to be developed, (2002-2016)	127,138	147,474	274,612
Currently developed (approximate)	98,625	98,625	197,250
TOTAL irrigated area	**225,763**	**246,099**	**471,862**

Source: Irrigation Development Program, WWDSE, MoWR June 2002

[21] Government of Ethiopia (2001). **Methodological Framework for the Preparation of Water Sector Development Program (WSDP)**, Draft final report. Ministry of Water Resources, February, 2001.

Ethiopia's general policies on irrigation are[22]:

- To ensure the full integration of irrigation with the overall framework of the country's socio-economic development plans, and more importantly, with ADLI strategy.
- To promote the development of irrigation based on strategic planning for achieving socioeconomic goals and a participatory approach for promoting efficiency and sustainability.
- To develop irrigation within the framework of the overall water resources management policy.
- To allocate a reasonable share of GDP for irrigation development.
- To promote decentralization and user-based management, with special emphasis to the needs of the rural women.
- To develop a hierarchy of schemes on the basis of achieving food self-sufficiency and production of industrial raw materials.
- To support and modernize traditional irrigation by providing inputs that would improve their efficiency.
- To protect and maintain acceptable water quality standards for irrigation.
- To develop water allocation and priority setting criteria.
- To integrate the provision of appropriate drainage facilities as part and parcel of the irrigation infrastructure.
- To enhance greater participation of the regional and federal governments in the development of large scale irrigation.

The strategies for irrigation are outlined under a number of main elements: technical and engineering; financial and economic; institutional; capacity building; social and environmental aspects. The **technical and engineering** aspects focus on initiating the planning and implementation of a comprehensive, well-coordinated and targeted irrigation development programme, by rehabilitating the existing schemes, completing the ones already started, and developing new ones. **Financial** aspects stress making higher budgetary allocations from government sources for the implementation of short, medium and long-term irrigation development plans by allocating a certain percentage from GDP. The strategy also addresses implementing norms and procedures for financial sustainability and viability for irrigated schemes through cost recovery systems and the establishment of user fees.

Institutional aspects aspire to strengthening institutional regulatory frameworks at all levels, reactivating and reinforcing the role of government bodies at all levels in the development of large schemes and farms, ensuring operational sustainability small-scale irrigation by establishing O&M departments, and encouraging the participation of the private sector. **Capacity building** aspects look at equipping the institutions involved with basic know-how and strengthening technical capacities of the national, regional, zonal

[22]Government of Ethiopia (1999). **Ethiopian Water Resource Management Policy 1999**. Government of Ethiopia (1999). **Ethiopian Water Resource Management Policy 1999**. Ministry of Water Resources, Government of Ethiopia.

and *woreda* offices with respect to planning, design, implementation, and monitoring and evaluation.

Social aspects underline the integration of irrigation development activities with the country's socio-economic development, particularly with ADLI, and the institution of decentralized and grassroots user-based management of irrigation systems, taking into account the special needs of rural women in particular. **Environmental** aspects involves conducting appropriate Environmental Impact Assessments for irrigation schemes, establishing guidelines for the maintenance of irrigation water quality, minimizing forest loss, and offering protection from erosion, siltation, salinization and pollution.

Water supply and sanitation and the Universal Access Programme

In line with wider reforms, in 1999 GoE developed the following general policies for WSS[23]:

- Recognize that water supply is an integral part of the overall management of water resources management and incorporate water supply planning in the domain of comprehensive water resources management undertakings.
- Promote the development of water supply through participatory, demand driven and responsive approaches, without compromising social equity norms.
- Integrate and coordinate the development of water supply with other sector development objectives, including those for irrigation and hydropower.
- Create and promote a sense of ownership in communities, making them aware of their responsibilities for O&M of water supply systems, and develop participatory management practices.
- Improve rural water supply by enhancing the development of different indigenous water sources currently utilized by communities.
- Ensure that rural drinking water and livestock water supply systems shall be an integral part of overall socioeconomic development, centered on self-reliance, community participation and management.

GoE has also created an Integrated Water Supply and Sanitation Policy. This document specifies the following requirements for the success of the sub sector:

- Recognize that water supply and sanitation services are inseparable and integrate the same at all levels through sustainable and coherent framework.
- Promote the "User Pays" principle for urban water supply and sanitation services.
- Promote, as much as possible, the development and O&M of water supply and sanitation systems by the most appropriate body and at the decentralized level.

[23] Government of Ethiopia (1999). **Ethiopian Water Resource Management Policy 1999**. Ministry of Water Resources, Government of Ethiopia.

- Ensure efficient and sustainable management of water supply and sanitation system by avoiding fragmented management but at the same time avoiding over-centralization of management.
- Create conducive situations for the participation of all stakeholders in integrated water supply and sanitation activities.
- Develop national standards, guidelines and procedures for the different aspects of water supply and sanitation.
- Work in partnership with stakeholders on water supply, drainage and wastewater master plans in major urban areas, and prepare water supply and sanitation strategies in rural and other urban centers.
- Ensure that water supply and sanitation financing is based on an established set of criteria incorporating and prioritizing the relevant factors.

Stating it '*is determined to radically alter the unfavorable performance*'[24] of the WSS sector, the GoE has adopted a plan designed to extend services to all communities. This plan, the Universal Access Programme (UAP), will cover the timeframe 2006 to 2012; within this 7-year period, approximately 50.9 million people are expected to gain access to water supply and 66.9 million people are expected to gain access to adequate sanitation facilities[25], targets that are challenging in the extreme. A more detailed discussion of the UAP is provided below in Section 3.2.

3 WATER RESOURCES AND MANAGEMENT IN ETHIOPIA

3.1 Water resources and demands

Ethiopia receives on average 850 mm rainfall per year, or the equivalent to 940 km^3 per year. Approximately 13% of total rainfall is diverted into so-called blue water, i.e. river flows and fresh water in lakes (Figure 2). Most rainfall is allocated to green flows, i.e. water transpired and evaporated from different land use systems. Of total rainfall, only 3% can be sourced back to rainfed agricultural production, which occupies 15% of Ethiopia land area. Most rainfall, 60%, is consumed in savannah and grassland types of land use systems on 36% of the land area. Approximately 40% of land area is classified as arid, sparse shrub land with a green water loss of 12%, mainly due to the small amounts of rainfall. Only 1% of total rainfall is used for irrigation. The rainfall is highly variable both spatially and temporally, affecting livelihoods and land use. The western parts of the country have a unimodal rainfall starting in February/March and ending in October/November. Bimodal rainfall seasons are also found in the eastern parts, with one major and one minor season, whereas the bimodal season in the southern parts are more evenly distributed. Even in 'good' rainfall years approximately 4-6 million people rely on food distribution for their survival[26].

[24] Government of Ethiopia (2006). Universal Access Program document. First English Edition, December 2006.
[25] Ibid.
[26] FAO AQUASTAT country information
http://www.fao.org/ag/agl/aglw/aquastat/countries/ethiopia/index.stm

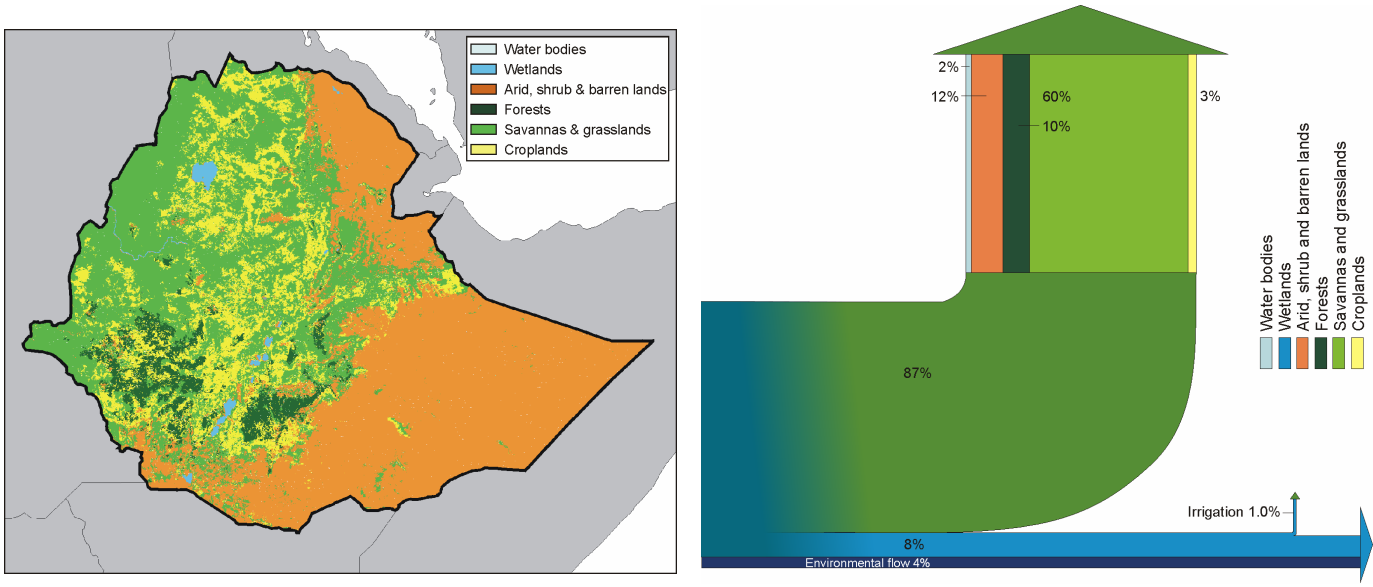

Figure 2: Green blue water flows depending on current land use in Ethiopia

Ethiopia has 12 major river basins, with a total estimated annual flow of approximately 122 billion m^3 of water[27]. Though this is a relatively big endowment, the paradoxical situation is that 80% of the country's water resources are concentrated in the western part, where only 33% the population reside, while the eastern part with 67% of the population has only 11% of the surface water resources[28], which means there are less water resources in the area with very big demand and larger amounts of the resource in areas with relatively low population. A total of 70% of Ethiopia's river basins are trans-boundary[29]. The climatic conditions of the country are elevation (altitude) dependent, with temperature as high as 47^0C in Denakil depression and as low as 10^0C in the highlands. A large fraction of the blue flow in Ethiopia, around 70%, feeds into the downstream countries of the Nile basin through the Abbay (Blue Nile) and the Atbarah (Black Nile). These rivers also contribute with large sediment loads downstream. More than 80% of Nile river sediment load originates from the Ethiopian highlands.

Due to the uneven spatial distribution of the country's surface water resources, it is generally agreed that further exploitation of groundwater resources are needed. The main reason is that, unlike surface water resources, groundwater occurs throughout the country. Estimates show that the groundwater potential of Ethiopia is approximately 2.6 billion m^3/year, of which very little is explored and developed. A study conducted by G. Hailemichael in May 2004 showed that the development of groundwater is an

[27] Government of Ethiopia. **Water Sector Development Program**. Ministry of Water Resources, Government of Ethiopia.
[28] Ibid.
[29] Ibid.

indispensable option, noting it is the only available resource in drought-affected parts of the country. Nevertheless, the available studies of groundwater resources are still very limited in that the delineation of aquifer systems, the water balance and determination of the aquifer characteristics have not been conducted. The water balance for the different groundwater basins (aquifer systems) has not yet been studied in Ethiopia. Figure 3 shows the decreased per capita blue water availability for Ethiopia due to population growth. By 2020, Ethiopia will be physically water scarce as the per capita blue water availability becomes lower than 1000 m3/cap/year (Figure 4). Increased groundwater use can postpone the critical decrease in readily extractable water for different consumptive uses.

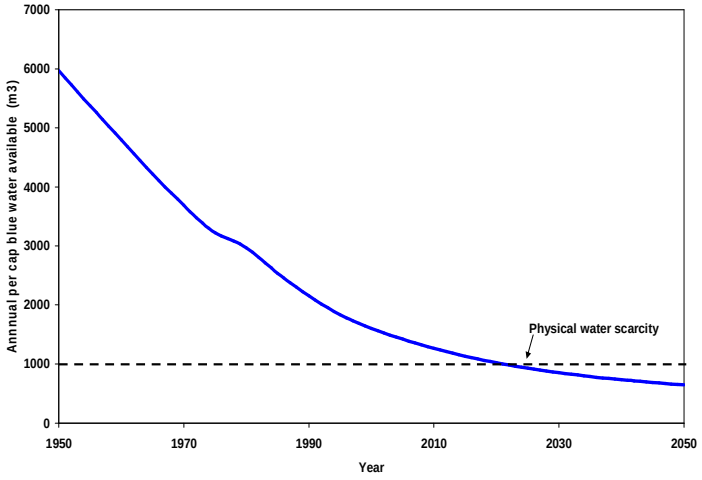

Figure 3: Per capita blue water availability of Ethiopia, 1950-2050
Source: after Awulachew et al., 2005

Table 4: Potential and irrigated areas by basin

River Basin	Irrigation Potential(ha)	Irrigated (ha)	% irrigated
Blue Nile	977,915	21,010	2.1
Rift valley	122,300	12,270	10
Awash	204,400	69,900	34.2
Omo-Gibe	450,120	27,310	6.1
Genale	435,300	80	0.02
Wabi Shebelle	204,000	20,290	9.9
Baro	748,500	350	0.05
Tekeze	312,700	1,800	0.07
Ogaden	-	-	-
Afar	3,000	-	-

Source: Ministry of Water Resources Water Supply Development Program

The total irrigation potential of Ethiopia is estimated to be 3.7 million ha, of which not more than 3% is currently under irrigated agriculture. The total net irrigation potential for small-scale irrigation is around 472,900 ha. According to the official estimate of the Ministry of Water Resources Water Supply Development Programme (WSDP), of the 197,250 ha currently under irrigation in Ethiopia, a total of 98,625 ha are under small-scale irrigation. According to the GoE's Central Statistics Agency, the extent of traditional irrigation in Ethiopia was 63,000 ha in 1998-1999. The irrigation potential and irrigated areas by basin are summarized in Table 4 and Figure 4. However, it should be noted that land for potential expansion of irrigation is often already in productive land use, e.g. rainfed agriculture.

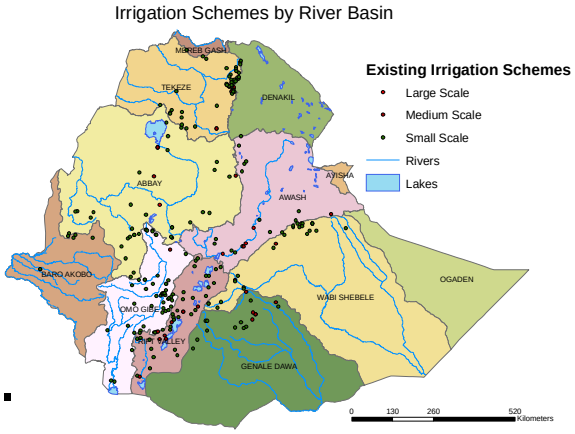

Figure 4: Irrigation schemes by river basin
Source: IMWI

According to AQUASTAT[30], Ethiopia holds a total of 3.5 km^3 storage capacity in nine large and medium dams (more than 15m height and/or more than 3 million m^3). Smaller dams for irrigation purposes are mostly located in Amhara and Tigray regional states.

In terms of hydropower development, Ethiopia is endowed with a number of large rivers. Due to a suitable topographic setting, most of the country's rivers exhibit falls and extreme gradients suitable for the construction of dams and gravity-driven hydropower generation turbines. Hydropower is the most dominant source of energy for the national grid, with an estimated potential of about 30,000 MW. However, in terms of its utilization, only 2.6% i.e. 767 MW has been developed so far[31]. Others have estimated the country's hydropower capability as high as 260 TWH/yr[32], which further highlights how under-exploited this resource is. GoE introduced the Universal Electricity Access

[30] AQUASTAT (2007). http://www.fao.org/ag/agl/aglw/aquastat/countries/ethiopia/index.stm. Accessed June 2007.
[31] Government of Ethiopia, Rural Electrification Project II Appraisal Report August 2006
[32] UNESCO (2005). **Water: a shared responsibility**. The Second World Water Development Report. UNESCO, Paris.

Programme in 2005, which has as its objective increasing the electricity penetration rate from the current 17% to 50% by 2011; thus hydropower could play a key role in meeting this goal.

3.2 Agriculture

Agriculture (including livestock) is the main source of livelihood and income generation for the majority of Ethiopians today. As noted above, agriculture is the single largest sector contribution to GDP, and coffee is a major export product from agriculture activities. Future overall country development is also by and large expected to be driven by the progress in the agricultural sector.

Ethiopia has abundant water resources, but distribution of suitable land is increasingly limiting. Current estimated agricultural land is between 10-15% of total land area, depending on source[33]. However, several areas are subject to different agricultural constraints due to steep slopes, too hot/cold, erratic rainfall (Table 5, Figures 4 and 5) and the incidence of trypanosomiasis (sleeping sickness) in certain parts of the country. Thus, it is expected that unless production can increase in erratic rainfall areas, land expansion for agriculture is limited given the current status of technical development. However, expanding into erratic rainfall areas demands new farming strategies to ensure good water and land husbandry, addressing soil moisture and fertility for improved crop production, either through upgraded rainfed systems and/or introduction and expansion of supplementary or perennial irrigation. In order to increase production as well as water productivity both on high potential and more marginal land, current farming systems must be improved in a number of areas. Water management is one step to ensure better returns to attract additional investments in improved seeds, tillage, fertilizer and weed management, as well as shifts to higher value crops (Box 1).

Table 5: Major agro-climates in Ethiopia

Type of agro-climate	Number of hectares (millions)	Use
Arid	42.3	Pastoral grazing
Semi-arid	2.9	Grazing and cultivation
Dry sub-humid	19.0	Cultivation of annual crops
Moist	24.5	Cultivation of annual crops
Semi-humid	16.5	Cultivation of annual/perennial crops
Per-humid	0.7	Cultivation of perennial crops

Source: adapted from Awulachew et al., 2005

[33] FAOSTAT (2007). http://faostat.fao.org/; Global Land Cover Characterisation (2000), EROS/USGS http://edcsns17.cr.usgs.gov/glcc/

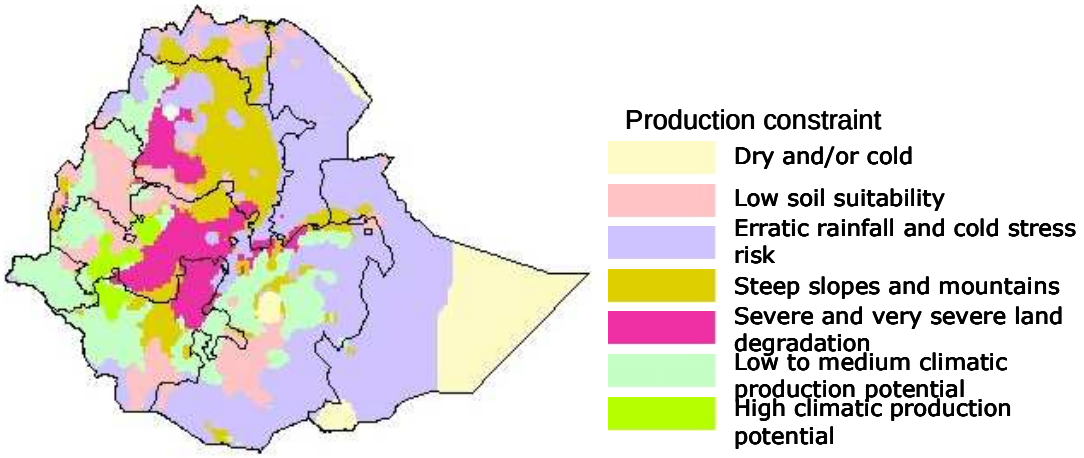

Figure 5: Major climatic and topographic constraints for agricultural production in Ethiopia
Source: FAO Country Statistics.

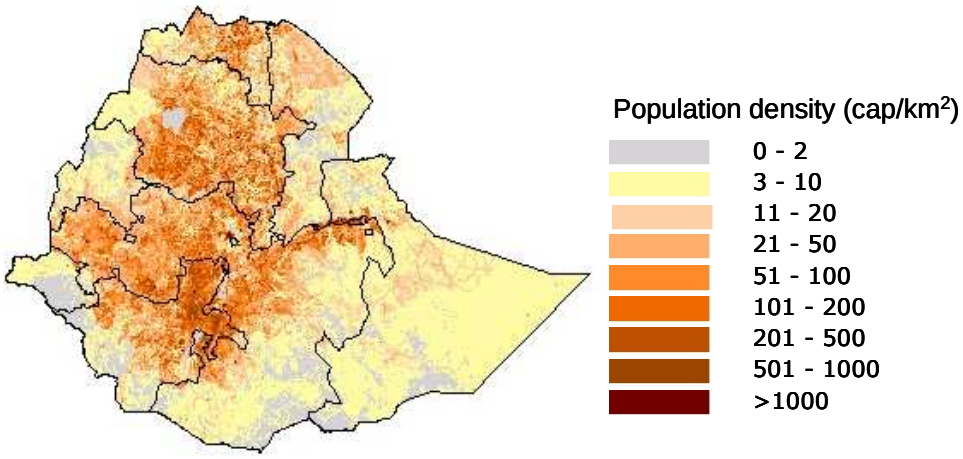

Figure 6: Ethiopian population densities year 2000 in capita per km^2
Source: FAO Country Statistics.
http://www.fao.org/countryprofiles/index.asp?lang=en&ISO3=ETH/

Livestock

Ethiopia's cattle population, one of the largest in Africa, puts additional pressure on water and land resources. Cattle and small ruminants are key sources for rural livelihoods and income, as well as a source of animal energy and proteins in diets. Cattle also provide 95% of draught power for land preparation - a very time and energy consuming task. Approximately 25% of cattle are based in lowland semi-arid zones in pastoral systems, and 75% in highland mixed farming systems[34]. Water for livestock keeping is potentially a sector which needs further investigation to address water management on the national and local level. Current research and development has highlighted the importance and

[34] FAO (2007). http://www.fao.org/ag/againfo/resources/en/publications/sector_briefs/lsb_ETH.pdf . Accessed June 2007.

water gains to be made both in quality and quantity aspects of involving livestock into water management plans at the initial stage[35].

Impact of rainwater harvesting on agricultural production

The combination of lack of storage and spatial and temporal variations in rainfall largely limits most farmers to one crop per year. Thus, the promotion of small-scale irrigation and rainwater harvesting can enable households to cultivate a second crop during the short rains in insert, enhancing both food and income security. During a field visit to Boset *woreda*, in East Showa in the regional state of Oromia, members of a rainwater harvesting association emphasized this aspect. The farmers noted that before the introduction of runoff water harvesting the trend in the area was for farmers to grow one crop during the three-month long rains, which meant most community members were limited to grow only early maturing crops and remained idle during the other nine months of the year. The farmers described their community as chronically food-insecure. However, the introduction of 6-70 m^3 rainwater catchment ponds provides another 2-3 months of water supply for supplementary irrigation, enabling farmers to remain engaged in production for longer periods during the year.

The members of the rainwater harvesting association also noted, in addition to the food security benefits, the irrigation had opened another door, by exposing them to the possibility of growing high-value crops and fruit for markets. As a result, participating farmers have been able to invest in oxen for traction and dairy cows, where excess milk is also being marketed. Members noted that many of them now had corrugated iron sheet roofs as compared to grass-thatch on their houses as a result of their increased incomes; many had also invested in cell phones to facilitate information flow and maintain contact with a marketing cooperative. This household-level rainwater harvesting scheme also works well in terms of O&M, with each farmer responsible for maintaining his own pond, thus avoiding problems with frequent water unavailability as can occur in community-level schemes.

[35] D. Peden et al. (2006). **Agricultural water and livestock production case study in sub-Sahara Africa.** Chapter 4 in *Investment in agricultural water management in sub-Sahara Africa: diagnosis of trends and opportunities*. Case studies report (Vol. 2): Highlights of findings of various components. African Development Bank.
http://www.iwmi.cgiar.org/africanwaterinvestment/files/Case_Studies/CASE_STUDIES_VOL_2_Final_12_November_2004.pdf

Box 1: Increasing productivity in rainfed and irrigated agriculture

Ethiopia is rich in the water and land resources needed to meet the food security challenge that has dominated its history. There are a number of crop and livestock system improvements with considerable scope to improve both water (unit biomass per input water) and land (unit biomass per land unit) productivity. Rainfall is highly variable both within seasons and between seasons, thus the Ethiopian government has embarked on a highly ambitious plan to increase irrigation. However, there are also many interventions that can help realize the potentials in rainfed systems, such as improved seeds, tillage, choice of crops, fertilizer, weeding and pest management[36] and most important by promoting the utilization and management of runoff water. In a forthcoming study by Makombe et al.[37], economic productivity between rainfed farms and irrigated farms were compared for two sites in the Rift Valley outside Addis Ababa. Through analyses of so-called stochastic production frontiers, it was shown that rainfed farms were larger in size on average, but had four times less marginal productivity. The irrigated farms had higher levels of fertilizer, seed and management inputs, including labour (number of working days). Thus, the irrigated farms had shifted to a higher-intensity farming system and made greater gains. The rainfed farms were not technically inefficient, but need to shift the production frontier, i.e., upgrade to new crop management systems through, for example, improved water and soil management, or increased input use rather than attempt to increase production in current farming system. These upgrades can only be achieved with help and advice from other farmers, as well as extension services in combination to access to improved seeds, fertilizers, technologies, etc.

Photo by Stacey Noel

A household garden, irrigated through rainwater harvesting

[36] Rockstrom et al. (2007). Managing water in rainfed agriculture. Chapter 8 in "*Water for food, water for life: a comprehensive assessment of water management in agriculture*". International Water Management Institute (IWMI), Sri Lanka. (http://www.iwmi.cgiar.org/assessment/index.htm); Noble et al. (2006). Intensifying Agricultural Sustainability: An Analysis of Impacts and Drivers in the Development of 'Bright Spots'. Comprehensive Assessment Research Report No. 13, Comprehensive Assessment Secretariat, Colombo, Sri Lanka.

[37] G. Makombe, et al. (forthcoming). **A comparative analysis of rainfed and irrigated agricultural production in Ethiopia**. Irrigation and Drainage Systems, accepted January 2007.

Private sector participation in agriculture seems to be currently very low, though the GoE's policies recognize the importance of the private sector's role and would like to encourage an increase in the sector's involvement. Many people interviewed, both within the government and those with NGOs, noted that very little had been achieved with respect to this goal.

Food security

Ethiopia is currently relying on its own produce for consumption. Per hectare production has increased slightly in recent years. Most of this increase in agricultural produce is from new land being converted into agricultural production (Figure 7). However, the per capita yield has been relatively stagnant as the population has increased. As a consequence the daily energy consumption (in cal/cap/day) has been stagnant since the mid 1990s (Figure 8). The average per capita energy intake for Ethiopia is 1,550 cal/cap/day, which is below the daily recommendation of 1,850 cal/cap/day for a healthy and active life. The diet is on average 5% derived from animal products and 95% from plant materials, clearly unbalanced from a nutrient point of view which normally suggests a 20%:80% ratio.

The challenge to meet food security by the agricultural sector until 2015 is two-fold. Average diets needs to be increased to 2,500-2,700 cal/cap/day as well as to increase the use of animal calorie intakes per capita. The population growth imposes additional stress on this challenge. Assuming that a balanced diet (2,700 cal/cap/day, 80% vegetal and -20% animal calorie intake) is approximately equivalent to 3.24 m^3 water per capita per day, and basing on FAOSTAT Food balance sheets for the year 2005, the approximate water requirement to produce that much equivalent food for the country was almost 27 km^3 water per year (Figure 9). If the MDGs on hunger are to be fulfilled, water needed in agriculture more than quadruples, amounting to 112 km^3 per capita for the year 2015. If all Ethiopians are to be fed sufficiently, it may require up to 115 km^3 water per year in allocation to agricultural production. This constitutes more than 10% (as compared to only 3%) of total annual average rainfall of Ethiopia at 936 km^3 (equivalent to 850 mm per year). Thus, agricultural production is facing a great challenge to meet the commitments of MDGs in terms of water resources, land management and utilization.

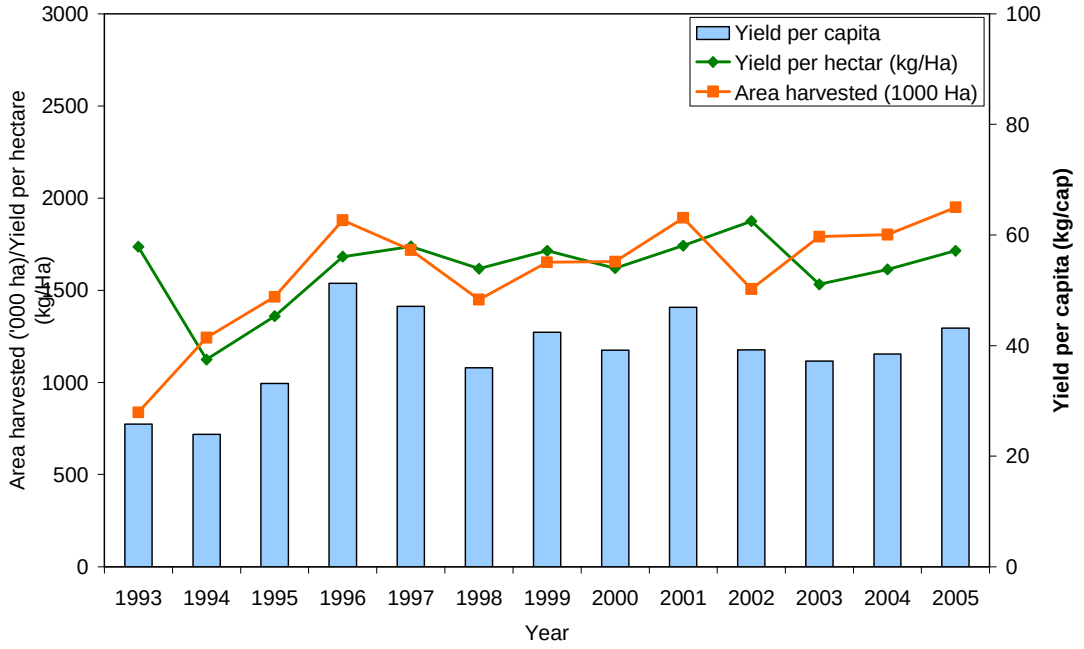

Figure 7: Maize yield productivity per hectare
Maize yield productivity per hectare (green, left axis) and per capita staples (right axis). Total annual maize yield (orange, left axis), 1993-2005
Source: FAOSTATS, FAO Statistical databases http://faostat.fao.org/default.aspx

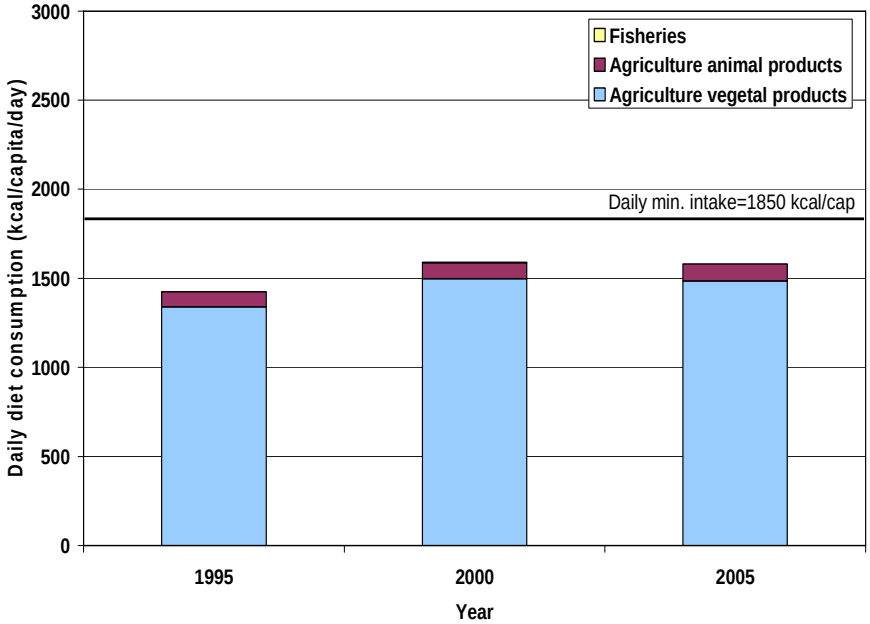

Figure 8: Daily average calorie intake per capita 1990-2005 in Ethiopia for vegetal, animal and fishery food supply
Source: based on data from FAOSTAT, 2007

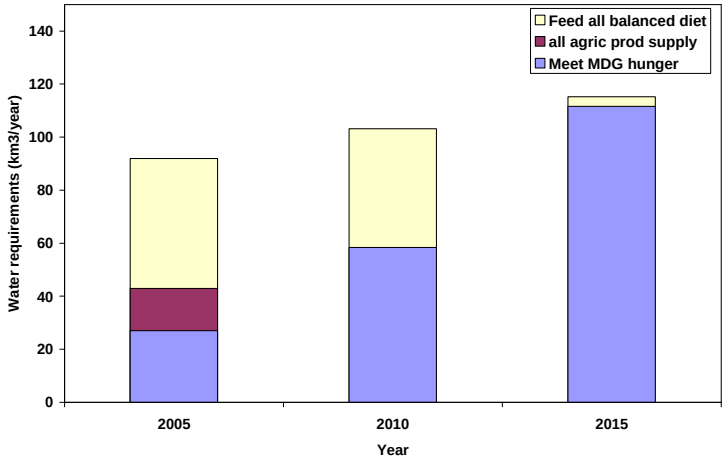

Figure 9: Water requirements for total dietary water requirements for Ethiopia 2005 to 2015 with projected improved dietary balance, increase in per capita daily energy intake and meeting the MDG on hunger (staples)
The water required to feed total population a balanced diet of 2 700 kcal/cap/d is shown as line.
Source: based on data from FAOSTAT, 2007

3.3 Water supply and sanitation

The Universal Access Programme (UAP), described above in Section 2.2, aspires to extend coverage for water supply to 98% of the population and sanitation coverage to all Ethiopians by 2012, a full three years ahead of the global deadline for the MDG targets. However, in part this ambitious goal will be achieved in some instances by aiming for a lower standard of service (Box 2).

The Millennium Development Goals Needs Assessment Synthesis Report[38] for Ethiopia estimates the costs for meeting the MDG drinking water target at US$2.7 billion, of which approximately 60% will go to rural areas. Consumers will be expected to cover 14.6% of this cost through payment of tariffs, with the urban population contributing 30% of the investment needs in their areas and the rural population covering 6% of the investment in non-urban areas. For sanitation, the cost estimate is US$4.6 billion, with 19% benefiting rural areas. GoE's assumption is that urban communities - with the exception of slums – will cover their own expenses for sanitary facilities as well as connection costs to sewers when available, thus making the urban population's contribution to be 77% of the estimated budget. In rural areas, subsidized schemes will be considered, with the household contribution in rural areas expected to comprise 86% of the total rural budget.

In May 2007 discussions with donors and international NGOs, many staff expressed the opinion that the UAP seemed too ambitious but, given the fact that the Ethiopian Parliament had approved the plan, both donors and NGOs had decided to support

[38] Government of Ethiopia. **Millennium Development Goals (MDGs) Needs Assessment Synthesis Report.** Development Planning and Research Department, Ministry of Finance and Economic Development, Government of Ethiopia, p. 33.

achievement of UAP goals. When staff were asked for their opinion on the lowering of the criteria (in terms of distance and l/p/d supplied for drinking water in rural areas, and definition of sanitation) many noted that the English version of the UAP, published in Amharic in August 2005, had only become available in December 2006 (five months before the interviews took place), thus many were not yet completely clear as to what exactly what the ramifications of the change in definitions would be. Multiple interviewees noted that GoE needed to give more attention to O&M of existing projects, expressing concern that the UAP focused excessively on new infrastructure. The GoE estimate is that 30-40% of existing schemes are not functioning, but some felt this figure might actually be higher. The UAP addresses this issue, identifying 47,397 water schemes in rural areas requiring rehabilitation and maintenance, prioritized to occur in the 2006-2007 timeframe; in urban areas, a total of 401 towns are to receive upgrading and improvement of existing water schemes.

Substantial resources from the donor community have been committed to the WSS sector, including significant amounts from the AfDB and the World Bank, UNICEF and international NGOs such as WaterAid, are also contributing to the effort, and in some cases the relationship with GoE is not only quite reciprocal but also allows for experimentation with different types of service delivery/management systems (Box 3).

Photo by Stacey Noel

Stream diversion project in Oromia, providing a source of irrigation and drinking water as well as water for other domestic uses

Box 2: **A comparison of definitions for water supply and sanitation: MDG, JMP, and UAP**

The definition of what constitutes meeting the MDG target on WSS has been variously defined at global and national levels. The MDG (Goal 7, Target 10) uses the terms 'sustainable access to safe drinking water and improved sanitation'. The WHO/UNICEF Joint Monitoring Project (JMP) has measured national progress across all countries based on its definition of the MDG; GoE's Universal Access Programme (UAP) has interpreted the MDG target somewhat differently. Below is a comparison of the two.

Drinking water

JMP

(i) source within 1 km and 20 l/p/d;
(ii) sources defined as improved: piped water into dwelling, plot or yard; public tap/standpipe; tubewell/borehole; protected dug well; protected spring; rainwater collection

UAP

Rural:
(i) source within 1.5 km, 15 l/p/d
(ii) source: wells (including hand dug, shallow, and deep); springs; streams; cisterns; ponds

Urban:
(i) source within 0.5 km, 20 l/p/d
(ii) source not defined, though the UAP (p. 16) states: '*all necessary measures will be taken to ensure the quality of the water source'*.

Sanitation

JMP

Defines improved sanitation as: flush or pour–flush to a piped sewer system, septic tank, or pit latrine; ventilated improved pit latrine; pit latrine with slab; or composting toilet

UAP

'Lowest cost option that ensures a clean and healthful living environment both at home and in the neighbourhood of users'.

Sources:
WHO/UNICEF Joint monitoring Programme
Government of Ethiopia, Universal Access Programme

Box 3: **GOE's collaborative relationship with NGOs: WaterAid in Ethiopia**

Although relationships between GoE and NGOs fluctuate, as they have with bilateral and multilateral donors, GoE has worked quite closely with NGOs working in the water sector. A good example is the GoE – WaterAid collaboration: GoE has provided WaterAid with materials for some of the NGO's projects, such as pipes, and has also seconded staff to WaterAid projects, while in turn, in its country strategy document, WaterAid has committed to providing 3% of the progress needed to meet Ethiopia's MDG target on WSS. The NGO, with a 2006-7 budget of £1.6 million for its Ethiopia work, has also provided direct funding to local-level governments for WSS.

The role NGOs play in Ethiopia's water sector is not limited to service provision, and in fact it may be that what are seen as secondary or supplemental activities are of even greater importance. As WaterAid Ethiopia points out, with 70 million people to provide with WSS, any one NGO's contribution to that effort will be relatively small; it is a job that can only be done by GoE. Instead, WaterAid points to other comparative advantages NGOs may have - due to their mandate - which allows more flexibility in experimenting with different models, thus expanding the range of options by developing, for example, new ways of reaching the marginalized or more effective partnership arrangements. An example is WaterAid's efforts to introduce community management of complex WSS systems: the GoE was initially unsure that communities had the capacity to undertake these responsibilities, but after WaterAid had success with community management, GoE took it up and made it a component of its own WSS projects.

Source: discussions with WaterAid Ethiopia, May 2007.

Rural water supply and sanitation

The 2002 Water Supply and Sanitation Programme Development[39] provides a roadmap for GoE efforts for the rural and urban water supply sector. For drinking water, the UAP states that the development of technologies for rural areas will focus on the following criteria[40]:

- water schemes that can be completed with least cost, shorter time, and which could minimize water tariffs;
- reliability and purity of water
- low cost of operation
- simplicity of management system and its sustainability

A total of 21,289 new water schemes will be constructed per year over the 7-year period; the mix of types of schemes and numbers of planned schemes is shown in Table 6.

[39] Government of Ethiopia, MoWR, Ethiopian Water Supply and Sanitation Program, June 2002, Addis Ababa.

[40] Government of Ethiopia (2006). Universal Access Program document. First English Edition, December 2006, p. 28.

Table 6: Rural water schemes to be installed to meet UAP targets, 2006-2012

Type of water scheme	National water source mix	Number of schemes
Hand dug well (community); average depth, 10m	0.1352	69,745
Modern hand dug well; average depth, 15m	0.2692	38,568
Spring on the spot	0.1259	14,426
Spring development (motor or gravity)	0.0049	210
Stream (motor pump)	0.0058	90
Gravity system	0.0420	325
Medium stream	0.0566	438
Higher stream	0.0071	
Shallow well	0.1124	9,737
Shallow well (with hand pump)	0.0173	9,510
Shallow well (with motor pump)	0.1852	1,570
Deep well	0.0017	2,986
Others (treated surface water)	0.0269	20
Shallow well (with solar pump)	0.0016	36
Shallow well (wind mill)	0.0008	18
Cistern (with wall)	0.0001	57
Pond (with hand pump)	0.0051	565
Cistern (with plastic lining)	0.0022	721
TOTAL	**1.0000**	**149,022**

The UAP identifies a number of factors as causes for low coverage for drinking water in rural areas. One is the lack of attention to technologies which can be built with community labor and participation; this will indeed be important to the success of the programme, as the UAP expects the community participation component of the water supply programme to comprise almost 12% of the total budget[41]. To facilitate this, the programme envisions training artisans who will dig wells, undertake minor spring development, and dig ponds for *kebeles*. The UAP will also emphasize private sector participation, with a lack of capacity in that sector also identified as a reason behind the low current levels of coverage. Other constraints named were expenses related to development, drilling and water supply construction works, and other financial costs; and a lack of capacity in terms of adequately-trained personnel at different levels; the scattered settlement pattern of the population; geological complexity; and the absence of local supply for new construction, improvement and maintenance works.

For rural sanitation, the estimated budget required to meet the UAP 100% coverage target is approximately 669.4 million Birr (US$73.8 million). GoE expects the digging of the toilet pits and construction of the buildings to house these toilets to be undertaken by the beneficiaries[42]. GoE aims to provide a total of 13.38 million SanPlats to almost 67 million beneficiaries (the assumption is 5 people per family); the rural plan will also include hygiene education for the same number.

[41] Ibid, p. 16, based on the total for Figure 2.4.1.
[42] Ibid., p. 20.

Urban water supply and sanitation

The UAP estimates that 64% of the urban population utilizes public taps[43]. Reasons given for low water supply coverage are: (i) high wastage of water from old and damaged pipes and illegal connections; (ii) lack of capacity; (iii) failure to follow a business plan; (iv) rapid population growth; and (iv) limited service over the day from public distribution points in small towns[44]. The National Water Supply and Sanitation Master Plan, 2002-2003, estimated that 30.1% of the water produced from urban water supply systems is lost, and only 48% of the amount that can be produced is in fact produced and distributed[45].

GoE expects 22 towns with populations >50,000 will be able to operate a cost recovery system, while 68 towns (populations between 20,000-50,000) will require borrowing from the market until residents can pay water tariffs, and the remaining 666 towns (with populations between 2,000-20,000) will require some level of subsidies [46].

In terms of sanitation services, the Central Statistical Agency showed a coverage rate of 82% in 2004, though the type of facility is not specified and the UAP notes that '*some of the toilets considered as operational are highly dangerous for health*'[47]. Among the reasons given by the UAP for low rates of access to sanitation in urban areas are lack of community awareness, the fragmentation of responsibility for sanitation among different institutions, limited resource allocation, absence of adaptable technologies, and the dependency on subsidies. The 2002-2003 Master Plan states that, given that access to sewer systems costs more than water supply, the construction of the latter will be given priority. The UAP envisions the construction of sewerage systems in a total of 11 townships, including Addis Ababa[48]. As with the rural programme, the sanitation strategy in urban areas will include a public hygiene education campaign. What has not been addressed in the urban sector in Ethiopia is the potential of non-conventional approaches to sanitation provision that are alternatives to centralized sewerage on the one hand and conventional household latrines on the other. This includes approaches such as neighbourhood sewerage and ecological sanitation.

3.4 Integrated water resources management

Several examples of integrated watershed management projects, for the most part in the initial stages, are provided below, drawn from May 2007 briefings from staff at the Ministry of Water Resources. These include the Koga Irrigation Project, the Awash Flood Control and Watershed Management Study Project, and the Ganale-Dawa river basin project. Ethiopia is also a participant in the Nile Basin Initiative (Box 10).

[43] Ibid., p. 45
[44] Ibid., p. 48.
[45]Ibid., p. 44
[46] Ibid., p. 72
[47] Ibid, p. 49.
[48] Ibid., p. 51.

The Koga project is in a highly-populated area that has experienced some degradation, relying on rainfed agriculture and producing only one crop per year; food security is the main agenda in the area, year after year. Under the new irrigation scheme, 7,000 ha would be developed, benefiting around 12,000 households, resulting in land holdings averaging 0.58 ha per household. The plan further calls for farmers to produce high-value crops for marketing. Notably, the project includes components for examining and monitoring environmental health. Although the scheme is not yet fully underway, it already faces many challenges indicative of the complications inherent in introducing dams in Ethiopia. First and foremost is the plan to pursue full cost recovery for the scheme, including both O&M *and* capital costs. Project managers currently estimate that this will require payments of US$153 per household per year over the 40-year lifespan of the project: a burden, possibly infeasible, for poor households.

In addition to the farmers' objections, an NGO staff member interviewed also pointed to the fact that, with numerous backward and forward linkages, there will be a number of beneficiaries, and questioned why only farmers were paying for the scheme. The interviewee suggested the Koga scheme for cost recovery would work if it were linked to high-value crops and related agro-processing, and recommended its integration with the World Bank's Tana multi-purpose project. A secondary issue is population displacement by the dam, anticipated to number around 200 households; all these families must all accommodated with new plots, thus reducing the farm size of all participants, which has caused much concern among stakeholders.

The Awash Flood Control and Watershed Management Study Project is entering its second phase, building on a series of previous studies in the basin that investigated such topics as institutional, physical structure, geomorphology, sedimentation and socioeconomic factors. In the second phase, additional projects based on these studies will be developed; these are expected to include irrigation projects for Amibara and Nura Era, flood control for Dire Dawa, a development project for Modjo Badland, and a watershed management project for the Upper Kassen.

The Ganale-Dawa river basin project is similar in nature; this AfDB-funded project began in 2003 and is nearing completion. Its main components are Phase 1, data collection and analyses; Phase 2, master plan preparation, including pre-feasibility studies for immediate projects such as watershed management, WSS, and hydropower in the basin); and Phase 3, which will comprise a feasibility study for three basin irrigation projects.

Box 4: Nile Basin Initiative

The Nile Basin is spread across 10 countries: Burundi, Congo, Egypt, Eritrea, Ethiopia, Kenya, Rwanda, Sudan, Tanzania and Uganda, and drains as an area representing one-tenth of Africa's land mass. In Ethiopia, the basin covers 32% of the country's national land area, but provides approximately 70% of the country's water. Ethiopia contributes between 70 to 85% of the Nile river flows in Sudan and Egypt.

The Nile Basin Initiative (NBI) was created in 1998 to facilitate the dialogue on Nile water resources between the countries. Although the participating nations have reached consensus on the shared vision and action programme, differences on core matters such as legal and institutional questions remain unresolved. The agreements from 1929 and 1959, between Sudan and Egypt, still regulate the Nile river flows. However, these agreements are not fully recognized by all riparian countries. Ethiopia is required to seek permission from downstream nations for any developments that may affect flow patterns or quantities contributing to the Nile. From an Ethiopian standpoint, these permissions of consent seriously compromise national integrity as well as hamper Ethiopia's development potential for irrigation, hydropower and other uses required to shift Ethiopians out of poverty.

Predicted climate changes and population growth in the Nile basin may further aggravate the situation, when downstream users may further wish to safeguard the Nile flows for their own development agendas. But as long as the NBI continues to facilitate the dialogue, and to strengthen uni- and bilateral cooperation around the Nile water resources, then is there is hope that the full Nile basin agreement will be reached.

Map source: www.nilebasin.org

Sources: FAO AQUASTAT; Arsano and Tamrat, 2005; Conway, 2005; BBC News, 2005.

4. CONCLUSIONS

Ethiopia is endowed with a huge water resource, out of which little is tapped. The present government has shown strong commitment to developing the country's water resource as a means of improving the livelihoods of its population at large. The multipurpose water utilization policy advocates integrating water for power, for crop and livestock production, and for public consumption and sanitation wherever the possibility exists. In spite of the commendable achievements in the recent past and the GoE's dedication to attaining the ambitious plans of the MDGs, the human and institutional capacity needs further strengthening to implement development strategies at the state and local level in Ethiopia. Another area that needs to be explored further is the participation of the private sector in public development strategies.

4.1 Water supply and sanitation

Due to the low attention given to the water sector in the past, the takeoff point for development of water supply and sanitation improvements has been very low. Encouraging achievement has been attained in the recent years, but still the coverage is well below half of the total population. As in many developing countries, the lion's share of responsibility from design to implementation and operation are shouldered by the government. The mobilization of beneficiary communities is being promoted, but the introduction of more organized procedures and methods for cost sharing and recovery is needed. The involvement of more private sector, NGOs and community-based organizations (CBOs) is at an infant stage. Promoting the engagement of this sector could release government institutions to carry out their due roles of exploration, regulation and monitoring.

Detailed investigation is needed to assess the groundwater supply potential. However, the high cost of groundwater development does not make it the primary option for water supply and irrigation in rural areas. Given the constraint caused by the difficult landscape and scattered nature of the settlement pattern in rural Ethiopia, 'off-the grid' solutions (i.e., small scale technologies which can be maintained and serviced by users on local markets) may present opportunities to address both MDG targets as well as provide local communities with self-sustained and easily maintained sustainable water resources. Rainwater harvesting for domestic use is so far an untapped source for development and should be given stronger attention. Unfortunately this sector is not well anchored within the government structure and is currently being promoted by civil society (Ethiopian Rainwater Harvesting Association). With an assortment of viable and appropriate technologies and the formulation of an effective strategy, rainwater harvesting for domestic use, supplementary irrigation and livestock development could greatly contribute to improved livelihoods for the rural population.

The sanitation programme in urban areas is well planned on a cost sharing basis. However, for rural areas, the planned scheme is very much dependent on the government supplying sanplats for pit latrines. It is recommended to seek a less dependency-prone approach of engaging the beneficiaries and local artisans through provisions such as

revolving funds. Skills development and the establishment of market chains to supply materials for latrine construction at affordable prices are also needed if the sanitation challenge is to be addressed.

4.2 Water for agricultural production

To meet future targets in food security and nutrition standards, significantly more water needs to be allocated to agricultural production, in terms of both rainfed and irrigation systems. With present estimates of an almost four-fold increase in water use, or approximately 10% of total annual rainfall volume to meet hunger goal to 2015, it is clear sustained actions are needed. To meet this challenge without compromising other water uses such as hydropower development and downstream commitments as well as avoiding the degradation of ecosystem functions, may require reconsideration of some current development implementation strategies. Strong commitment to the Ethiopian agricultural sector is key to this shift. At the local level, there is currently a gap in supporting innovations at the farm level, i.e., to assist farmers in new and upgraded farm systems to attain higher yields and improved livelihoods.

Over 190,000 ha of irrigation schemes have been developed during the past decades. Plans to harvest runoff and harness the blue water resources for irrigation are well underway to meet the MDG and beyond. Unlike the past government, the present trend is to promote small-scale farmer-targeted irrigation aimed at alleviating poverty and supporting the declared "Agriculture Led Industrialization Development" policy. Organization and management of the irrigation schemes by the beneficiaries has not been well established. There is a need to give focus to O&M if the irrigation schemes are to serve the intended purpose. The issue of finance, decentralization and capacity building that goes with it requires the support of all stakeholders. Providing an enabling foundation to the private sector, CBOs and NGOs could relieve pressure on the governmental capacity and allow it to better play its role while unlocking resources from the population.

It is estimated that 80% of the population is earning a living from rainfed agriculture and livestock production. Given the present farming practice relying on variable rainfall, low input production technology combined with population growth, food insecurity has remained endemic. Moreover, because of high population densities in the eastern and northern of the country (where the water resources for irrigation are scarcer), more people are forced to move towards marginal lands, which further aggravates land degradation. However, improving rainwater management, combined with soil management, could play a key role in addressing this challenge. The agricultural extension service should be capacitated to promote water conservation and management technologies for crop and livestock production more than what it is presently offering. It is estimated that only 11% of rainwater is used for crop production. Integrating rainwater utilization with other improved land management practices could go a long way towards increasing food production and improving livelihoods in general.

ACKNOWLEDGEMENTS

The authors would like to thank the AfDB Ethiopia staff, especially Dr. Pierre Thizier Seya, Mr. Hailemariam Hailemeskel and consultant Rahel Kaba, for their time and insights. His Excellency Mr. Adugna Jabessa, State Minister, also graciously offered his time, as did numerous other Government of Ethiopia officials, including Mr. Abara Challa, who facilitated and accompanied us on a field trip to Oromia, and Mr. Mogess Ayele, Mr. Girum Keshelwasely, and Mr. Manaye Yimenu, all of whom gave us comprehensive briefings on their respective basin management projects. We further benefited from a number of discussions with donor and NGO staff, especially Ms. Sarina Prabasi of WaterAid and Mr.Yitbarek Tessema of World Bank (who very kindly spoke with us on an official work holiday). We also offer a special thanks to Dr. Eng. Sileshi Bekele Awulachew of IWMI's East Africa and Nile Basin Office, whose generosity with his time added a great deal to the report. Lastly but certainly not least, we thank all the stakeholders we interviewed in the field for sharing their thoughts and their hospitality.

REFERENCES

AsDB, CIDA, DANIDA, EC, GTZ, Irish Aid, IUCN, SEI, Sida, SIWI, SDC, UNDP, UNEP and WHO, 2006. Linking poverty reduction and water management. Poverty-Environment Partnership. UNDP, New York.

AfDB/OECD, 2007. African economic outlook 2004/2005: Ethiopia. www.oecd.org/dev/aeo

Arsano, Y and Tamrat, I., 2005. Ethiopia and the Eastern Nile basin. Aquatic Sciences 67:15-27

Awulachew, S.B., Merrey, D.J., Kamara, A.B., Van Koppen, B., Penning de Vries, F., AND Boelee, E., 2005. Experiences and opportunities for promoting small-scale/micro irrigation and rainwater harvesting for food security in Ethiopia. Working paper No. 98. IWMI, Addis Ababa.

BBC News, 2005. Ethiopia and Egypt dispute the Nile. 24 February 2005. http://news.bbc.co.uk/2/hi/science/nature/4274757.stm

Conway, D., 2005. From head water to international river: observing and adapting to climate variability and change in the Nile basin . Global Environmental Change 15:99-114.

FAO AQUASTAT, 2005. Irrigation in Africa in figures – AQUASTAT Survey 2005. Accessed on June 2007.

Government of Ethiopia, 2006. Ethiopia: Building on Progress. A Plan for Accelerated and Sustained Development to End Poverty (PASDEP). Ministry of Finance and Economic Development, Addis Ababa.

Government of Ethiopia, 2001. Initial National Communication of Ethiopia to the United Nations Framework Convention on Climate Change. Ministry of Water Resources, National Meteorological Services Agency, Addis Ababa.

Global Land Cover Characterisation, 2000. EROS/USGS. http://edcsns17.cr.usgs.gov/glcc/

Makombe, G., Kelemework, D., Aredo, D., forthcoming. A comparative analysis of rainfed and irrigated agricultural production in Ethiopia. Irrigation and Drainage Systems, accepted January 2007.

Peden, D., Astatke, A., Baltenweck, I., Sonder, K., and Tadesse,G. , 2006. Agricultural water and livestock production case study in Sub-Sahara Africa. Chapter 4 in Investment in agricultural water management in sub-Sahara Africa: diagnosis of trends and opportunities, Case studies report (Vol. 2): Highlights of findings of various components. African Development Bank. http://www.iwmi.cgiar.org/africanwaterinvestment/files/Case_Studies/CASE_STUDIES_VOL_2_Final_12_November_2004.pdf

Rockstrom, J., Hatibu, N., Oweis, T, Wani, S., Barron, J., Bruggeman, A., Farahani, J., Karlberg, L., Quiang, Z., 2007. Managing water in rainfed agriculture. Chapter 8 in "Water for food, water for life: a comprehensive assessment of water management in agriculture". Comprehensive Assessment on Water Management in Agriculture. IWMI, Sri Lanka. http://www.iwmi.cgiar.org/assessment/index.htm

SIWI/UN Millennium Task Force on Water and Sanitation, 2005. Health, Dignity, and Development: What Will It Take? SIWI, Stockholm.

UN Millennium Project, 2004. "Millennium Development Goals Needs Assessments for Ghana, Tanzania, and Uganda". Background paper.

UNESCO, 2005. Water: a shared responsibility. UN World Water Development Report 2. UNESCO, Paris

UNDP, 2006. Human Development Report 2006. UNDP, New York.

WHO, 2007. WHO Statistical Information Service. http://www.who.int/whosis/database/core . Accessed June 2007

WHO, 2006. Meeting the MDG drinking water and sanitation target: the urban and rural challenge of the decade. WHO, Geneva

World Bank, 2007. www.worldbank.org

Accessed June 2007.

WSP, 2006. Getting Africa on track to meet the MDGs on water and sanitation: a status overview of sixteen African countries. WSP-Africa, Nairobi.

LIST OF PERSONS CONTACTED IN ETHIOPIA

Mr. Getachew Abdi, Ministry of Water Resources

Ms. Belinda Abraham, Project Officer, Water, Sanitation and Hygiene Program, UNICEF

Mr. Sisay Asrat, Beneficiary, Godino irrigation project

Dr. Eng. Sileshi Bekele Awulachew, Head, East Africa and Nile Basin, Sub-regional Office, Nile Basin and East Africa, IWMI

Mr. Mogess Ayele, Head, Koga Project, Ministry of Water Resources

Mr. Bifa Badhadha, Oromia Irrigation Development Authority

Mr. Mulugeta Barkessa, Project Resident Engineer, Gimbichu-Fantalle WSS, Oromia Water Resource Bureau

Mr.Abara Challa, Department Head, Oromia Irrigation Development Authority

Mr. Abdissa Gemechu, Plant Expert and District WRB Head, Oromia Irrigation Development Authority

Mr. Abiy Girma, Ministry of Water Resources

Mr. Hailemariam Hailemeskel, Agricultural Economist, African Development Bank

Ms. Rahel Kaba, WSS Consultant, African Development Bank

Mr. Girum Keshelwasely, Flood Control and Watershed Management, Awash Basin Management Project, Ministry of Water Resources

Mr. Tesema Legebo, Head, Agricultural Sector Support Project, Ministry of Agriculture and Rural Development

Mr. Yohanis G. Medhin, WSS Department Head, Ministry of Water Resources

Mr. Teferi Menkir, WASH focal person, Ministry of Water Resources

Ms. Sarina Prabasi, Country Representative, WaterAid

Dr. Pierre Thizier Seya, Resident Representative, African Development Bank

Mr. Mesfin Shiferaw, Agro-Engineer, Oromia Irrigation Development Authority

Mr. Shume, Beneficiary, RELMA water harvesting project

Mr. Sisay, Beneficiary, RELMA water harvesting project

Mr. Endale Tegene, Beneficiary, Gawa work irrigation project

Mr. Yitbarek Tessema, Senior Water and Sanitation Specialist, World Bank

Mr. Samuel Tolessa, WASH focal person, Oromia

Mr. Jan T. Twarowski, AASP M&E Specialist, Ministry of Agriculture and Rural Development

Mr.Manaye Yimenu, Ganale Basin Management Project, Ministry of Water Resources