

ECONOMIC IMPORTANCE AND ENVIRONMENTAL CHALLENGES OF THE AWASH RIVER BASIN TO ETHIOPIA

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ABSTRACT

Ethiopia's agriculture currently depends on rainfall with limited use of water resources. Highly variable rainfall, frequent floods and droughts, and limited storage capacity continue to constrain the ability of the country to produce reliable food supplies in a country that is relatively rich in water and land resources. The Awash Valley has been the major focus of medium and large scale irrigated agriculture developments since the 1950s, and presently has over 70 percent of Ethiopia's non-traditional irrigation. In addition, there are traditional and non-traditional small-scale irrigation systems within the valley, and major dams to improve the management of water for agriculture and produce hydropower have been constructed. Furthermore, this economic activity has produced major secondary benefits to the valley area. With the continuing decline of the productivity of the rain-fed agricultural lands and the anticipated doubling of food demands over the next two decades, improved water management in agriculture, including irrigation is of paramount importance. Numerous authors, policy makers and other observers have stressed the very high-unrealized potential for intensification of agriculture through irrigation in Ethiopia. Yet, apart from the Awash Valley, limited development has occurred in irrigation development. Like much of the highlands of Ethiopia, mixed livestock cropping system predominate in the upper basin, whereas pastoralism was traditionally and currently practiced in the middle and lower reaches. The major irrigated agriculture and water resources have occurred in the middle valley and, more recently, towards the lower reaches. Other issues associated with the water management in the middle and lower basin is soil salinization, water contamination and increased water-borne diseases, and poor design leading to water loss through leakage and evaporation. Expanding irrigation threatens wetlands, and conflicts over access to water constrain smallholder farmers and pastoralists, which depend on livestock herds for their existence. Because communities lack skills and institutions to

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manage common property resources, water resources, basin/watershed and irrigation management infrastructure quickly fall into a state of disrepair. In the lower valley, desertification is a serious threat.

INTRODUCTION

Overview

At approximately 50% of the GDP, agriculture, most of it based on rain fed smallholder system and livestock, is by far the largest part of the economy and growing on average 5% per year. Despite this, the country could still face more than 6 million tons of cereal deficits by the year 2016 (UK Trade and Investment 2004). Ethiopia has an estimated 3.7 million hectares of irrigable land, yet only about 200,000 hectares (5.4%) is presently irrigated and only provides approximately 3% of the country's food crop requirements.

Description of the Basin

Most of the irrigation schemes in Awash Basin have good reputation in irrigation efficiency and the irrigation efficiency in Awash River Basin varies from 30 to 55 %. Based on physical and socio-economic factors the Awash Basin is divided into Upper Basin (region above Koka Dam), Upper Valley (region between Koka Dam and Awash National Park), Middle Valley (region between Awash National Park and Gewane town) and Lower Plains (Figure 1a and 1b). The mean annual flow is around 2200Mm³ at Tendaho. The highland part of Awash Basin gets adequate rainfall as compared to the Middle and Lower Valley. The source of Awash River is the central plateau in the west of Addis Ababa. Awash River starts at an elevation of about 3000 m a.s.l. It flows northeastwards along the rift valley to the Afar triangle where it terminates in Lake Abe near Djibouti at an elevation of 250 m.a.s.l (Abate 1994). The Awash River basin covers a total land area of 110,000 km² and serves as home to 10.5 million. The mean annual surface water resource of the Basin is in order of 4900 M m³, utilizable 3850 M m³ and currently diverted for irrigation is 2250 M m³.

The Awash River Basin is the most intensively utilized river basin in Ethiopia due to its strategic location, access roads available land and water resources. However, the basin suffers from severe environmental degradation, annual flooding, improper utilization of land, water resources, socio-economic constraints, poor agricultural practices, and low yielding and community health problems.

Flooding

The Awash River basin is mostly located in the arid lowlands of Afar Region in the north- eastern part of Ethiopia. It frequently floods in August/September following heavy rains in the eastern highland and escarpment areas. A number of

tributary rivers draining the highlands eastwards can increase the water level of the Awash River in a short period of time and cause flooding in the low-lying alluvial plains along the river course. Certain areas, which frequently, almost seasonally, get inundated, are marshlands such as the area between the towns of Debel and Gewane in the vicinity of Lake Yardi and the lower plains around Dubti down to Lake Abe in Afar Region. The third area, which often floods, is about 30 kilometers north of Awash town in the vicinity of Melka Werer.

Water Reservoirs

Though Ethiopia has substantial hydropower potential it has one of the lowest levels of per capita electrical consumption in the world. There are three functional dams in Awash River Basin, Aba Samuel (1.5 GWh/year) commissioned in 1939, Koka (110 GWh/year) commissioned in 1960, Awash II (165 GWh/year) commissioned in 1966, and Awash III (165 GWh/year) commissioned in 1971. Koka was built on the upper Awash for hydropower generation and irrigation development downstream. The dam has served for four decades. In the coming years five additional dams are proposed to be built for hydropower generation and irrigation development in the basin.

Hydrological Balance

The available water from rainfall in the basin is 39845 (Mm^3/yr), 72 % of the rainfall (28383 Mm^3/yr) is lost through evapotranspiration, 18 % (7386 Mm^3/yr) runoff and 10% (4074 Mm^3/yr) is rechargeable water..

Deterioration of Watersheds

As with other parts of Ethiopia, the upper Awash basin, and its major tributaries have been subjected to major environmental stress. The demand for natural resources by the high and fast growing population remains a major challenge to effective agricultural and forestland management. The high pressure on forest resources in particular, has led to the exploitation of fragile watersheds and ecosystems that have resulted in loss of vegetation and subsequent soil erosion in the lower part of the Awash River Basin (Kinfie 1999).

Addis Ababa, the capital of Ethiopia with three million inhabitants and by far the largest city in the country, is located in the upper Awash basin. There is very little capacity for wastewater treatment; therefore, wastewater is discharged directly into the natural watercourses of the Akai River, which eventually joins the Awash River. The Akai River is an important water source for small farm operations in and around Addis producing vegetables and livestock fodder.

This presents a significant health hazard from the microbiological contamination to the surface and groundwater, and concerns that heavy metals are accumulating

soils. Few rigorous investigations have been undertaken, but nitrate levels are reported to be above 10 mg/l in the surface water, and according to Biru (2002) and Itanna (2002), arsenic (As) and zinc (Zn) are measurably higher in the soils irrigated by the Akai River. Akaki River is one of the tributaries draining Addis Ababa City to the Awash River. In the middle and lower Awash the water-related health hazards are malaria and schistosomiasis, which are reported to be increasing in prevalence and severity. Basic requirements such as water supply, sanitation and health facilities are poor (Waltainformation 2004).

A major health concern in much of the middle and some of the lower Awash River Basin is high levels of fluorides in the groundwater, which is used as a major source for drinking water (Gizaw 1996; Tadesse et al., 1998). The fluoride risks come as people drink groundwater, other wise the Awash River water is free of fluoride. High concentrations of fluoride occurring naturally in groundwater water are a major source of fluoride intake. It has long been known that excessive fluoride intake carries serious toxic effects. The long-term use of high-fluoride drinking water results in both dental and skeletal fluorosis, which is found in populations in the Middle and Lower Awash, and the Rift Valley Basin.

Ecology and the Environment

The single overriding factor in the ecology of the Awash basin is the rapid and continuous increase in population and the adverse effects on the resources of the basin, in particular, on the rapid erosion and degradation of the upland soils. The high indication of the sediment load is a result of deforestation and less ground cover in the highland of the upper basin.

Development of large scale irrigation projects without functional drainage systems and appropriate water management practices have led to a gradual rise of saline groundwater tables in the Middle Awash Region (Tadesse and Bekele 1996). Shallow and saline ground water table has created surface salinity on the once productive lands. As a result, a large productive area has got secondary salinization, which is brought up by faulty irrigation practices. In general, implementation of appropriate sub-surface drainage projects with proper leaching practices is effective and efficient reclamation methods for sustainable agricultural production under the Middle Awash irrigated conditions (Aabegaz and Tadesse 1996).

Desertification

Manifestations of desertification in Awash River Basin include accelerated soil erosion by wind and water, increasing salinization of soils and near-surface groundwater supplies, a reduction in soil moisture retention, an increase in surface runoff and stream flow variability, a reduction in species diversity and plant biomass, and a reduction in the overall productivity in dry land ecosystems with

an attendant impoverishment of the human communities dependent on these ecosystems. The lower Awash River Basin is under severe land degradation and desertification. As the few trees are removed for charcoal and fuel wood, salt patches and salt accumulation is appearing over large areas killing the vegetation cover. In both Middle and Lower Awash River Basin *Prosopis Juliflora*, an aggressive exotic plant species, is spreading at alarming rates in alluvial fertile land, around homesteads, and in drainage canals and roads. *Juliflora* believed to have allelopathic potential on indigenous vegetation.

Cropping Pattern and Crop Production

In 1988 the irrigated area in the entire basin was estimated to be 69 000 ha. Currently the state farms control 90% of the irrigated area, private farmers control about 7% and the remaining 3% of the irrigated area is more-or-less abandoned due to salinity build up water logging from shallow ground water. The state farms are generally found in the Middle and Lower sections of the valley and the major irrigators in the upper valley are the Ethiopian Sugar Corporation Ethiopian Share Enterprise (ESC) and Ethiopian Horticultural Corporation Share Enterprise (HDC). Historically sugar and cotton have been the major crops grown in Middle and Lower Awash Valley.

Fruit production has been increasing since about 1999, with the bulk of fruit and vegetables sold in the local market in all river Basins in Ethiopia. The production of high value flowers and vegetables for export has recently been introduced in the Rift Valley Lake Basin and Awash River basin. In 2001 and 2002 the exported vegetables has increased by 95 % as compared to 1998 (Table 1). Among this 45 % of the flower exported comes from the Awash River Basin. As the external market opportunity is growing several private flower enterprises are emerging (Table 2). In the lower valley of the drier areas where moisture is critical summer cropping pattern is common such as cotton. However in the Upper Valley the highest percentage of cropping is occupied with sugar cane (Table 3). Ethiopia is completely self-sufficient in cotton. This crop holds significant opportunities for export. Existing textile industries demand approximately 50,000 tons of lint cotton annually. In addition, there are good prospects for exporting lint. Opportunities for production and processing of cotton in Ethiopia are significant. The prevailing cropping pattern in the upper Valley is sugar cane (74%), in the middle Valley cotton (82%) and in the lower Valley cotton (75%).

Table 1. Domestic fruit, vegetable, maize and factory products in Awash Basin (quintals = 100kg).

Year	Fruits	Vegetables	Maize	Factory products
1998	63,818	719	314	9,727
1999	378,421	2,383	5,833	1,314
2000	382,971	1,866	533	5,278
2001	404,818	1,888	578	0
2002	395,020	1,101	376	5,104
2003	335,353	368	268	2,293

Source: Ethiopian Horticultural Corporation Share Enterprise (Annual Report 2003)

Table 2. Flower & vegetable exports (quintals).

Year	Flowers	Vegetables
1998	1,470	23,803
1999	547	30,588
2000	470	33,407
2001	30,695	374,124
2002	1,150	374,124

Source: Ethiopian Horticultural Corporation Share Enterprise (Annual Report 2003).

Table 3. Production and sales of cane sugar in Ethiopia from the Awash Basin.

Year	Total production (tonnes)	Total sales (tonnes)
2000	250,867	257,483
2001	251,368	253,055
2002	261,041	234,800
2003	263,209	307,476

Source: Annual Report of Ethiopian Sugar Industry Support Center Share Company (2003).

The Middle and Lower Awash is one of the major cotton producing areas of Ethiopia. However, during the last decades most of the agricultural land has been abandoned as a result of inherent soil salinity and saline shallow ground water. In most of the irrigation project development drainage system were not built. Thus the irrigated land did not change over time and expanded, as salinity became a major threat for development of agricultural land (Table 4 and 5). Cotton produce after ginning is supplied to local textile industries.

Table 4. Area planted under cotton (ha).

Producer	1996/97	1999/98	1998/99	1999/00	2000/01	Average
Lower Awash	5,450	5,625	5,955	5,645	4,117	5,358
Middle Awash	5,153	5,268	4,789	1,667	5,407	4,457
Upper Awash	1,000	1,000	1,000	1,000	1,000	1,000

Source: RATES 2004

Table 5. Yield of seed cotton (tonnes/ha).

Producer	1996/97	1999/98	1998/99	1999/00	2000/01	Average
Lower Awash	1.5	1.4	1.6	2.0	2.0	1.7
Middle Awash	2.9	2.2	2.0	3.5	2.9	2.7
Upper Awash	2.1	2.1	2.1	2.1	2.1	2.1

Source: RATES 2004

Livestock

The Awash valley has historically been a main gateway for the caravan trade between the coast and the highlands of Ethiopia to Djibouti and Berbera. At present, the strategically important official import and export trade activities of the country take place through the pastoral areas of the Afar and Somali regions. Cross-border trade with neighboring countries is also an important aspect of the economic life in these pastoral areas of the country. In 2001, the total population of the Afar region was 1.24 million while that of the Somali region was about 3.9 million. In addition to the large human population, these regions also account for a large number of the livestock population of the country. The Afar region, which is part of Middle and Lower Awash River Basin, has 3.6 million cattle, which is 7.4% of the national total, while the region's sheep and goat populations are 2 million (7.8%) and 3 million (13.8%) respectively. Besides this, the Afar region has 192,872 pack animals, i.e., 3 % of the national total, and 871,832 camels, which is 27 % of the national total (Reporter 2003). The livestock population in Afar Region in Middle and Lower Awash Basin has showed an increasing trend starting from 1998 (Figure 2). This was mainly due to several water points developed in the region, which once was a critical issue in the region. Currently great attention is paid for the pastorals development to increase, feed resources, watering points, health and marketing.

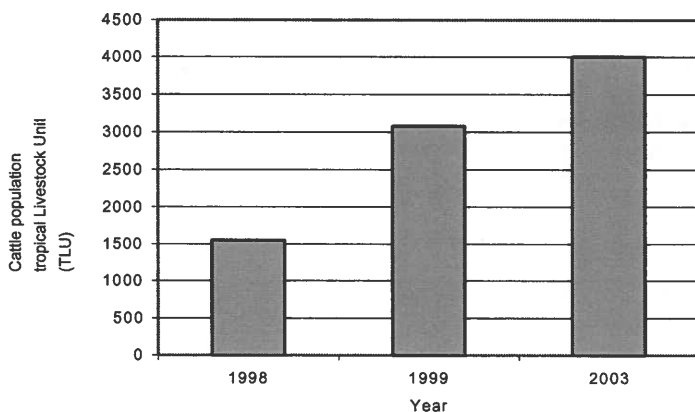


Figure. 2. Cattle population in Middle and Lower Awash Valley (Afar Region).

SUMMARY & CONCLUSIONS

The Awash Basin has the most developed water system in Ethiopia, and because of these developments the basin has been a major component of the Ethiopian economy for the past four decades.

The original major investments in the basin were to produce sugar and cotton. Sugar continues to be a major crop, and the cropped area and production is increasing. However, cotton production has declined. Fruit and vegetable crop production for the domestic market is rapidly growing in the valley, and in the past few years the production of high-value vegetable and flowers has emerged.

The basin is now essentially a closed basin and the water resources may even be over-appropriated. Also, many factors, including increasing population, migration into the basin, further expansion of irrigated areas, inappropriate management practices of the upper catchment's, and so forth, are threatening the sustainability of irrigation in the basin.

The environmental condition of the valley is a cause for concern. Loss of vegetation in the highlands is further accelerating the erosion rates in the upper Awash and its tributaries, which, among other things is reducing storage capacity of major reservoirs. Also in the highlands, irrigation of raw-eaten vegetables with untreated wastewater from the expanding urban center of Addis Ababa is creating a health threat.

Salinization of soils has resulted in loss of productive lands, especially in the lower parts of the basin.

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Figure 1a. Map of Ethiopia showing the approximate watersheds, main rivers and lakes.

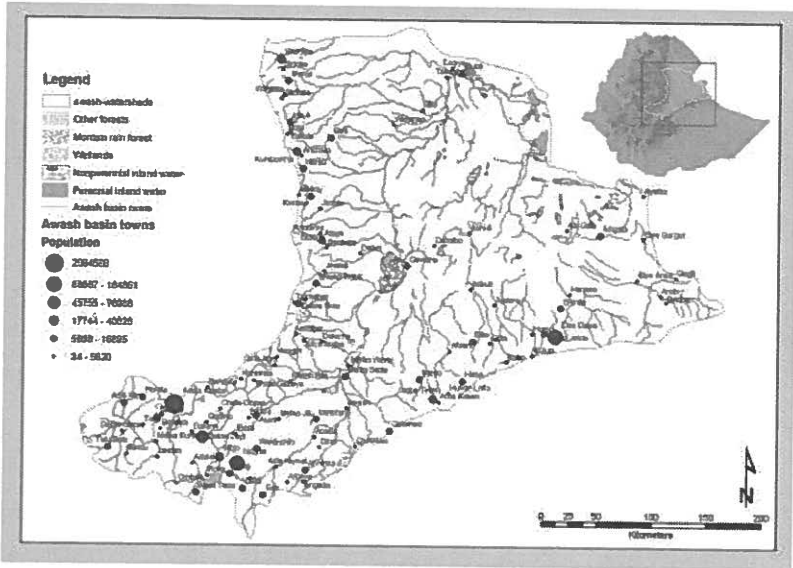


Figure 1b. Awash Basin map.