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Awash River's the Ongoing Irrigation Practices, Future Projects and its Impacts on the Environment of Awash River Basin

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Abstract

This Review Article aims to review irrigation potential of Awash River, opportunities and impacts on the Environment of Awash River Basin. Awash River basin 37 irrigation potential sites are identified out of which 5 are small-scale, 18 are medium-scale, and 14 are large-scale. The estimated irrigation potential is 134,121 hectares. Out of these, a potential, 30,556 hectares are for small-scale, 24,500 hectares for medium-scale and 79,065 hectares for large-scale development. Most of the irrigation schemes in Awash River Basin have good reputation in irrigation efficiency which varies from 30 to 55 %. The Awash River Basin faces land degradation, high population density, natural water degradation, and Salinity and wetland degradation. There should be proper wetland restoration system for the areas such as Becho plain, Borkena swamp affected by water logging and there must be afforestation and soil and water conservation measures for the desertification of middle and lower Awash.

Keywords: *Awash River* • Environmental impacts • Future project • Ongoing Irrigation practice.

Introduction

General Background

There are twelve major river basins in Ethiopia of which Awash Basin is one and the most utilized River basin so far. Awash Basin covers parts of Afar, Amhara, Oromia, Somali Regional States, SNNP and Addis Ababa and Dire Dewa Administrative councils. It is the fourth populous basin in Ethiopia and ranks the 3rd of all basins of Ethiopia in terms of population density and stands 4th and 7th in its area and volume of water respectively. The Awash Basin covers a total area of 116,000 km^2 and has an annual flow of 4.9 billion m^3 [1] . At approximately 50% of the GDP, agriculture, contributes by far the largest part of the economy and is currently growing on average 5% per year. 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.

Most of the irrigation developed to date in Ethiopia is located in the Awash River Basin. Awash Basin is the most developed basin in Ethiopia due to availability of land suitable for agriculture, water resources that can be easily tapped, and its strategic location. The estimated irrigation potential is about 206,000 ha out of which more than 160,000 ha or 77.7% (current survey excluding hectares less than 2.5 ha) is already developed by surface irrigation systems and it also serves for drinking water supply for big towns and rural community, hydropower and fisheries [2].

The Awash River starts in the highlands of central Ethiopia, at an altitude of about 3000 m above sea level. After flowing to the southeast for about 250 km, the river enters the Great Rift Valley at an altitude of 1500 m, and then follows the valley for the rest of its course to Lake Abe on the border with the Djibouti Republic, at an altitude of about 250 m. Lake Abbe has an average size of 34,000 ha open water, surrounded by 11,000 ha of salt flats. The area is shrinking during dry years. The water level can drop up to 5m and maximum depth is 36 m. The total length of the river is about 1200 km and its catchment area is 113 700 km^2 (FAO/SF 1964).

The geographic location of the Awash River Basin is between 7°53'N and 12°N latitudes and 37°57'E and 43°25'E of longitudes [3]. It is an example of a closed drainage basin, hence outflow does not occur. It is one of a chain of six connected salt lake (*Gargori, Laitali, Gummare, Bario and Afambo*). Awash River Basin is bordered to the north by the Danakil River basin, to the west by the Abbay, to the south-west by the Omo-Gibe and Rift Valley Lakes, to the south-east by the Wabi Shebele River and to the east by the Republic of Djibouti, the Somali Democratic Republic and the Aysha Dray Basin. The main physiographic components of the Awash Basin are the Ethiopian Plateau and the Rift Valley, which widens to the north into the Afar Triangle [4].

The Awash River Basin faces land degradation, high population density, natural water degradation, and Salinity and wetland degradation. Already desertification has started at lower Awash River Basin. In the high land part deforestation and sedimentation has increased in the past three decades. As more water is drawn from the river there could be drastic climate and ecological changes which endanger the basin habitat and human livelihood. Draining the wetlands for irrigation could imbalance the sustainability of the basin. The Awash River Basin was divided into 3 sub-catchments: Upper (upstream from Koka Dam station), Middle (between Koka and Awash station), and Lower (between Awash and Tendaho station) for a better resolution in the calibration and simulation routines. However, the impact assessment was done over the whole of the basin by summing up the 3 sub-catchments' discharges into one. (Figure 1)

Conventional Climatic Zones

One of the major factors determining climatic conditions in the Awash Basin, as elsewhere in Ethiopia, is altitude. Ethiopian tradition identifies four major natural zones according to altitude, climate, and to some extent, natural vegetation. These are described below.

Dega: This is the name given to tropical highlands above 2,500 m. 7%, of the Awash River catchment lies in this zone.

Woina Dega*:* This name is given to the tropical to sub-tropical plateaus altitudes from 2,500 m. down to 1,800 m. 13% of the awash catchment lies in this zone.

Kolla*:* This covers the agricultural lands lying between 1,800 m. and 1,500 m. 22% of the Awash River basin lies in the Kolla, of which 6% is in the humid valleys.

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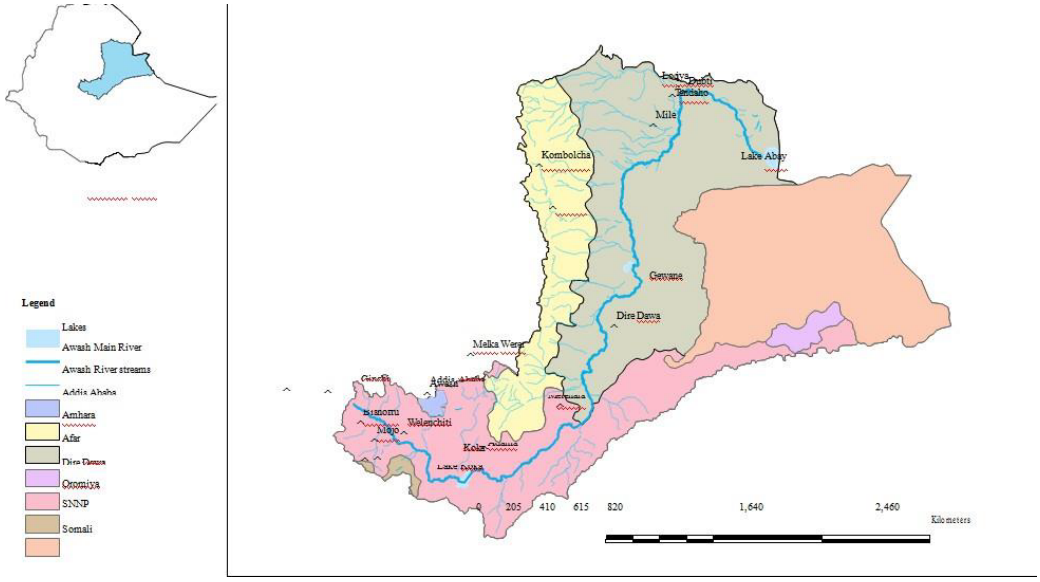

Figure 1. Location Map of Awash River basin.

Bereha: This name is given to semi-arid and sub-desert lowlands at altitudes below 1,500 m. 58%; of the Awash basin lies in this zone (MOA, 1998).

Rainfall :In general, plateaus over 2,500m receive 1,400 -1,800 mm yr-1, mid-altitude regions (600 -2500m) receive 1000 -1400mm/year, and lowlands get less than 200 mm yr-1. The rainfall distribution, especially in the highland areas is bimodal, with a short rainy season in March, April and the main rains from June to September.

Statement of the problem

Currently, about 3% to 5% of the irrigable land is irrigated while the irrigation potential has been estimated to be about 4.3 million hectares of arable land. Irrigated agriculture is becoming increasingly important in meeting the demands of food security, employment, rural transformation and poverty reduction. For Ethiopia, increasing agricultural productivity, enabling households to generate more income, increasing their resilience as well as transforming their livelihoods stands out as the most pressing agenda now and for the coming decades. This depicts the fact that if we maximize our efforts to utilize the untapped water resources for irrigation development, we will be able to improve the household livelihood and overcome the challenges of food insecurity within the shortest time possible.

Therefore, this term paper aims to review literatures information related to irrigation potential along Awash River, opportunities and impacts on the Environment of Awash River Basin.

Objectives

To Review Literatures regarding Awash River ongoing Irrigation practice, future projects and its impacts on the Environment of Awash River Basin.

Ecosystems and biodiversity in the basin

Vegetation: The Upper Basin Rained area is used by pastoralists during the rainy season because of the higher rainfall and there crop utilization is high. The dominant vegetation in the Upper and Middle Valley is grassland with some scrubland and riparian forest along the Awash River. The best wet season grazing areas here are the Alidge, Gewane, Awash and Amibara. Some of theplant species include Balanites aegypticus, Salix subserata, Flueggia virosa, Carissa edulis, Rumex nervosus, Tamarindus indica, Ulcea schimperi and Acacia spp.Lasiurus scandium, Pa nicum turgidum (highly palatable), in the plains of Gobbad and Hanle, associated with Acacia tortilis, Acacia asak (mainly present in the wadis), Cadaba rotund folia and Salvadora persica . Sporobolus spicatus, which is typical of saline depressions and swamps, bears signs of some degradation. Hyphaene thebaica (Doum palm) formations are characteristic but strongly degraded over the area. Lake Abe is a large (180 km), shallow and saline (170 g/l NaCl) lake, shared between Djibouti and Ethiopia.

Animal diversity: The wild ass lives in open desert country and in lava-strewn hills among the rocks and cliffs, across the plains of the Danakil region and the Awash Valley. The Somali wild ass (Equus asinus somalicus) is of global significance as it is the only existing representative of the African wild ass with only a few hundred individuals left. Awash National Park is the oldest and most developed wildlife reserve in Ethiopia. Featuring the 1,800m Fantalle Volcano, extensive mineral hot-springs and extraordinary volcanic formations, this natural treasure is bordered to the south by the Awash River and lies 225 kilometers east of the capital city, The wildlife consists mainly of East African plains animals, but there are now no giraffe or buffalo, Oryx, bat- eared fox, caracal, aardvark, colobus and green monkeys, Anubis and Hamadryas baboons, klipspringer, leopard, bushbuck, hippopotamus, Soemmering's gazelle, cheetah, lion, kudu and 450 species of bird all livewithin the park's 720 square kilometers [4]. Selemeta. http://www.selamta.net/national_parks.htm).

Hydropower on the Awash River Basins: 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 (165GWh/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 thecoming years five additional dams are proposed to be built for hydropower generation and irrigation development in the basin.

Environmental and Social Aspect: 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 [6] 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 schisto somiasis, which are reported to be increasing in prevalence and severity. Basic requirements such as water supply, sanitation and health facilities are poor [7]. 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.

Cropping pattern and crop production: 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 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. 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. 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. 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%).

The Middle and Lower Awash is one of the major cotton producing areas of Ethiopia. However, during the last decade's 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. Cotton produce after ginning is supplied to local textile industries.

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 [8]. The livestock population in Afar Region in Middle and Lower Awash Basin has showed an increasing trend starting from 1998. 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 (Figure 2).

Ongoing Irrigation Development of Awash River

The Ministry of Water and Energy has identified 560 irrigation potential sites on the major river basins. The total potential irrigable land in Ethiopia is estimated to be around 3.7 million hectares (without considering the groundwater potential and gently sloping areas). The area under irrigation development to-date is estimated to range between 160,000 - 200,000 hectares for the entire country. Estimates of the irrigated area vary, but still is less than five percent of potentially irrigable land [9]. In Awash river basin 37 irrigation potential sites are identified out of which 5 are small-scale, 18 are medium-scale, and 14 are large-scale. The estimated irrigation potential is 134,121 hectares. Out of these, a potential, 30,556 hectares are for small-scale, 24,500 hectares for medium-scale and 79,065 hectares for large-scale development. The challenges includes amongst others: closing the gap between planning and implementation of irrigation projects; improving the performance of existing irrigation schemes; removing constraints on the scale-up of irrigation projects; and ensuring the sustainability of water resources for irrigation.

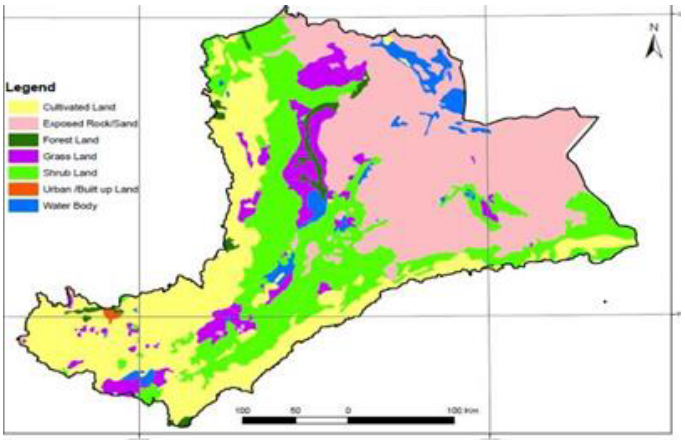

Figure 2. Land use/cover map of Awash River Basin.

Opportunity for Future Irrigation Projects of Awash River

The existence Irrigation Development in the basin

According to Taddese, there are three functional dams in the basin for hydropower generation and irrigation development. Furthermore, the majority (48 to 70%) of the existing large-scale irrigated agriculture of the country is located along this river [10,11]. Most of the irrigation schemes in Awash River Basin have good reputation in irrigation efficiency which varies from 30 to 55%. In the early 50's the Koka Dam was built in the basin, which served for hydro - electrical generation and irrigation development in the downstream. Soon after the first sugar factory was established in the basin. Large-scale irrigated farming is common on the floodplain. State farms control some 80% of the irrigated area and smallholder farmers farm the remaining 20% (Table 1). Of the state farm area 92% is grown with cotton, 3% with bananas and 5% with cereals and vegetables.

Future irrigation Development programs in Ethiopia

The Ethiopian Irrigation Development Plan (IDP) emphasizes the development of small-scale irrigation systems through giving highest priority for capacity-building in the study, design, and implementation of irrigation projects.

Table 1. Existing and potential large scale irrigation in Awash River Basin.

Location	Existing (ha)	New expansion (ha)	Total (ha)
Upper Awash	23300	10600	33900
Middle Awash	19900	35100	55000
Lower Awash	25600	36900	62500
Total (ha)	68800	82600	151400

Source: *Fiona Flintan and Imeru Tamrat. 2002.*

Increasing emphasis will also be given to the development of large and medium-scale irrigation schemes. Ethiopia has designed a Water Sector Development Programmed for the period ranging from 2002–2016 [4]. Accordingly, new irrigation works will be undertaken to develop a total of 274,612 ha of farmland under the irrigation development plan by the federal government and regional governments for large and medium scale irrigation developments. By the end of the water sector development program (WSDP) in 2016, the total area under irrigation will be 471,862 ha [4]. However, due considerations should be given during expansion of irrigation infrastructures. Irrigation can have adverse effects on environment and public health, if it is not properly managed. The basic opportunistic considerations regarding irrigation developments in Ethiopia are:

- Emphasis and priorities are given to irrigation in the growth and transformation plan of the country.

- Indigenous knowledge and introduction of promising household water harvesting and micro- irrigation technologies
- Government's strong political commitment and encouragement to private sector and public enterprises involvement in irrigation developme.
- Abundant water resources, climate and land suitability.
- Availability of inexpensive labor.
- Availability of suitable lands for irrigation developments especially at arid areas of the country (Haile and Kasa, 2015).

Water Partnership Agreement and Water Governance Program

To improve the water related living conditions for the people in the Awash River basin, by improving the performance of beneficiary partners on water governance, several Dutch and Ethiopian water institutes signed a Water Partnership Agreement on 1 March 2013. The partners agree to cooperate to improve the water governance situation in the Awash River basin, by setting up a Water Governance Program and Action Plan and the subsequent implementation of these plans. In the project "Set up of a Water Governance Program in the Awash river basin, Central Ethiopia" the Regional Water Authorities of the aforementioned Water Partnership Agreement and the WGC cooperate with the Awash Basin Authority (AwBA) and the Ministry of Water and Energy (MoWE) to identify the main water governance challenges, execute an assessment on water governance capacity and draft the Water Governance Program (Ronald Hemel and Henk Loijenga, 2013).

Challenges of Awash River Basin

Technical Gabs

There are four main challenges for the sustainable development of the Awash River basin:

1. Ensuring that the Awash River basin water resources management is strategically directed, supervised and integrated with other social, economic and environmental sectors.
2. Ensuring effectiveness of the water policy and the legislative framework already put in place by involving competent organizations in development and management of water resources and water related services.
3. On the long run: ensuring Awash river basin functional and operational full capacity as it is planned, designed and formulated in the water policies and regulations (facilities, staff, budget, planning, financial management).
4. Improve capability of involved organizations to better realize the potential (hydropower, irrigation) of the water system and to improve the situation on WASH (Water, Sanitation and Hygiene), in order to foster livelihood and wellbeing of local communities [1].

Environmental Challenges

Water Borne diseases: In the Awash Valley, *Schist-soma mansoni* is found at the higher altitudes (the upper valley) where the intermediate host, *Biomphalaria pfeifferi* profusely breeds in tertiary and drainage canals of the sugar estates. *Schistosoma haematobium,* causing urinary schistosomiasis, occurs in the middle and lower valley (where average temperatures are higher) where the intermediate snail host *Bulinus abyssinicus* breeds in the clear marshy waters of swamps in undeveloped flood plains. Health records show that before the development of sugar estates, prevalence was limited to the provinces of Harar, Tigray and the Lake Tana Basins of Gojam and Gondar. Agricultural development attracted people from these areas, including people infected with the parasit.

Malaria is a serious problem within the Awash River basin, the disease being present in all areas below 2000 a.m.l, frequent epidemics having been reported from areas within the basin [12]. Some areas showing no incidence of Malaria in the South Western parts of the basin, between Nazareth and the border of Addis Ababa up to 2000 (a.m.l.).

Wetland Degradation: Ethiopia adapted, the Awash Basin Surface Water Resources Master Plan, originally adopted in 1989, the plan focusing on management of the upper parts of the watershed, including development of irrigation, hydropower and livestock in the catchments area. Three wetlands were proposed for irrigation development. They are: the Becho Plains, the Gedebassa Swamp and the Borkena Swamp. At present some other small wetlands are being turned to agricultural lands and reservoirs for power generation or irrigation. At a smaller scale, wetlands are being drained resulting in degradation and destruction of the natural ecosystem of the basin. Attempts at draining swamps have not taken into consideration the existing intensive role of the wetlands in providing dry season grazing and other benefits to local communities. In effect the great pluvial lakes in the Afar region are reduced to a few small lakes and swamps, turned into fragile confined ecosystems. The size of Lake Abe has decreased by 67% since the 1930s. For manyyears, water from the Awash River was used for irrigation. This situation as well as recurrent droughts has contributed to the progressive drying up of the lake exacerbating the situation.

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. *Prosopis Juliflora* believed to have allelopathic potential on indigenous vegetation (Figure 3).

Soil Salinity and Water logging Salinity problems are recognized throughout the Lower Awash Valley. Another common problem in drained marshes and swamps is that soils become infertile and acid because of oxidation of sulphur and production of sulphuric acid in the drained soils. In poorly drained soils wilt syndrome to cotton is produced under anaerobic condition in the presence of easily oxidize- able-organic matter, presently hydrogen sulphide and reduction of NO3, Fe, Zn and Cu, this process affects growth of cotton root causing damage and other deformation in plants. Development of large scale irrigation projects without functional drainage system and appropriate water management practices have led to gradual rise of saline ground water in the Middle Awash region. In effect, development of persistent shallow saline

Figure 3. Desertification in Lower Awash Basin**.**

groundwater, capillary rise due to high evaporation and concentration of the soil solution together with the natural some seeps contributed to secondary Salinization [13].

Population: The population of the basin is estimated to be around 14 million as derived from the 1994 population and housing census [14] .The overall population in the Awash Basin is estimated to be 14.9 million from the CSA report of 2007 G.C. more than 65% of this concentrated in the Upper Awash

Occurrence of Baseka Lake: In the period between1986 to 2000 the lake surface area increased by about (11.6 km 2), where the expansion direction is restricted almost towards the South (Abadir farm) and towards the West. In this period the Lake almost established its current shape. Between2000–2008 the expansion of the lake is further restricted towards Abadir Farm in the south and towards Metahara Town in the North East. In general, the recent expansion trend of the lake is in the south, east and northeast directions.

To conclude the source of the lake is irrigation excess only since the area is prone to different tectonic activities as it is situated in central rift valley region [2] (Table 2).

Table 2. Surface area of the lake Baseka in different periods.

Year	Area (km^2)	Incremental area (km^2)	Cum. incremental area (km^2/yr)
1957*	3.0	0.0	0.0
1973	8.4	5.4	0.3
1975**	10.2	1.8	1.2
1986	29.5	19.3	3.0
2000	41.1	11.6	3.8
2008	42.6	1.5	4.0
Source: *Gulilat, 2000； * processed from 1975 topo-sheet			

Change in water quality: The summary of the mean water quality for the different water sources are presented as in Table

The effects of the highly saline (EC ~11 dS/m) lake on the different water sources, especially drainage and ground water, in terms of salinity (EC), sodicity (SAR) and specific ion toxicity (Na & Cl) is clearly observable from the table. Recently, the river faces a great environmental concern; mainly the saline water of Baseka lake expansion affects the surface and ground water dynamics and soil properties of the region and the condition is specifically dangerous for the sustainability of Metahara Sugar Estate and Metahara town in particular, and the Awash river basin in general (Table 3).

Flooding: The Awash River basin 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. The third area which often floods is, about 30 km north of awash town in the vicinity of Melka Werer. Flooding along Awash River was mainly caused by heavy rainfall in the eastern highlands and escarpment areas of North Shewa and Welo and not because of heavy rain in the upper watershed areas (i.e. upstream of the Koka Reservoir). Over the year's soil and water run - off in the escarpment areas have steadily increased as a result of deforestation, the most serious environmental degradation in the escarpment areas being caused by overpopulation in the highlands (Figure 4). Tributaries to Awash river such as Kessem, Kebena, Hawadi, Ataye Jara, Mille and Logiya rivers contributed most to the lowland flooding in Afar.

Invasion of *Prosopis Julifora* in the Middle Awash Valley: Currently, P. juliflora poses a threat to indigenous biodiversity where ever it is established

Table 3. Mean values for some of the water quality parameters for different water types.

Type of water	PH	EC	Na^+	Ca^{2+}	$HCO3^{-2}$	Cl^-	SAR
Awash River	7.73	0.38	1.58	1.52	2.70	0.50	1.6
Irrigation Canals	7.83	0.40	1.77	1.67	2.83	0.42	1.7
Reservoirs	8.10	0.38	1.70	1.41	2.60	0.21	1.8
Drainage water	8.10	1.26	24.31	0.36	1.65	0.49	2.5
Factory waste	7.92	0.40	57.03	1.59	2.90	0.54	57
Ground water	8.23	2.38	25.09	1.08	15.28	3.04	30
Baseka Lake	9.58	10.70	159.7	0.38	20.65	39.42	307
* All the units are in meq/L, except EC (dS/m) and PH. **Source:** Olumana et.al (2009)							

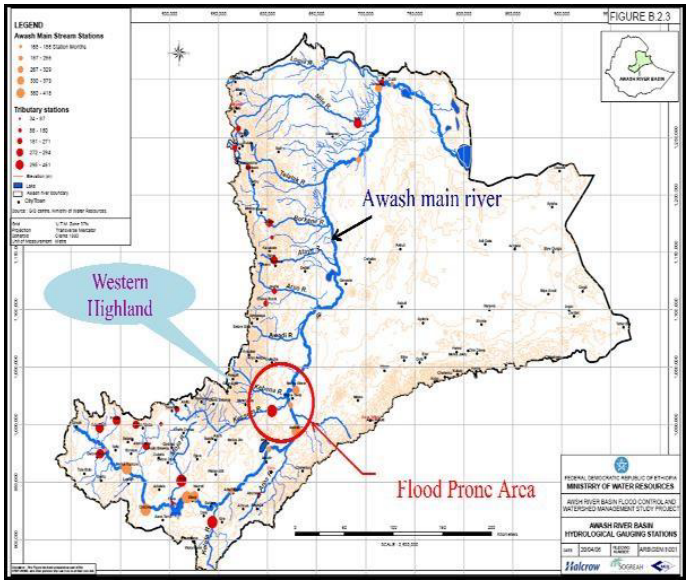

Figure 4. Location of Middle Awash River basin flood prone area along with discharge measuring stations.

in Ethiopia in general, in the Middle Awash area in particular because of its weedy and invasive nature. In the Middle Awash, about 30,000 hectare of grass land, rangelands, water points and croplands are estimated to be occupied by P. juliflora .Areas that are currently invaded by P. juliflora were important sources of forage for livestock for the Afar people. The invasion by P. juliflora reduces grass availability and stocking density by livestock. It impacts the plant biodiversity by creating a physical barrier on seedlings of other plant species, preventing sunlight to reach to the under canopy vegetation, lowering the water table and by releasing various chemicals that may have negative effect on the native plant species. Now P. juliflora has become the national no. 1 invasive species in Ethiopia [15]. According to Tessema, 2007, Prosopis is an invasive plant that discourages undergrowth of other plants or grasses. 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 (Figure 5).

Figure 5. Prosopis juliflora infestation in Middle and Lower Awash Valley.

The Infestation of this invasive alien species is rapidly encroaching into pasturelands making most middle valley rangelands in state of poor condition and at risk for livestock Production. The extent of both rangeland and Irrigated land degradation by this weed is unbearably high creating a serious concern for pastoral and agro-pastoral livelihood.

The invasive P. juliflora plant widely occurs in Ethiopia's Afar region where it currently occupies an estimated 360,500 ha of arid and semi-arid lands [16]. The species has several documented uses, both in its native and introduced ranges. In its native range, the species is exploited for human food, animal feed, medicine, timber, honey and energy products [17- 22].

Summary and Conclusion

Basin covers parts of Afar, Amhara, Oromia, Somali Regional States, SNNP and Addis Ababa and Dire Dewa Administrative councils. The Awash River Basin was divided into 3 sub-catchments: upper, middle, and lower for a better resolution in the calibration and simulation routine. This term paper aims to review literatures information related to irrigation potential along Awash River, opportunities and impacts on the Environment of Awash River Basin. The Ministry of Water and Energy has identified 560 irrigation potential sites on the major river basins, and total potential irrigable land in Ethiopia is estimated to be around 3.7Mha. The area under irrigation development to-date is estimated to range between 160,000 - 200,000 hectares for the entire country. This term paper aims to review Literatures regarding Awash River ongoing Irrigation practice, future projects and its impacts on the Environment Awash Basin [22-31].

The Awash River Basin faces Technical Constraints and Environmental challenges such as land degradation, high population density, natural water degradation, Salinity and wetland degradation, desertification, flood, water quality changes and invasion of *Prosopis Juliflora*. Already desertification has started at lower Awash River Basin. In the high land part deforestation and sedimentation has increased. As more water is drawn from the river there could be drastic climate and ecological changes which endanger the basin habitat and human livelihood. Therefore, from these findings I conclude that 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, Salinity and water logging, water borne diseases, desertification, and invasion of *Prosopis Julifora* and Expansion of lake Besaka expansion.

Recommendation

- There should be prevention and reclamation measures for salt affected areas (middle and Lower Awash).
- There should be proper restoration system for the areas such as Becho plain, Borkena swamp that are becoming degraded.
- Therefore, there must be afforestation and soil and water conservation measures for the desertification of middle and lower Awashz

References

1. Ronald Hemel and Henk Loijenga. “Assessment of Water Governance Capacity Awash River Basin Ethiopia Report”. (2013).
2. Olumana M, Loiskandl W, Furst J, et.al .“ Effect of Lake Baseka expansion on the sustainability of Metahara SE in the Awash River basin, Ethiopia”. (2009).
3. Gebrehiwot, Abraham B, Nata T, Bheemalingeswara K and Mokennen H. “Suitability of Groundwater Quality for Irrigation: A Case Study on Hand Dug Wells in Hantebet Catchment, Tigray, and Northern Ethiopia “.*J Am Sci* 7(2011): 191-199.
4. MoWR. “Transforming the economic role of the pastoral regions in Ethiopia. Media and Communications Center (MCC): Water Sector Development Programmed 2002–2016, Irrigation Development Reporter”. (2003).
5. Authority AB. “Strategic *River Basin Plan for the Awash Basin*.” *Adama Ethiopia* (2014).
6. Biru A. “Assessment of the fertility and pollution status of irrigated vegetable farms around Addis Ababa City Agricultural Office”. *Ethiopia.*
7. Walta information. “Vegetables Cultivated along City's Polluted Rivers Said Posing Danger to Health”. (2004).
8. Ethiopia C. “Summery and statistical Report of the 2007 Population and Housing Census”. (2007).
9. Awulachew SB, AD Yilma, M Loulseged, W Loiskand and Ayana M. et.al. “Water Resources and Irrigation Development in Ethiopia International Water Management Institute”. *IWMI Colombo* Sri Lanka. (2007): 66.
10. Flintan F, Tamrat I. “Spilling Blood over Water: The Case of Ethiopia”. *In Scarcity and Surfeit* 242-319.
11. Achamyeleh K. “Ethiopia: Integrated flood management”. WMO/GWP Associated Programme on Flood Management (2003):15.
12. WHO/UNICEF. “Joint Monitoring Programmed for Water Supply and Sanitation: Meeting the MDG drinking water and sanitation target: A mid-term assessment of progress”, USA. (2004).
13. Taddese G, Sonder K, Peden D.“The water of the Awash River Basin a future challenge to Ethiopia. International Livestock Research Institute (ILRI). Addis Ababa, Ethiopia”
14. “Ministry of Water and Energy, Projects and Programs: Dams and Hydropower”. Addis Ababa, Ethiopia (2010)
15. Shimles Ayales, Getachew Mulualem . “Controlling the spread of Prosopis in Ethiopia by its utilization. Ethiopian Agricultural Research Organization (EARO)”. 8: (2016):1-6.

16. Wakie TT, Evangelista PH, CS Jarnevich, Laituri M. "Mapping current and potential distribution of non-native Prosopis juliflora in the Afar region of Ethiopia". PLoS One 9: (2014):112854.

17. Felker P, Gastronomica. "Mesquite flour: new life for an ancient staple Gastron. "*J Food Cult* 5 (2005): 85-89.

18. Alemayehu T. "The impact of uncontrolled waste disposal on surface water quality in Addis Abeba". *Ethiopian J Am Sci 24 (2001).*

19. Goerner A, E Jolie, R Gloaguen . "Non-climatic growth of the saline Lake Beseka, Main Ethiopian Rift". 73 (2008): 287-295.

20. Gebre. "Flood Hazard Assessment and Mapping of Flood Inundation Area of the Awash Awash National Park: Selemeta". (2004)

21. Abebe G. "Feasibility study on the proposed remedial measures of the Lake Baseka level rise".MSc Thesis submitted to the Graduate School of Alemaya University, Ethiopia" . (2008).

22. Goerner A, E Jolie, R Gloaguen ." Non-climatic growth of the saline Lake Baseka, Main Ethiopian Haile GG, Kasa AK Irrigation in Ethiopia: A review". *Acad J Agric Res 3(2015):264-269.*

23. Itanna F. "Metals in leafy vegetables grown in Addis Ababa and toxicological implications". *J Health De 16 :(2002) :295-302.*

24. Achamyeleh K. "Integrated Flood Management in Ethiopia". (2003).

25. Haile ZM. "Invasion of Prosopis juliflora (SW.) DC and Rural Livelihoods: The Case of Afar Pastoralists at Middle Awash Area of Ethiopia". MSc. Thesis, Norwegian University of Life Science, Oslo (2008).

26. "Ministry of Agriculture". *Agro-ecological zones classification of Ethiopia*. Addis Ababa (1998).

27. "Transforming the economic role of the pastoral regions in Ethiopia. Media and Communications Center (MCC)", Ethiopia (2003).

28. Singh G. "An agroforestry practice for the development of salt lands using (*Prosopis juliflora Leptochloa fusca*)". *Agrofor Syst* 29 (1995): 61-75.

29. Taddese G, Bekele E, Eticha G and F Abegaz . "Evaluation Of Awash River Water For Irrigation Under Middle Awash Condition , Ethiopia" 27(1998):150.

30. Tadess G, Sonder K and Peden. "The water of the Awash River basin a future challenge to Ethiopia". (2012).

31. Yibekal Abebe Tessema . "Ecological and economic dimensions of the paradoxical invasive species-Prosopis juliflora and policy challenges in Ethiopia". *J Econ Sustain Dev* 3 (2012): 62-70.

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