Annex 3.1

Awash River Basin profile

Federal Democratic Republic of Ethiopia

Ministry of Water Resources

Food and Agricultural Organization of the United Nations

Project: Strengthening national water monitoring capacities, with emphasis on agricultural water management (GCP/GLO/207/ITA)

AWASH BASIN PROFILE
ETHIOPIA

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AWASH RIVER BASIN PROFILE
2008

1. Geography and Population

1.1 Geography

The Awash River Bain lies in the central part of Ethiopia between 7° 52'12"N and 12° 08'24"N and 37° 56'24"E and 43° 17'24"E [1] at elevations of 210- 4,195 m and covers about 110,000[1] km^2 draining the northern part of the Rift Valley in Ethiopia. The Basin covers parts of Afar, Amhara, Oromiya and Somali Regional Governments, and Addis Ababa and Dire Dawa City Administrations of the country. The Awash River which originates from central west part of Ethiopia and remains within the country has a total length of about 1,250 km. The main physiographic features of Awash River Basin are the Ethiopian Plateau and the northern part of the Rift Valley which widens to the north into Afar Triangle. While the alluvial plains in the Rift Valley are relatively wide, there are deeply incised river valleys and volcanic masses rising to 3,850 m. The Rift Valley is seismically active. The physical geography of the Awash River Basin is dominated by the underlying geology and lithology. The plateau is separated from Rift Valley by a series of major fault scarps producing a seep escarpment at the western edge of the valley. Given the geology, soils and climate it would be expected that these geomorphologic process would be highly effective in eroding the landscape.

1.2 Population

Based on Population and Housing Census of the 1994 carried out by the Central Statistics Authority of Ethiopia and adopting average national annual population growth rate of 2.9%, the population of the Awash River Basin was estimated to be about 12,059,000 in 2007 and is distributed into regions falling in the Basin as Table 1 shows [1]. The main population centers lie in the upper Basin and upland areas above an elevation of 1,500 m which is normally the limit for rainfed agriculture. Population densities significantly differ along the Basin with the highland densities ranging from 100 to 250 persons per km^2 while it is less than 1 person/km^2 in the lowlands. Table 1 also shows age profile of the population of Addis Ababa and Dire Dawa cities and Afar, Amhara and Oromiya regions based on the 1994 censuses. The rapidly expanding population in the Basin is placing an increasing pressure on agricultural land and forests, which is resulting in overgrazing, deforestation and land degradation.

Table 1: Population of Awash River Basin in 2007

Region	Population	% of Basin	Population up to 19 years of age	Active age (20-59 years)	Above 59 years
Addis Ababa	2,741,261	22.7	47.6	48.2	4.2
Afar	1,188,309	9.9	59.1	37.4	3.5
Amhara	2,260,001	18.7	54.9	38.6	6.2
Dire Dawa	326,741	2.7	51.2	44.5	4.3
Oromiya	4,521,219	37.5	57.5	36.3	5.3
SNNPR	111,493	0.9	?		
Somali	909,988	7.5	?		
Total	**12,059,012**	**100.0**			

Two types of population live in the Basin. These are sedentary cultivators in Amhara and Oromiya with insignificant number in Afar and Dire Dawa and transhumant pastoralists in the semi-arid and arid parts of Afar and Somali. Other ethnic groups from different parts of the country also live in the Basin. Farmers in the highlands of the Basin depend on the cultivation of food crops mainly for home

[1] MoWR website

consumption. Some part of the highland and the agro-pastoral areas are food deficit. The people make up the food deficit through food aid, off-season employment and selling livestock.

2. Climate and Water Resources

2.1 Climate

The climate of Awash River Basin is influenced by the Inter-Tropical Convergence Zone (ITCZ) which produces a rainfall distribution of characterized by two distinct wet seasons: spring (February to May) and summer (July to September) in the northern plain of the Basin. The southern part of the Basin has two dominant wet periods merging into more continuous distribution caused by prolonged exposure to moist air stream. The subsequent movement of the ITCZ southwards during August, September and October restores drier weather which prevails until the following small rainy season *(belg)*. The mean annual rainfall in the Basin is about 557 mm and varies from below 160 mm in the eastern lowland plains to more than 1,750 mm in the upland areas. Mean annual potential evapotranspiration varies from about 1,500 mm in the highland areas to about 2,500 mm in the lowlands. The amount of rainfall is not only spatially variable but its temporal variation is also significant constraining rainfed agriculture. Mean annual temperature varies from about 7.5°C in the highlands to 45°C at the lowest elevations.

2.2 Water Resources [2]

The Awash River flows east to the Koka reservoir and then descends and gradually turns northward draining the Rift Valley. The river, fed by many tributaries and with gradually declining longitudinal slope, abruptly turns eastward with defined and reduced river channel. The Awash River course within its valley alternates between reaches controlled by lithology and orientated along fault lines and alluvial reaches within which the channel has formed either as a singled-threaded meandering channel or as a channel/swamp system. The significant eastern part of the Basin does not contribute runoff. There are 38 gauging stations in the Basin (16 on the mainstream of Awash River and 22 on its tributaries) with different lengths of records. The total runoff annually generated from the Basin is 4.9 km^3 making the total water resources in the basin 5.7 km^3, out of which an estimated 1.264 km^3 is lost to evaporation and seepage. Ground water resource of the Basin is estimated to be 0.14 km^3. Average specific yield and per-capita availability of surface water are estimated to be 1.41 $l/s/km^2$ and 445 m^3/person respectively.

There are six storage reservoirs with a total storage capacity of 3.506 km^3 at maximum operating level. Three of the reservoirs (75 Mm^3) are for Addis Ababa water supply and one reservoir, namely Koka reservoir (1.071 km^3) is for hydropower and regulation. Two of the reservoirs (1.36 km^3) which are under construction are for sugar cane plantations.

Although the Awash River Basin better developed than other river basins in the country, a master plan has not been prepared for the Basin. However, preliminary assessments and specific studies indicate the irrigation potential of the Basin as 206,000 ha (about 4.76% of the total irrigation potential in the country). The hydropower potential is estimated to be 5,589 GWH per year. Koka Dam which is located in the upper part of the Basin is the first hydropower dam in Ethiopia.

Flooding is a major problem along the middle and lower valleys of Awash River where agricultural related developments (standing crops and infrastructure) and settlements are annually affected.

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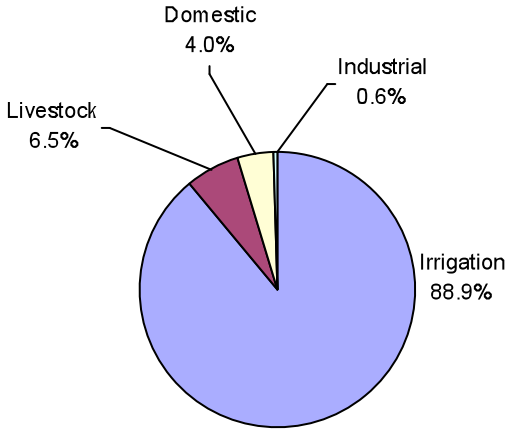
[2] Sources: MoWR website updated in September 2007

2.3 Water Use

Information on water use is not available at any level but agriculture is obviously the main water-consuming sector. Based on the irrigated area covered by the pilot survey and cropping pattern as well as water withdrawal data for large scale irrigation schemes registered by Awash Basin Authority, annual water use for agriculture is estimated to be about 1.444 km^3 out of which about 22 Mm^3 is agricultural drainage water thus making annual fresh water withdrawal for agriculture of 1.422 km^3 (about 25 percent of the total water in the Basin). Out of this about 0.83 km^3 is recorded flow for medium and large scale irrigation schemes and the balance is an estimated irrigation water requirement for community –managed irrigation schemes. Considering an average use of 25 l/d for urban towns including Addis Ababa, 15 l/day for rural towns and 10 l/d for rural areas, domestic water supply is estimated to be about 64 MCM and industrial water use is about 10 MCM which is estimated by applying 30 and 10 percent of domestic uses in urban and rural towns respectively. Similarly, livestock water consumption whose average use rates vary from 0.2 l/day for poultry to 65 l/day for camel is estimated to be about 105 MCM. These make the total water withdrawal in the order of 1.611 Km^3 (about 28.5% of the basins fresh water resources). As indicated in the figure, domestic, industrial, livestock water use is about 11.1 % of the total water withdrawal.

There is a growing concern in water use because of the conflict between the environment and agriculture particularly in lowland rural areas where total base flows are diverted for irrigation releasing little for ecological conservation. Ground water has not been considered for irrigation development mainly due to high investment and running costs. However, the frequent occurrence of drought in the country has made impacts on stream flows and this forced the country to consider groundwater development not only for domestic water supply but also for irrigation particularly for localized and sprinkler irrigation. Pilot irrigation schemes have already been started. Neither wastewater treatment nor reuse of drainage water has been considered for irrigation but the pilot survey indicates that agricultural drainage water was used for irrigating six of the surveyed irrigation schemes with total area of 900 ha.

Figure 1: Estimated Water Use by Category- Awash Basin (2008)



3. Agriculture and Food Security

3.1 Agriculture

As no master plan has been prepared for the Awash River Bain, the potentially cultivable area is not known. However, the majority of the population in the Basin depends on agriculture for their livelihood. There are four agricultural production systems in the basin defined by the main types of farming activity, agro-climatic conditions, natural resources and settlement characteristics.

Mixed Crop-Livestock System: This is the most important system in the plateau and the highland area of the Basin and smallholder rainfed agriculture predominates with limited but complementary livestock production. Cattle are mainly kept for draught power, meat and milk while equines are used as pack animals. Sheep, goats and poultry also play a significant role in augmenting household income. Land holdings are generally small with average landholding less than 1.0 ha which is fragmented into a number of plots with different land uses. The system engages the larger proportion of the Basin's population. Cereals and pulses are the main crops in the cropping pattern with some vegetables mainly for sale. Use of improved seeds, fertilizers and chemicals is insignificant. The average crop yields are in the range of 1-3 ton /ha for cereals and 0.7-1.5 t/ha for pulses.

Agro-pastoralism: In this farming system, crop and livestock are important and irrigation is practiced using traditional and modern diversion, pumps and spate irrigation. The main crops grown are maize and sorghum with some vegetables. While crop residues are used for livestock feed, irrigated forage production is being promoted following its introduction by the FAO in Ethiopia.

Pastoralism: This system plays an important role in the economy of the country and the Awash River Basin in particular. This livestock system is predominant in parts of Oromiya, Somali and almost the whole Afar Region. Livestock do not only play a significant role in the lives of the pastoralists but they are also considered a source of wealth and prestige. The movement of pastoralists with their livestock in search of grazing areas and water used to be guided by customary laws of natural resources management. However, conflicts over the use of water and grazing areas between adjacent clans are becoming a constant source of tension due to resources constraints. Transhumance pastoralism is also restricted by the establishment of irrigated farms along the Awash River which are converted from dry season grazing areas into state and private farms. Crop by-products contributed to animal feed but these are very small compared with the biomass lost from the rangeland and natural conditions. Hence, feed inadequacy remains the single most important impediment to increased livestock production and continued welfare deterioration of livestock dependent people.

Irrigated Farming: Small, medium and large scale irrigation is practiced in all parts of the Basin with medium and large scale irrigation concentrating along Awash River and small scale irrigation schemes dispersed every where. The medium and large schemes are state and private commercial farms producing sugar cane, cotton, fruits, vegetables and tobacco. Community-owned small scale irrigation farms produce maize, sorghum and some vegetables as well as cotton. Yield of cotton is steadily declining from time to time due to a number of factors including recurrent water shortage, inefficient water management, poor seed quality, flood and incidence of pests and diseases as well as social and environmental problems. Yield of cotton varies from 3.5-5.0 ton/ha whereas maize and sorghum yields are 2-2.5 and 1.2-1.8 ton/ha respectively.

Livestock are an integral of every farming system in the Basin. The total number of livestock in the Basin in 2007 is estimated to be about 6.74 million tropical livestock units (TLUs) comprising 6.87 million cattle, 3.05 million sheep, 3.64 million goats , 1.19 million equines, 0.41 million camels, 6.22 million of poultry and 0.263 million bee colonies. In the water management areas (irrigation schemes), stocking densities are very high reaching up to a range of 8.2-18.6 TLUs/ha. The

recommended values are 2 TLU/ha for well managed pasture in the highland area and 0.4 TLU/ha in lowland arid areas thus indicating the real concern for the livestock subsector.

3.2 Food Security

Much of Ethiopia's rural population lives in a state of chronic food insecurity. Recurrent drought, degradation of natural resources and rapid population growth are among the main causes of declining per capita food production. Average daily energy intake is estimated at 16 to 20 percent below the accepted minimum. Aggregate data at Awash River Basin level is not available. However, the same situation or even worse prevails within Awash River Basin. Agriculture in the Awash River Basin is characterized by the predominance of subsistence farming, with most rural households combining livestock and food and/or cash crop activities in the highlands, and being pastoralists and agro-pastoralists in the lowlands, with the exception of large scale irrigation farming (mainly for sugarcane and cotton) in some specific places. Rural households generally produce their own food and also purchase from the market. For them, the effectiveness of food market systems is as important as the reliability of food production for personal use. About 40% of the 122 woredas (30 woredas are in Addis and Dire Dawa) in the Basin are food insecure. The proportion of food insecure woredas in Afar and Somali regions is about 54%.

4. Irrigation and Drainage Development

4.1 Irrigation Development

Irrigation development in Ethiopia dates back centuries. Modern large scale irrigation schemes were established along Awash River in the early 1960s with cropping pattern dominated by industrial crops such as sugar cane and cotton. Currently the area under irrigation in Awash Basin is not known. According to the pilot baseline survey carried out in 2008 on the upper part of the basin and parts of the middle basin where public and commercial irrigated farms are concentrated there are, a total of about 67,700 ha is under irrigation in the basin (Table 2). These include about 19,500 ha of public (estate managed medium and large scheme schemes), 13,200 ha under private entrepreneurs (small to large scale schemes) and 35,000 ha of community-managed small to medium scale irrigation schemes including about 160 ha of individual or community schemes using water harvesting, flood recession or wetland irrigation systems.[3]

Table 2: Partial Area equipped for Irrigation in Awash Basin covered by baseline Survey

Category	ha	Scale	Ha	Water Source	Ha
Public	19 526	Larger	28 710	Surface water	61 911
Community	35 024	Medium	25 328	Ground water	4 892
Private	13 154	Small	13 666	Other sources*	901
Total	**67 704**		**67 704**		**67 704**

*Reuse of Agricultural Drainage Water

There are two forms of small scale irrigation schemes. Traditional irrigation schemes are small scale operations developed by the farmers themselves with little or no support. The diversion structures are constructed from local materials such as woods, stones and earth. Water is regulated by stone and soils and canal breaching is a common problem triggering gully development. The farmers apply mainly furrow irrigation and cultivate cereals and vegetables. The second are modern small-scale irrigation schemes which are also community-managed but are constructed by Government/NGOs with farmer participation. River diversion with permanent structures, pumps, and micro-dams for storage all with well laid irrigation distribution system are included in this category. Accordingly, 24

[3] Small, medium and large scale irrigation schemes are up to 200 ha, 200-3,000 and above 3,000 ha respectively.

440 and 43 264 ha are irrigated under traditional under modern irrigation systems respectively. Although water users associations (WUAs) or irrigation cooperatives are established for some of the irrigation schemes, water management techniques are still poor. Furrow irrigation is the main irrigation method applied in all the surface irrigation systems.

4.2 Status of Drainage Systems

Although drainage is an integral part of an irrigation system, it has not be given due attention even in large scale irrigation schemes in Ethiopia. A few surface drains are constructed only where significant runoff is expected to avoid damage to irrigation structures. Drainage systems are incorporated in the design of modern small scale irrigation schemes but they have never been implemented. Irrigation canals serve as drains in some cases. Construction of subsurface drainage system was started for Melkas Sedi/Amibara large-scale irrigation scheme in Awash Valley for salinity control but that discontinued. This is the only irrigation project that has a surface drainage system. According to the baseline survey, only about 90 ha of the irrigated area and about 890 ha of non-irrigated area are drained.

The highland farmers used to construct surface drains at critical locations in the rainfed fields to remove excess rainfall or runoff. The major problem of these traditional drainage systems is that the drains have been improperly laid out and constructed with low capacity. Hence, they used to be converted into gullies. Since recently due to the training of farmers in natural resources conservation and land management they are constructing drains with proper layout and shape. There is a lot to be done in making reasonable estimates of runoff rates and sizing of drains.

5. Institution and Finance

Several institutions are directly and indirectly involved in water resources development and management. The overall responsibility for planning, development, management, utilization and protection of the country's water resources as well as supervising all water development activities carried out by other institutions is vested in the Ministry of Water Resources (MoWR). Other institutions involved in the water sector development include:

Federal level institutions:
- Ministry of Agriculture and Rural Development (MoARD) is responsible for small scale irrigation development, water harvesting and watershed management;
- Ethiopian Electric Power Corporation (EEPCO) responsible for hydropower scheme development; and
- Environmental Protection Authority (EPA) responsible for the preparation of environmental protection policy and laws, directives and systems necessary for evaluating the impacts of social and economic development projects

Regional Institutions: Water Resources Development Bureaus responsible for small-scale irrigation and water supply schemes; and Agriculture and Rural Development Bureaus (BoARD) in charge of extension services in rainfed and irrigated agriculture, implementation of water harvesting and watershed development programmes and projects.

Organizational Structures

The Ministry of Water Resources has the 15 Directors of which the main ones are the following:

1. Irrigation and Drainage: Responsible for medium and large scale irrigation schemes
2. Master Plan Preparation, Implementation and Monitoring
3. Water Resources Information: with two sub-directors (Hydrology, and GIS, Remote Sensing and metadata)

4. Dams and Hydropower
5. Ground water study and monitoring
6. Permit and Water Control
7. Water Supply and Sanitation
8. Transboundary Rivers Administration
9. Water Development and Research
10. Policy and Plan Preparation, Implementation and Monitoring
11. Service Delivery and Monitoring
12. Human Resources
13. Audit, Public Relation, Gender Affairs Directorates

Regional Water Bureaus have different organizational setups: At region level, all regions have two major sectoral divisions: Irrigation and Water Supply. In some region like in Amhara, Oromia, South region (SNNPR) and Tigray, the setup goes down to zone and woreda levels while in others the structural setup remains at region.

NGOs: Some NGOs, the main ones being Organization for Rehabilitation Development of Amhara (ORDA), World Vision Ethiopia, SOS Sahel, Water Aid, Water Action, Agri-Service Ethiopia, etc are also involved in the water sector particularly in small-scale irrigation and rural water supply projects.

Awash Basin Water Resources Administration Agency (ABWRAA) responsible for the overall water resources management of the Awash River Basin

Awash Basin Water Resources Administration Agency (ABWRAA)

ABWRAA which was established under the Proclamation 129/1998 (1) is the first Basin Agency entrusted with the management and administration of the river basin in Ethiopia. The Agency has many commercial characteristics and a mandate to be self-financing and is vested with the following powers and duties:

a) Overall administration of surface water in the Basin;
b) Construction and operation of water works and enforcement of health and safety standards;
c) Issuing permits for water extraction and waste water discharge;
d) Maintenance of major irrigation works and collection of water charges;
e) Monitoring and control of groundwater levels to prevent secondary salinization; and
f) Monitoring flood events and implementation of flood protection works

The Agency has a decision-making body known as River Basin High Council which is chaired by the Deputy Prime Minister and has seven ministerial and agency members (Ministries of Finance and Economic Development, Water Resources, Agriculture and Rural Development, Industry, Mines and Energy, Ethiopian Power Corporation, Geological Institute of Ethiopia) and regional presidents whose regions fall within the Basin. The Council which meets twice annually invites regional water bureau heads, two major water users and others as deemed necessary to its meetings. The Agency has dual accountability and reports to the Council and MoWR. Its main office is located at Werer/Amibara (about 275 km East of Addis Ababa) and two branch offices at Dupti and Metehara. It has about 300 permanent staff.

The capacity of the ABWRAA to carry out the tasks mentioned above is so far limited. Its offices have inadequate facilities and logistics support and among the staff are a disproportionately high number of non-productive support staff as well as many unskilled temporary and contract employees , Constrained by limited resources; the Agency's functions have been limited to monitoring the functioning of the Basin by technicians at each major water user; operation and maintenance of primary irrigation infrastructure, construction and maintenance of flood protection works, construction and maintenance of access roads, networking with other stakeholders, issuing of water permits and collection of water charges from large enterprises. Small scale irrigation operators who

are mainly community groups do not pay water charges for the reason that they do not receive adequate service.

The planned development of large scale irrigation schemes and the expansion of community irrigation schemes and private investments in the Basin require proper allocation and management of the Basin's water resources, tasks which ABWRAA cannot fulfill as per the present situation. Therefore, the Flood Study recommended[4] restructuring ABWRAA in order to enable addressing the present shortcomings with respect to staffing issues and to strengthen management and implementation capacity. The restructuring proposal includes transforming the Agency into a proficient self-financing, service oriented body with the technical and administrative capacity to take responsibility for the operation and management of water resources in the basin through public consultations on medium and large water development projects and establishment of water user associations (WUA).

The Federal Government allocates budget for the ABWRAA while part of its annual budget is covered from revenues generated from different activities including irrigation water use charges, water works and discharge permits, flood protection levy, and from hiring out earthmoving machineries to other agencies.

[4] Awash River Basin Flood Control and Watershed Management Study Project, Phase 2 Summary Report, Volume 2, Annexes B-C, Halcrow, November 2007

6. Perspectives for Agricultural Water Management

Ethiopia cannot meet its large food deficit through rainfed production even in good years and this condition, with growing population pressure in the highland areas of rainfed agriculture on a rapidly declining natural resource base, has secured irrigated agriculture a prominent position on the country's development agenda. The Awash River Basin is the most developed basin in the country in terms of irrigated agriculture. Although there is no basin-wise information on area planned for irrigation, there are four large scale irrigation schemes under construction. Two of them are public schemes with aggregate area of about 90,000 ha for sugar cane production and the other two with a total planned area of 22,000-25,000 are community schemes. There is no a plan for small scale irrigation schemes in the basin, but farmers and communities abstract water wherever the river morphology and physiographic conditions permit.

Applying the annual gross irrigation water requirement of Metahara sugar estate[5] of 23,120 m^3/ha for large scale schemes and 16,000 m^3/ha for typical community farms (mixed cropping), the total annual agricultural water withdrawal from Awash River may increase from the present estimate of about 1.42 km^3 to 3.9 km^3 in 3-5 years if all irrigation schemes currently under construction will work at full capacity.[6] That would mean a dramatic reduction of available water resources, as the share of renewable water resources in the basin abstracted for agriculture would increase from 24% to 75%.

So far, irrigation development has been based on a single project approach and hence, it had both positive and negative social and environmental impacts. The water management policy of 1999 emphasizes on integrated approach of water resources development to maximize positive impacts and avoid or minimize negative effects of irrigation development. As the implementation of the policy is expected to bring a positive impact on water resources, irrigation management and food security, the policy is welcomed for its emphasis on integrated approach including food security dimension, environment and gender considerations. The policy also underscores that project funding will be based on cost sharing principle and cost recovery system and this is expected to attract donors. As a result of the policy, the following departments/units have been established within the Ministry of Water Resources:

Irrigation and Drainage Department
Dams and Hydropower Department
Policy Development Coordination and Foreign Relation Department
Water Utilization Control function Section within the Master Plan Development Studies Department
Research and Development Department
Water Resources Development Fund (WRDF) which is weak in mobilising resources.

7. Environment and Health

7.1 Environment

The potential and existing environmental hazards in the Awash River Basin include soil erosion, sedimentation, flooding, river channel change, water quality deterioration and salinization. Due to the poor agricultural practices combined with undulating topography, high intensity of rainfall in the upper catchment of the Basin, soil erosion is high reaching in 60-100 ton/ha per annum with an average erosion rate being about 67 ton/ha per year [2]. With an average soil density of 1.65 gm/cc,

[5] The Metahara estate alone for 65% of the total water withdrawal from Awash River

[6] The current estimate of 1.42 km^3/year is an underestimation as it comprises only the withdrawals from the sites included in the baseline survey, which covers about 19 % of the irrigated area in the basin.

this is equivalent to losing 0.4 cm of top soil annually. Sedimentation and flooding are serious problems in the middle and lower valleys of the Basin both damaging and destroying agricultural and range lands as well as infrastructure including settlements and causing livestock and human lives. The sediment load also disrupts the functioning of gauging stations. The Koka reservoir is silting up at a rate of 17 Mm^3 per year [4].

The extent of rangeland degradation in the Basin is unbearably high. As witnessed by heavy infestation of invasive species such as Prosopis and the widespread absence of ground vegetation to protect the soil,, presently most middle valley rangelands are in state of poor condition. Both natural and manmade factors have contributed to this undesirable state of affairs. Drought, which has already become a common phenomenon in the most part of the Basin, has contributed to the loss of desirable herbaceous forage species. Primary rangeland production even in non-drought years is generally low due to the low, erratic and unreliable nature of the rainfall regime. Periodic drought when combined with other factors such as overgrazing accelerates the depletion of vegetation cover and soil-seed bank of desirable herbaceous forage species. Since most of the rangelands are part of the watersheds, overgrazing has triggered surface run-offs that resulted in the loss of top soil, flooding and siltation of rivers.

The problem of water-logging is also a serious in some localities such as Becho plain in the upper part of the Basin and Gewane areas. While the former is rainfed agricultural land and settlement the latter is not under any type of use but has created favourable conditions for the proliferation of malarial mosquitoes. The pilot survey indicated that only 3 ha of irrigated areas are waterlogged while about 190 ha are abandoned due to salinity. It also indicates that about 6 ha of the irrigated areas are eroded and flooded due to steep canal routes and and 13 ha degraded due to improper intake structures.

Salinization is also the potential problem in the middle valley. Although the extent is not known, some areas in this valley are abandoned due to salinization caused by irrigation and flooding. Water quality is becoming the major problem because of directly discharging untreated industrial effluents into the river system. The majority of industrial effluents come from the urban centers of Addis Ababa and Mojo.

7.2 Health

According to the Ministry of health, the rural population has little access to modern health services which leads to inability of the system to respond to both qualitatively and quantitatively to the health requirements of the people and the situation in the Basin is not different. About 75% of the population suffers from some type of communicable diseases and/or malnutrition both of which are preventable. Malaria is the most deadly disease in the middle and lower valley of the basin followed by HIV/AIDS although figures on affected population are unavailable. To mitigate the health problems the regional government supported by international donors and NGOs is expanding health stations and health posts and is undertaking awareness raising campaigns for rural communities.

11% of 520 irrigation schemes covered by the pilot survey in the upper Awash Basin report malaria problem related to the introduction of irrigation. This proportion is low because the survey was carried out in highland area of the basin where malaria does not spread easily.

One of the major health concerns in urban/peri-urban irrigation is related to water quality. Most Irrigation schemes in Addis Ababa use small streams which are sinks of industrial and residential effluents. The water is observed to cause discoloring of irrigators' skins for which they simply use skin lotions. Although not assessed, this indicates a risk of some sort of microbial contamination and parasites such as giardia, microorganisms and this is a concern particularly for vegetables such as lettuce and cucumber supplied from such irrigation schemes.

8. Main Issues in the Awash River Basin

The upper part of the basin receives high rainfall while the major part of the Basin has short and intense rainy season with highly unreliable rainfall leading to frequent droughts and flooding in the middle and lower part of the basin. Hence, rainfed crop production has been increasingly becoming impossible in the larger part of the basin.

Many of the small tributaries of Awash Basin are becoming intermittent, i.e. the flow of water in dry years can occur only for a few months.

All its tributaries originate from Amhara and Oromia highlands where most of the steep lands are under cultivation. This improper land use coupled with high rainfall intensity resulted in increasingly high soil erosion rates and deposition on rangelands, and economic and social infrastructure (hydropower plants, irrigation schemes, settlements, etc).

In the lower basin, grass cover is rapidly deteriorating due to overstocking, recurrent drought, soil erosion, deforestation, sedimentation of infertile soils and the rapid expansion of Prosopis, all affecting livestock feed..

Over-utilization of water resources and pollution arising from high-density urban settlements (Addis Ababa, Nazareth, and Modjo), and other industrial development have an impact on the social, economic, and natural environments downstream.

Management issues regarding agricultural water use:

- weak administration of water resources (weak basin authority)
- uncontrolled expansion of irrigated area coupled with inappropriate water abstraction and water management causing water scarcity and conflicts

9. Information and Data Gaps

Information gaps, as they are perceived at the current point in time, are indicated below. They are either lacking or are not readily available and would be time consuming to assess them:

Spatial distribution of irrigation schemes and other water control systems in the Basin
Detailed spatial information on the crops grown in small scale rainfed and irrigated agriculture to make more accurate estimates on agricultural water use in these systems
Availability of farm-scale soils information
Local rangeland benchmark descriptions
Detailed rangeland condition assessments for comparison with benchmarks
Spatial aspects and intensity of drought phenomenon
Effectiveness of farmer support and information technology in various districts
Basic farming (and irrigation) practices that may be improved in relation to local soil types, markets and infrastructure
Agricultural water use
Benchmark soil sites
Risk management support systems
Best practice technologies for particular soil-climate-cultural-market situations.
Land quality indicators for use in monitoring and evaluation.
Data on water quality

10. References

1. Awash River Basin Flood Control and Watershed Management Study Project, Phase 2 Summary Report, Volume 2, Annexes B-C, Halcrow, November 2007

2. Awash River Basin Flood Control and Watershed Management Study Project Baseline Report 2, Volume 1 Main Report: Socioeconomic Appraisal and Community Development, Halcrow, February 2007

3. Awash River Basin Flood Control and Watershed Management Study Project Baseline Report 5, Flood Control, Drainage and Irrigation Development, Halcrow, October, 2006

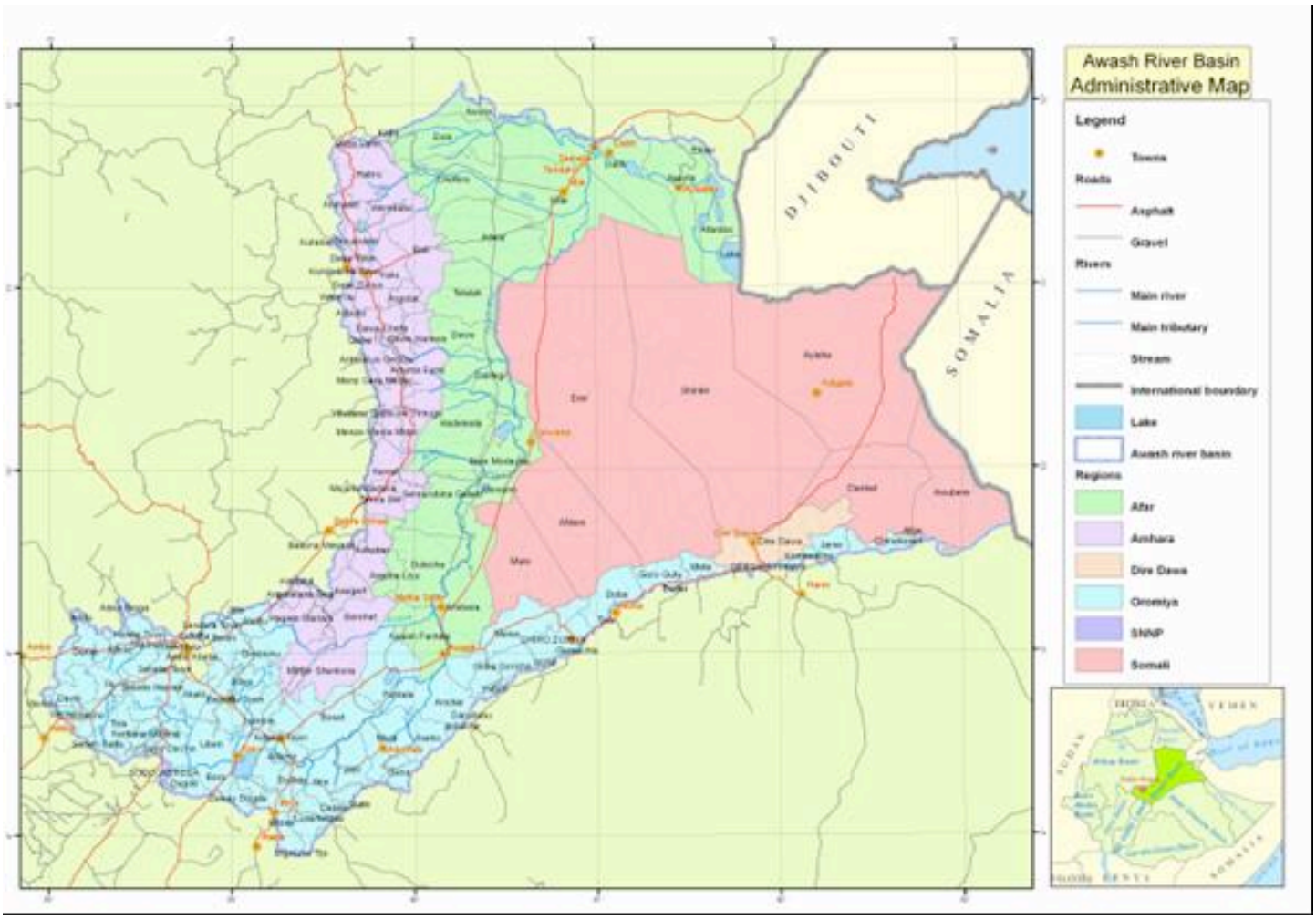
4. Awash River Basin Flood Control and Watershed Management Study Project, Phase 2, Vol 1, Main Report, Annex A; summary Component Profile Sheet, Halcrow, October, 2006

5. Strengthening Water Sector Monitoring an Information System in Ethiopia with GIRWI, Final Report of the Diagnostic Phase, Getachew Alem and Associates and Giovanni Canitano, May 2008

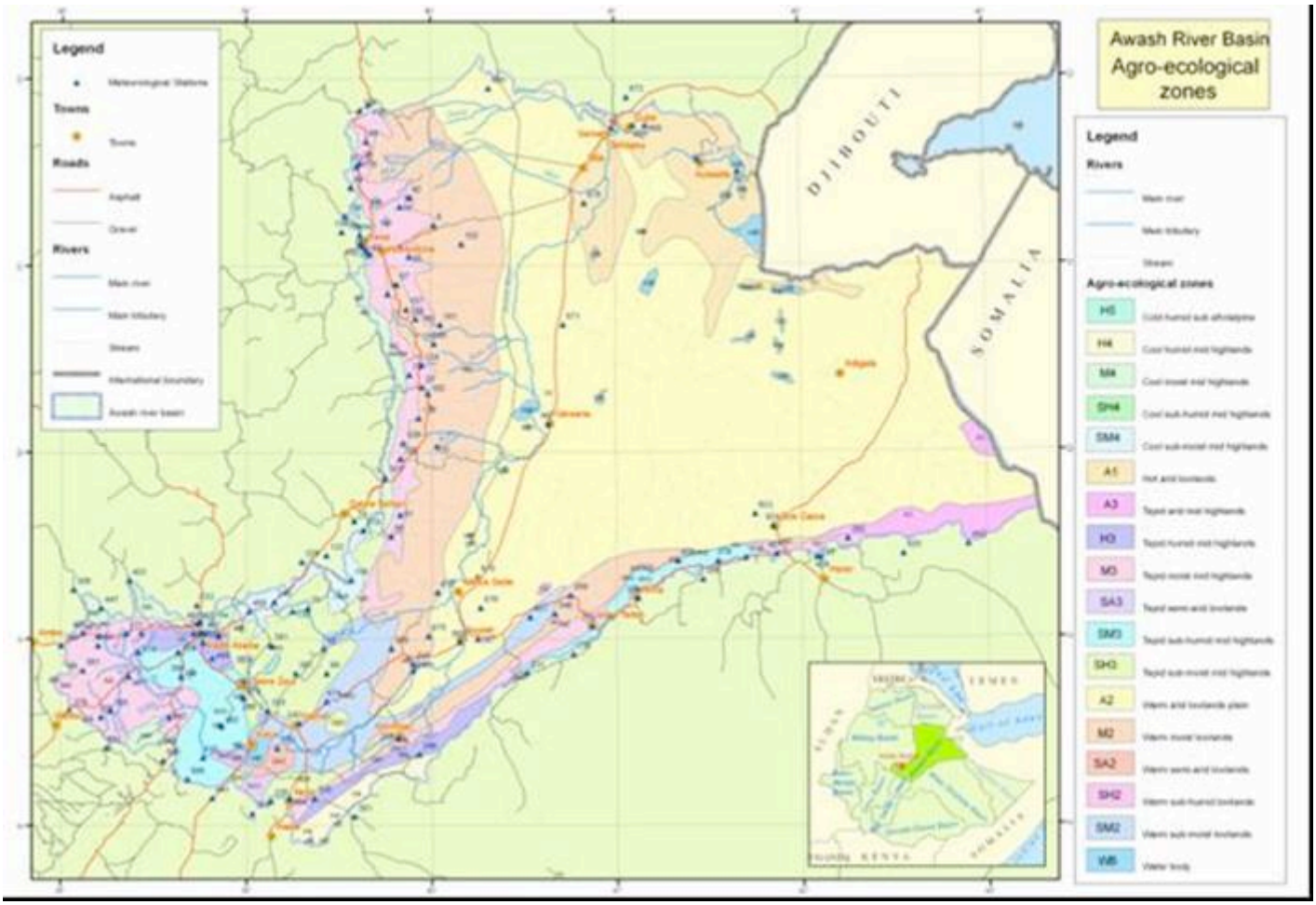
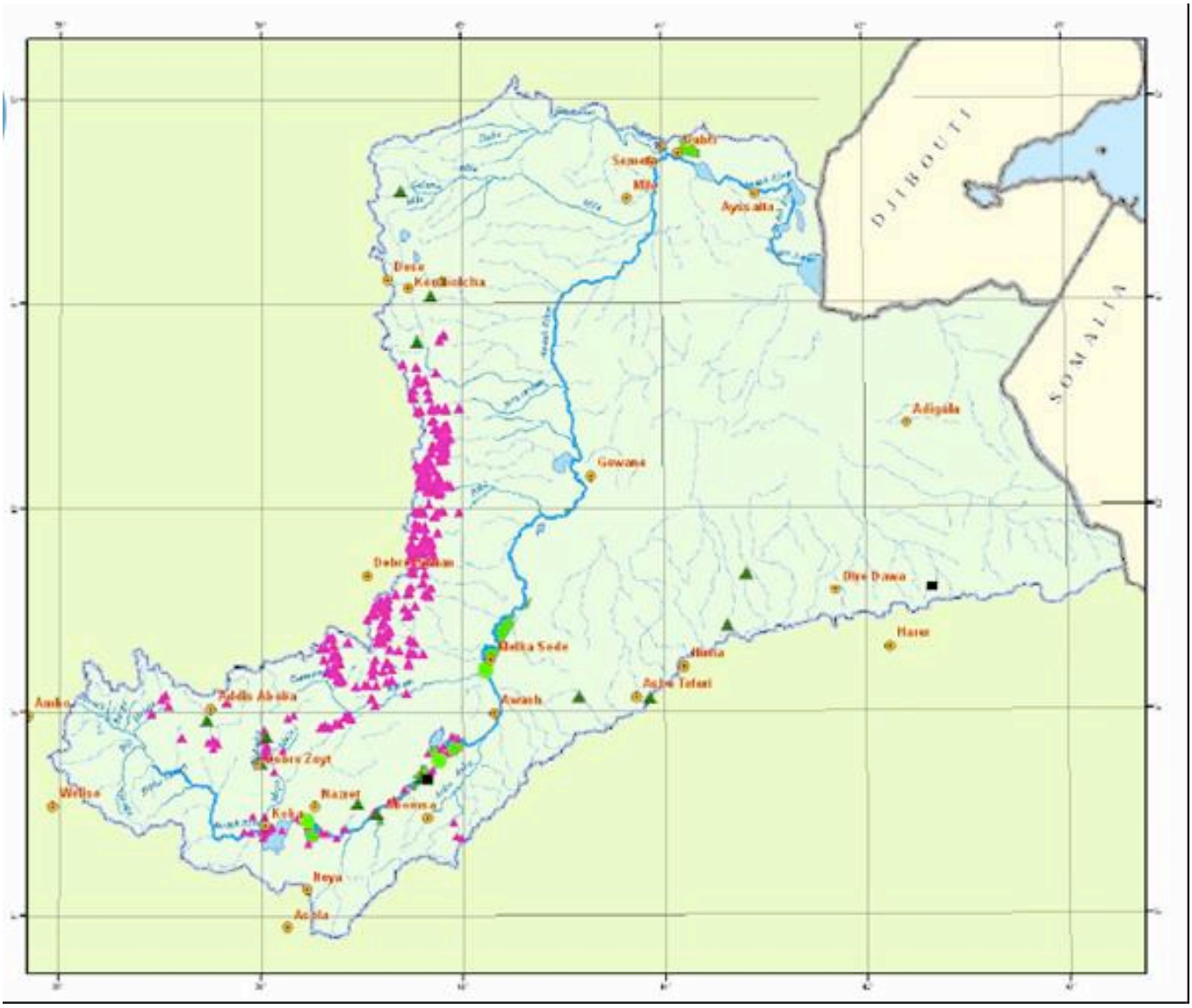
6. Website of Ministry of Water Resources of Ethiopia (http:/www.mowr.gov.et/)

7. Ethiopian Water Resources Management Policy, 1999

Annex 1: Awash River Basin



Annex 2: Agro-ecology Zones of Awash Basins



Annex 3: Irrigation Schemes in Awash Basin covered by pilot Survey