

# Baseline Survey of Irrigation and Rainfed Agriculture in Blue Nile Basin

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## **Abstract**

This paper discusses issues and challenges of agricultural developments in the Blue Nile Basin of Ethiopia. The crop land in the basin can not sustain the population unless agricultural productivity increases. Due to climatic factors and low yield rainfed agriculture can not support the high population in the basin. Up to date the land under irrigation is very small. Like most Nile Basin countries though agriculture dominates the economy of Ethiopia much was not done in the irrigation agricultural resources development.

Irrigated agriculture is the largest draw on the waters of the Nile in Egypt and Sudan. But the others 8 Nile countries agriculture is mainly rainfed and they are not using even 2% of Nile water. Ethiopia is contributing more than 85% of the Nile water annual discharge and yet is not using even 1 % of it. In near future the water scarcity in agricultural development of the Nile Basin can be affected by ever increasing population, unpredictable climate, soil infertility, uncertainty of surface water allocations, unexplored groundwater resources, low water availability, infrastructure etc. Agriculture is by far the main user of water in the Nile basin and therefore requires due attention in future investments. Ethiopia does not achieve food security until it utilizes Nile water for irrigation.

## **1. Background**

The Nile river basin covers an area of approximately 3.1 million square kilometers and with a total population of

around 370 million people. The Nile basin countries are Burundi, the Democratic Republic of Congo, Egypt, Eritrea, Ethiopia, Kenya, Rwanda, Sudan, Tanzania and Uganda.

The FAO-ITALY supported project “Information Products for Nile Basin Water Resources Management” is implementing a basin wide survey of current and future water use in rainfed and irrigated agriculture. The Project “Information Products for Nile Basin Water Resources Management” is intended to strengthen the ability of the governments of the ten Nile countries to take informed decisions with regard to water resources policy and management in the Nile basin. The project is supported by the Government of Italy and carried out under the umbrella of the Nile Basin Initiative, of which Italy is a full partner. The project will make extensive use of regional expertise. It will also draw on the specific experience and knowledge residing at FAO, especially in the fields of agricultural water use and water productivity.

## **2. Objectives**

The survey is intended to provide stakeholders and decision makers in the Nile Basin with a thorough assessment of the linkage between agriculture and water in the basin. The survey is expected to address the following issues:

- What are the opportunities for enhancing productivity in agriculture?
- Create Agricultural production database at district level providing information on area, yield, and production for the main commodities for a baseline year from (2000);
- Analysis of the current agricultural productivity under rainfed and irrigated conditions;

- Rapid export growth through production of high value agricultural products;
- Decentralization to shift decision making closer to community to improve responsiveness and service delivery;
- Increase proper and modern water resources utilization.

### 3. Rainfed Agriculture

- A baseline survey (for the year 2000 and onwards) of agricultural water use covering all aspects of agriculture is in progress. The survey includes a detailed review and maps of population, land use, cropping patterns, estimate of water use in rainfed and irrigated agriculture, and an assessment of current water development facilities.
- Projections for 2030 of demand for food and other produce in the basin, with estimates of arable land expansion in irrigated and rainfed agriculture, yields of major crops, cropping patterns, and cropping intensities will be executed. Results of a set of scenarios on water development for agriculture will be based on analysis by administrative units.
- The study will focus at national and sub-national levels with particular attention to the main crop production systems. Agricultural water productivity will be analyzed at district level. Results will be aggregated to country level with the aim to build up a comparable picture of water productivity in rainfed and irrigated agriculture across the basin.

rain fed agriculture is the major livelihood of the country, which is characterized by low productivity associated with underdeveloped, low input systems and highly degraded natural resources. peasant agricultural lands on the plateaus of the northern and south-central part of ethiopia have been degraded because of over-utilization for centuries. one cannot hope that ethiopia can maintain her food production through the traditional farming method of highland agriculture. absolute dependence on rainfed agriculture and low productivity associated with underdeveloped, low input systems of production and degraded natural resources base has rendered these areas highly vulnerable to even minor shocks. irrigated crop

production is insignificantly low in these areas. different agro ecological considerations might lead to the improvement of agricultural production. the following map shows the main agro ecological zones of the basin. one can see clearly the topography in the east is not easy for farming (figure 1). regional specialization based on suitability and provisions of compatible packages for the different agro ecologies that will lead to the improvement of small-scale agricultural production are the basic development directions.

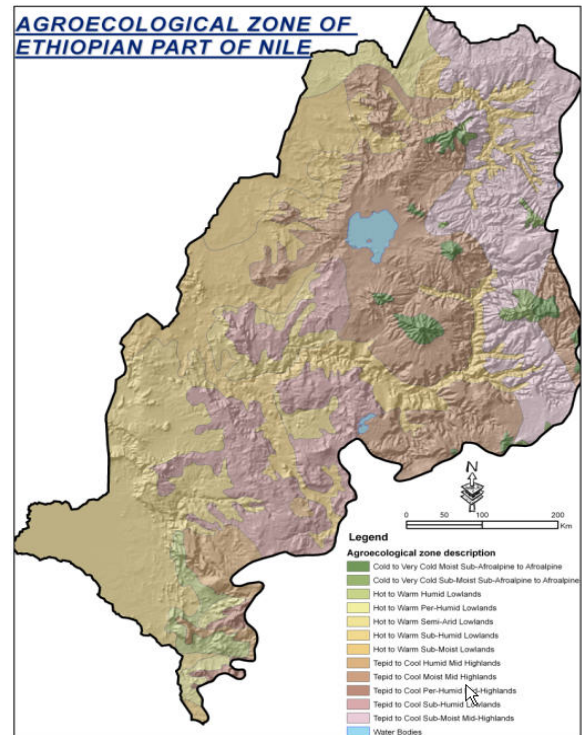


Figure 1. Agroecological Zone of the Blue Nile Basin

Production and productivity are very low in the basin and the use of improved productivity enhancing inputs and technologies is extremely low. The expansion of irrigated agriculture is among other factors is constrained by the rugged topography and terrain. Most of the regions have poor market access due to underdevelopment of infrastructure as whole and agricultural markets in particular. Natural resources degradation (soil erosion and deforestation) are extremely severe in the basin, which makes it a necessity for all development interventions to be oriented towards

sustainable natural resources management as a matter of priority.

### 3.1 Crop yield distribution of Blue Nile Basin

Crop data from rain fed and irrigated agriculture was collected from Nile Countries through national consultants. Major crops were provided in terms of crop production, acreage and yield.

The only district based agricultural survey was carried out in the year 2001/02 (1994 Ethiopian Calendar). However the survey data from 1994 (1987 Ethiopian calendar) provides also useful information on area, production and productivity even if this survey was zone based.

The crop production data is for both seasons ("Meher" and "Belg") for all holdings. The "Meher" is the major season while the "Belg" is the small season. Crops harvested between the months of September and February are considered "Meher" crops while those harvested between the months of March and August are considered "Belg". Private peasant holding is predominant while large-scale commercial production is negligibly very little. In this rainfed production dominated small scale farming system, the share of irrigated agriculture is also very little. The distribution of some major crops yield was displayed on (Figure 2,3,4). Countries like Egypt, Kenya have higher yield than Ethiopia. Especially Egypt which has used all its crop land for irrigation agriculture attains the highest yield in the Nile Basin. The yield for Blue Nile of Ethiopia is quite low in the range of 0.3 ton/hectare to 1.5 ton/hectare for major cereal crops.

The following maps present the spatial distribution of the dominant crops found in the Basin. It aims to provide insight in the cropping distribution of the farming systems, in particular in relation to the natural conditions determined by topography and climate.

The data presented are the result of an intensive database compilation on reported cropping statistics. As such they combine findings from multiple data sources. After a process of quality

control, data were eventually selected as per the principle "best data source so far available around the reference year 2000". All data are presented as they are and occasionally represent different time periods. It is to express types and distribution of cropping systems. Map of major crops (teff, wheat, maize etc).

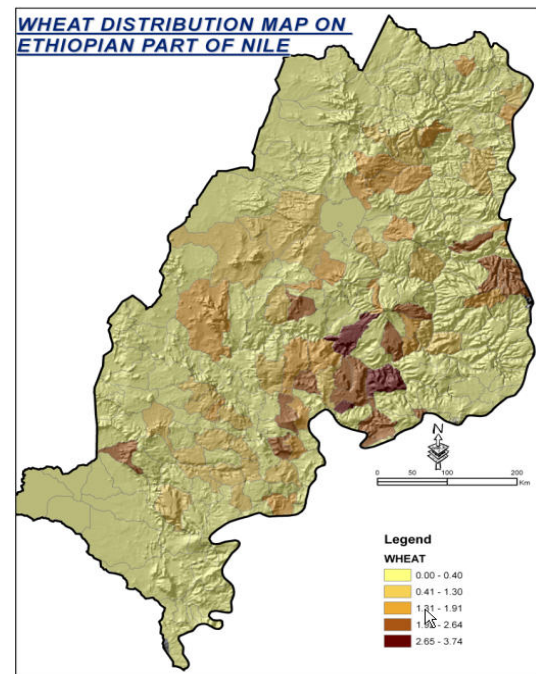


Figure 2. Wheat distribution of the Blue Nile Basin

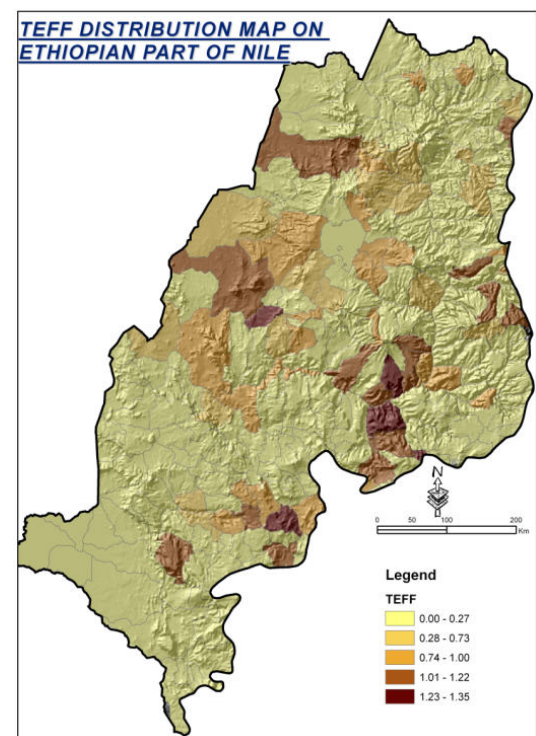


Figure 3. Teff Distribution of the Blue Nile Basin

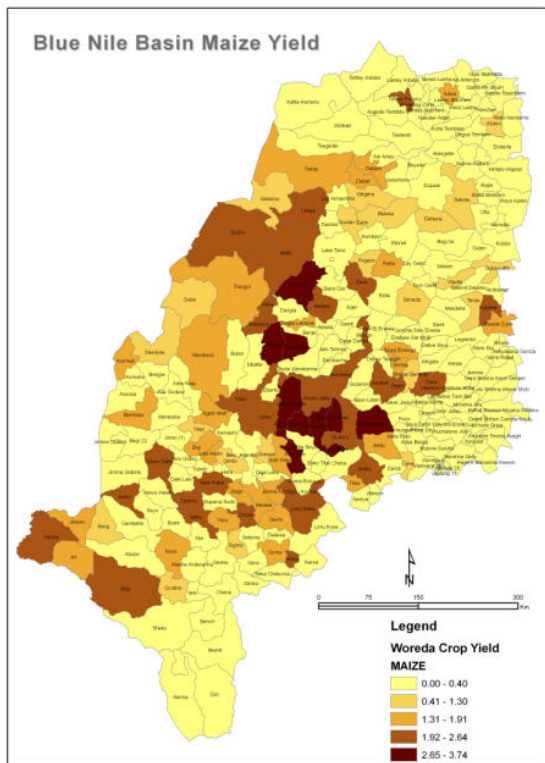


Figure 4. Maize Distribution of the Blue Nile Basin

#### 4. Potential and Existing Irrigation Schemes

The fundamental goal of achieving sustainability irrigation Agricultural system is complex and initiates many new questions that require further studies, which in turn requires multi-disciplinary collaboration and funding. The investigation and further study programs would be essential for development of improved methods and technology for improving agricultural productivity, and to alleviate future scarcity of water. The assessment of methodologies for sustainable development is also quiet essential. In addition, the goal requires continuing research and gathering field data to assess management approaches. So this project output supports and benefit the Nile Countries to some extent.

Blue Nile of Ethiopia covers an area of about 367,000km<sup>2</sup> and a population of 31 millions according to 2005 UNPD figure. The Nile Basin in Ethiopia stretches over a very wide geographic area with diverse agro ecological conditions. The Nile basin comprises of the following contributing basins:

- The Abay river basin
- The Tekeze river basin
- The Baro Akobo river basin
- The Mereb river basins (partially)

The Nile Basin of Ethiopia known as Blue Nile contributes more than 85% of the annual discharge of the Nile being a big contributor, Ethiopia to date use only 1% of it.

According to the Master Plan Studies of Ministry of Water Resources, Blue Nile Basin has 165 Potential irrigation sites with total area of 2,126,700ha. The existing irrigation schemes have been collected as point data and it is difficult to calculate the area.

#### 4.1 Blue Nile and GIAM

According to Global Irrigated Area Map (GIAM) most irrigation lands are situated in Egypt and Sudan. The rest upper Basin countries have minor land under irrigation. Ethiopia Blue Nile land under irrigation is so small compared to its potential area. According to the Master Plan Studies of Ministry of Water Resources, Existing irrigation is 57,561 ha and the potential is 1,774,676 ha. Ethiopia in order to feed her fast growing population the irrigation potential of the country has to be developed.

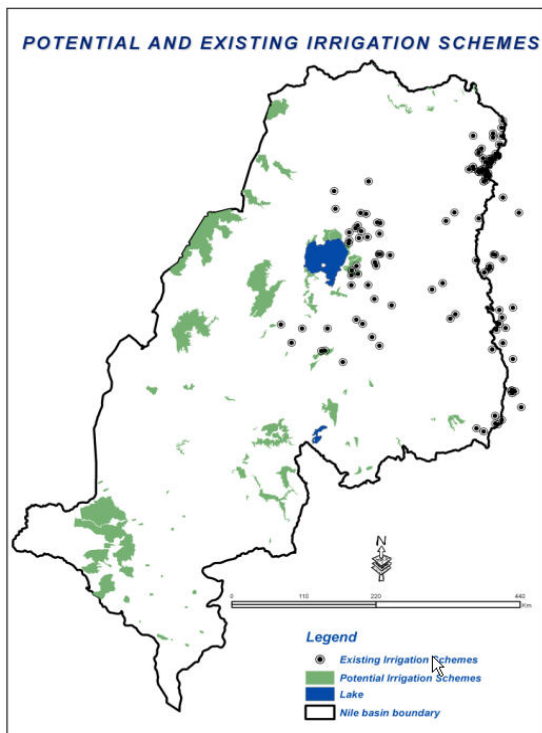


Figure 5. Potential and Existing Irrigation Schemes of the Blue Nile Basin

Table 1. Existing and potential irrigation Summary in the basin

Sub-basin	Administrative Units	Area (km <sup>2</sup> )	Mean Water Resources (*10 <sup>6</sup> m <sup>3</sup> /yr)	Existing Irrigation (ha)	Potential Irrigation (ha)
Blue Nile (Abbay)	Amhara, Benishangul Gumuz, Oromia	199,812	49,000	37,347	719,088
Baro Akobo	SNNPR, Oromia, Gambella, Benishangul Gumuz	75,912	23,237	12,315	486,299
Tekeze/At bara	Tigray, Amhara	86,510	8,191	7,899	569,289
Total		362,234	80,428	57,561	1,774,676

topography. But there are some pocket areas which have potential for irrigation.

The irrigation potential of Ethiopia is estimated between 1.8 (Blue Nile Basin) and 3.7 (for the whole country) million hectares out of which only 5% is under irrigation (Irrigation in Africa by Food & Agriculture of the UN programme latter called AQUASTAT). As it is displayed in (Figure 5) Evapotranspiration map in general the west marginal area which is in

reddish brown color though it is flat and convenient for irrigation, it has high evaporation. The eastern and central part of the basin with bluish color is characterized by low evapotranspiration and rugged

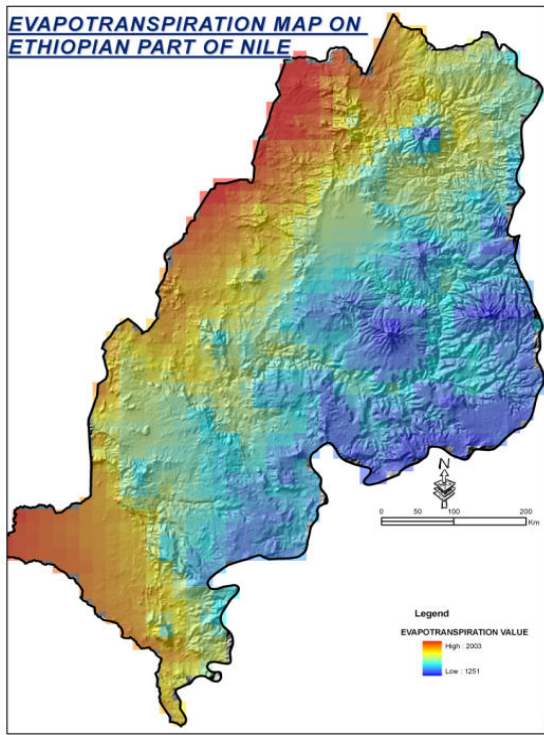


Figure 6. Evapotranspiration Map of the Blue Nile Basin

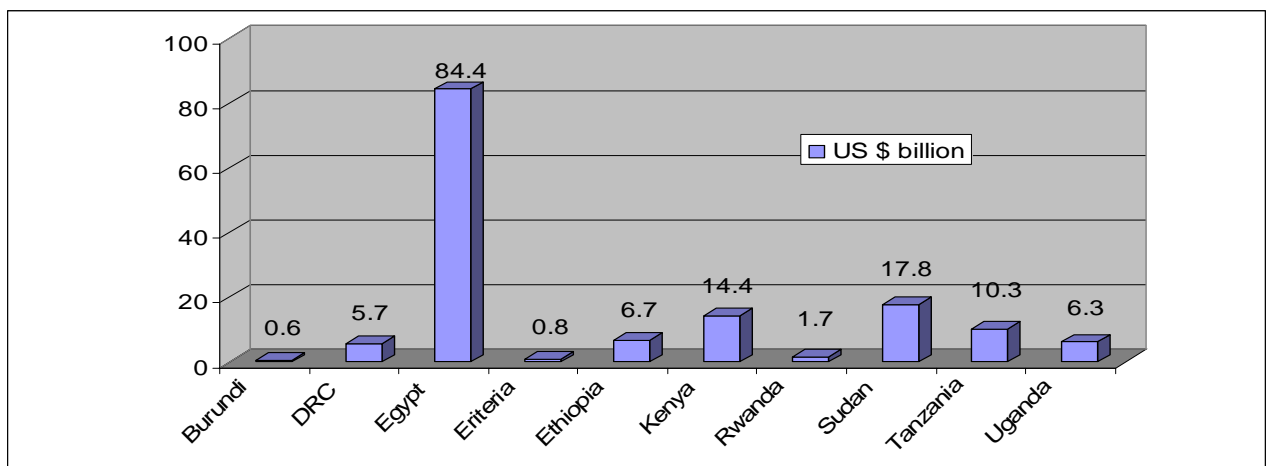
### 5. Agricultural Trade of Nile Basin countries

Agriculture dominates the economies of most African countries, providing jobs,

income exports. A stronger performing agricultural sector is fundamental for Africa's overall economic growth. A constantly growing agricultural sector is crucial for addressing hunger, poverty and inequality. More than 70 percent of the total population and the majority of the extreme poor and undernourished live in rural areas. A healthy agriculture sector means more jobs, more income and more food for the poor.

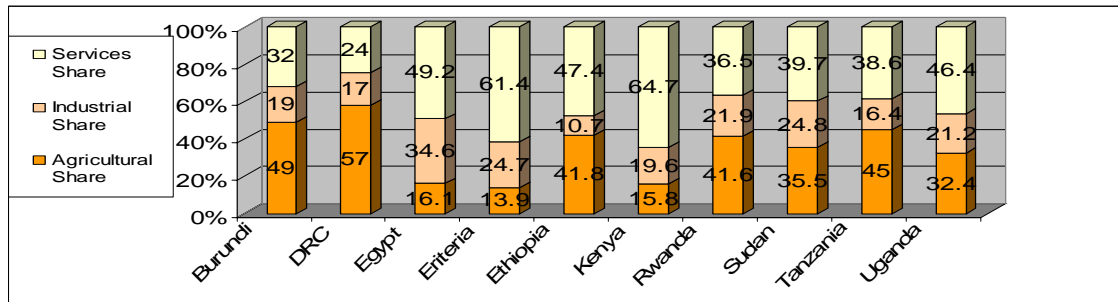
Nile Countries mainly depend on export of primary agricultural products. The gross domestic product (GDP) of Nile Countries is very low as compared to other developing countries. Among the Nile Countries Egypt has a GDP of greater than 80 billion USD while the rest have a GDP of less than 20 billion USD according to African Development Report (Graph 1). When we see the composition of the GDP for countries like Democratic republic of Congo, Brundi, Tanzania, Ethiopia and Rwanda agriculture contributed above 40% of the GDP (Graph 2).

## Gross Domestic Product (GDP), 2003



**Graph 1 Gross Domestic Product (GDP)**

## Composition of GDP, 2003



**Graph 2 Composition of GDP**

For Egypt, Eritrea, DRC and Rwanda the import of agricultural commodities is higher than export of agricultural commodities. For Countries like Ethiopia and Sudan the difference between export and import of agricultural commodities is not so much even though import is a little bit high. For Kenya, Uganda, Tanzania and Brundi their export of agricultural commodities is higher than importing (Figure 7).

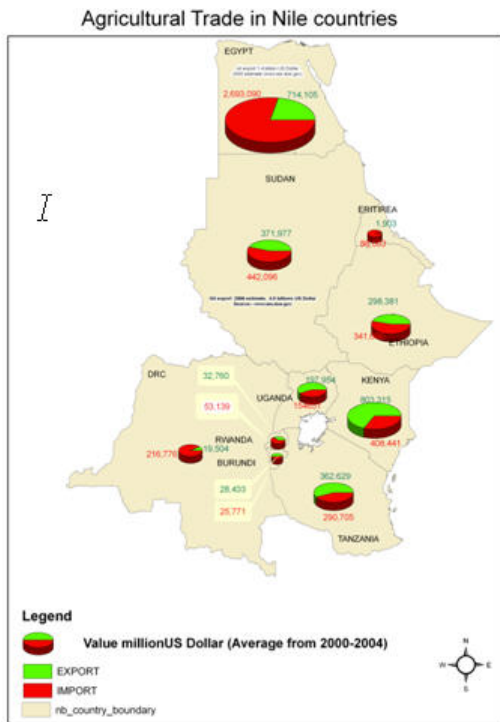
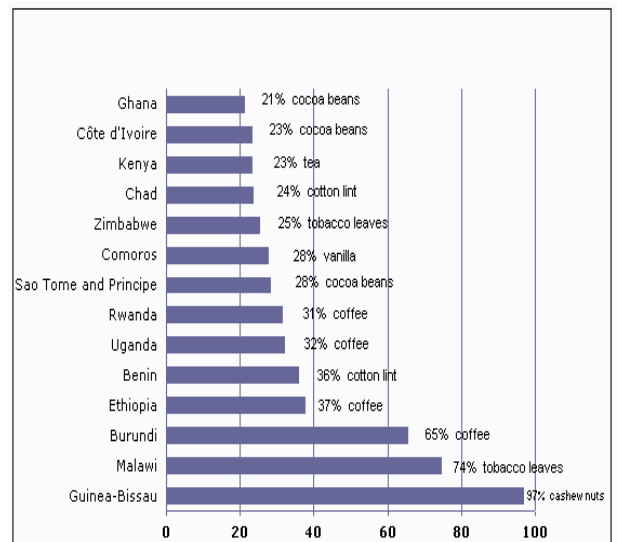


Figure 7. Agricultural trades in the Nile countries

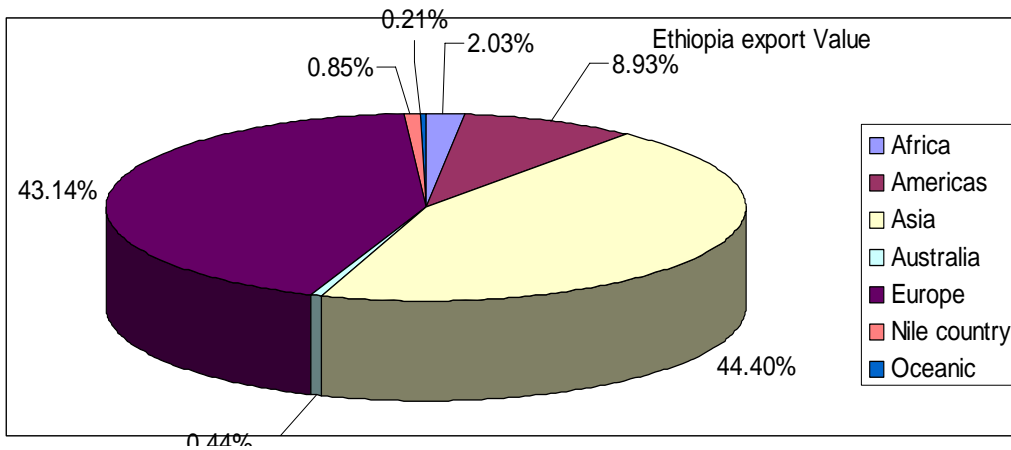
At present, a characteristic of too many African countries is a relatively undiversified economy with little industry and manufacturing and exports dominated by one or two raw commodities (Graph 3). Often a single, primary agricultural commodity is the major source of export earnings, creating a source of uncertainty because of their low income elasticity of demand and their declining and volatile terms of trade. Overall, Africa's agricultural sector accounts for about 20 percent of total merchandise exports, declining from more than 50 percent in the 1960s



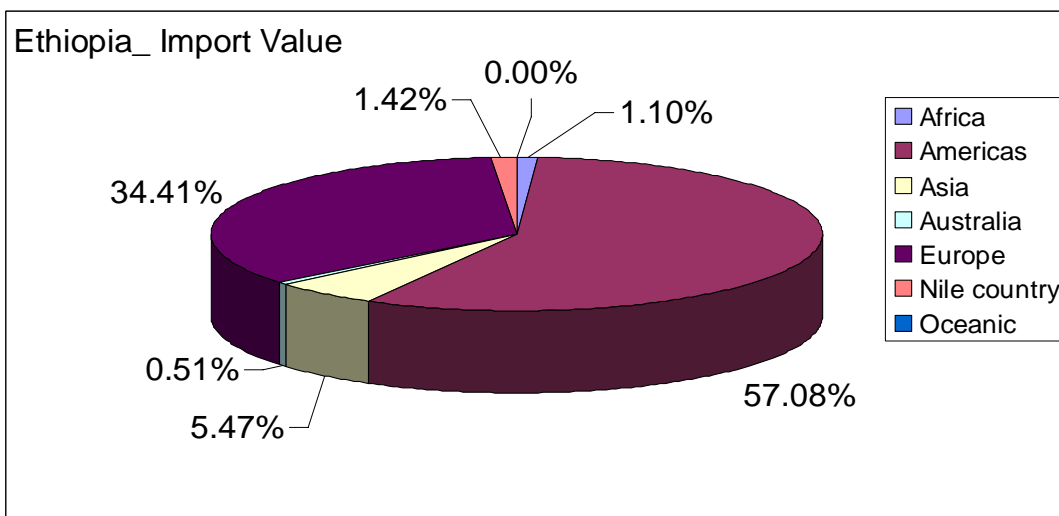
Graph 3. African Countries are highly dependant on single agricultural commodity

Over the past 30 years, agricultural imports have outstripped agricultural exports, making the region a net agricultural importer since 1980, Indeed, as population growth in Africa outpaces food production, imports and food aid are required to make up the difference In the mid-1990s, out of the world total of 32 million victims of disasters receiving relief assistance from the World Food Programme (WFP), 21.5 million were living in Africa. In 2000 Africa received 2.8 million tones of food aid, which is more than a quarter of the world total. In 2001, the number of people suffering from food emergencies ranged between 23 and 28 million.





Graph 4. Ethiopian agricultural import is mainly from America and Europe. The import from Africa and within Nile Countries is insignificant



Graph 5. Ethiopian agricultural export is mainly to America and Europe. The export to Africa and within Nile Countries is insignificant

Increasing trade and market opportunities locally, regionally and internationally contribute to agriculture's ability to grow expand incomes and reduce poverty and food insecurity. Trade often introduces new, more productive and more sustainable production technologies, processing systems and related services. Trade provides opportunities to produce higher value products. For many producers, expanding agricultural trade opportunities locally and within the region is an important first step for taking advantage of potential new access international markets. However, according to a recent paper,<sup>1</sup> trade continues to be marked by overwhelming dependence on traditional overseas markets in industrial countries, although (admittedly from a low base), there has been substantial growth in intra-regional trade within Africa. If we exclude unrecorded, often informal-sector, trade across the porous borders, on average, only 10 percent of exports of countries belonging to each African Regional Economic Organization are destined within itself.

## 6. Recommendations

Unless the level of food production increases it will be hard to sustain the ever increasing population

- Increase export growth through production of high value agricultural products to get foreign earnings

Rather than depending on single commodity it is advantages to diversify raw commodities.

The potential area in the Blue Nile Basin need to be developed before water shortage becomes an issue.

Community based irrigation projects should be encouraged by the government

## 7. Major sources of information and data for the survey

- 7.1 Irrigation (potential) in Ethiopia both existing and possible schemes, FDRE, Ministry of water resources, September 2005, Addis Ababa
- 7.2 Tana Beles Integrated rural development project rehabilitation and restructuring study, December 1993
- 7.3 Tekeze basin integrated development master plan project second phase report, vol. No. 4, June 1997
- 7.4 Ethiopian Agricultural sample enumeration 2001/2002 (1994 E.c), Federal democratic republic of Ethiopia, central, Agricultural Census commission (Amhara, Tigray, Oromia & Benishangul gumuz regions)
- 7.5 Abby River basin master plan study.
- 7.6 Tekeze river basin master plan study.
- 7.7 Baro Akobo river basin master plan study
- 7.8 National statistical survey 1994/95 (1987 Eth. Cal.)(Estimates of area, production and yield)
- 7.9 Agro ecological zones Ministry of Agriculture and natural resources ----
- 7.10 Woody biomass inventories and strategic planning project (WBISPP)