

**NILE BASIN INITIATIVE – NBI
 EASTERN NILE SUBSIDIARY ACTION PROGRAM - ENSAP
 EASTERN NILE TECHNICAL REGIONAL OFFICE – ENTRO**



Some Features of the Baro-Akobo-Sobat Sub-basin

**BARO-AKOBO-SOBAT (BAS) MULTIPURPOSE WATER RESOURCE
DEVELOPMENT STUDY PROJECT**

APPROACH PAPER TO PROJECT STUDY

BY:

**JACKSON ELISOMA MUSO
REGIONAL PROJECT COORDINATOR
BAS – NBI/ENTRO**

**ENTRO
Addis Ababa – Ethiopia**

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LIST OF ACRONYMS

AfDB	African Development Bank
AFD	France Development Agency
AWF	African Water Facility
CAHW	Community Animal Health Workers
CRA	Cooperative Regional Assessment
DGP	Domestic Growth Product
ENCOM	Eastern Nile Council of Ministers
ENSAP	Eastern Nile Subsidiary Action program
ENSAPT	Eastern Nile Subsidiary Action program Team
ENTRO	Eastern Nile Technical Regional Office
ICCON	International Consortium for Cooperation on the Nile
IDEN	Integrated Development of the Eastern Nile
IPPF	Infrastructure for Projects Preparation Facility
IsDB	Islamic Development Bank
IWRDM	Integrated Water Resource Development and Management
NBI	Nile Basin Initiative
NEPAD	New Partnership for African Development
Nile-COM	Nile Council of Ministers
SSEA	Strategic Social and Environmental Assessment
TOR	Terms of Reference

1. Background Information:

The Eastern Nile Countries (Egypt, Ethiopia and Sudan) recognize that, there are more potential in the future development of the Eastern Nile Region through a regional approach to its Sub-basins. Mostly they identify need for sustainable development of the water and affiliated natural resources through environmental and socially best approaches. Therefore resource base conservation and options for development synergies that can sustain development/investment for prosperity of the Eastern Nile region is of major concern.

While focusing on transboundary water resource issues, national concerns as well that can provide the Eastern Nile Countries with opportunities for making significant progress in their economic, social and environmental development which could be difficult to achieve unilaterally are co-opted.

The guidelines principles of this project are drive from those adopted by the NBI's Council of Ministers of Water Affairs (Nile-COM); EN-COM and ENSAP/T, which could further define the principle objectives of the BAS project as:

- To develop the water resources of the BAS in a sustainable manner, (no harm and no regret),
- Equitable way that ensures prosperity, security, and peace for all its peoples.
- To ensure efficient water management and the optimal use of the resources.
- To ensure cooperation and joint action among Eastern Nile Countries, seeking win-win gains.
- Target poverty eradication and promote social and economic integration; and
- To ensure that this project move from planning to action.

In the Eastern Nile Subsidiary Action Program – ENSAP, the Baro-Akobo-Sobat (BAS) Multipurpose Water Resources Development Study Project became one of seven (7) projects of the Integrated Development of the Eastern Nile (IDEN), a mechanism for translating the ENSAP's program, like the BAS project into ground.

At the meeting of the International Consortium for Cooperation on the Nile (ICCON) held in Geneva June, 2001 the African Development Bank (AfDB) expressed its willingness to support the Baro-Akobo-Sobat project. It is on this basis that ENTRO submitted the grant proposal and have this opportunity of engaging the Bank to support BAS project study.

1.1 Project location and description:

The Baro-Akobo-Sobat Sub-basin is located to the South-western parts of Ethiopia and South-eastern and central Sudan, covering an estimated area of about 450,000 km²; and it is a home to about 12.6million people living along the basin; engaged in subsistent



agriculture (crop production), livestock rearing, fishing, hunting, forestry harvesting and some trade activities for their livelihood.

The Sub-basin is relatively well watered, characterized by one rainy season that starts around April/May and ends around October/November; followed by a longer dry season. Effective average rainfall is about 750 mm annually in the lowland and about 1,250 mm in the higher land areas of the Sub-basin. Mean annual temperature range from 17.5⁰C to 27.5⁰C in the high and low land respectively.

The Sub-basin comprises a number of rivers. The Baro River with its tributaries arise from the Ethiopian plateau draining westwards in to the Sudan. The Pibor River with its tributaries originates from the higher lands in Eastern Equatoria State, Sudan draining northwest wards through the Sudanese flat plains to meet the Baro River, at which confluence the Sobat River is formed. The Sobat River forms a defined channel flow northwest wards through grassy flat plain giving numerous back swamps and lagoons until it join the White Nile 15km south of Malakal town in the Sudan. The topographic conditions here offer steady flow of the White Nile until it joins the Blue Nile at Khartoum.

1.2 Project goal:

The goal of Baro-Akobo-Sobat (BAS) Multipurpose Water Resources Development Study are within the overall framework of the Integrated Development of the Eastern Nile (IDEN) program of enhancing national and regional food and energy security; reduction of rural poverty through sustainable management of, and benefiting from the water resources of this Sub-basin.

1.3 Project Objectives:

From the ENSAPT meeting of September 2009, the BAS project objectives were divided into Short-Term/Immediate and Long-Term development and investment objectives: -

The immediate project objectives include:

- Establishment of Baro-Akobo-Sobat knowledge based system for data and information.
- Identification and preparation of Fast Track project activities ready for implementation by the Countries.
- Improved resource productivity and Sub-basin accessibility.

The long term objectives include:

- Enhancement of regional food and energy security.
- Irrigation and hydropower development.
- Flood management and water resources conservation.

Project Components:

- The meeting clearly identifies the Strategic Social and Environmental Assessment (SSEA) as the major component for this unique Sub-basin.

- Clearly mention fast track project activities as means for natural resource / watershed development targeting poverty reduction in the Sub-basin and build trust and confidence on the ground.

1.4 Immediate objectives of this grant (AfDB) request include:

- To streamline identification and preparation of Fast Track projects ready for implementation by the Eastern Nile Countries; to demonstrate early benefits of cooperation on the ground given the post conflict nature of this Sub-basin region.
- To undertake Strategic Social and Environmental Assessment (SSEA) as an analytical tool for generating Medium and Long-term development and/or investment options given un-explored and un-mastered nature of the BAS Sub-basin.
- To facilitate stakeholders' forum and resource mobilization while preparing the prioritized development/investment projects.
- To develop profiles of the identified medium and long-term investment projects.

In the long-term the project aims at up-scaling of the above results / grant to:

- Detailed preparation of the investment projects ready for implementation.
- Undertake round table conference for the Sub-basin investment.

In the dialogue meeting of 28-29th January, 2010 held at ENTRO Addis Ababa, Ethiopia between ENTRO team and AfDB – AWF representative. The grant estimate for the above activities would reach up to 4.5 Million USD within the period of 48 months. Details are to be worked out in the appraisal mission and processes leading into signing of the Grant Agreement between the Bank and ENTRO.

2. What ENTRO have and is doing:

2.1 Support from the Netherlands Embassy in Ethiopia: In search for most appropriate approach, given the unique nature of this Sub-basin and the project area. ENTRO in September 2009 supported by the “Horn of Africa Regional Environmental Cooperation (HoA-REC)” under the Netherlands Embassy in Ethiopia successfully concluded a Regional Stakeholders Workshop in Addis Ababa- Ethiopia aiming at defining and streamlining the overall objectives of BAS project. Integrated water resource development approach was unanimously identified and adapted by the Regional Stakeholders as the most appropriate approach for BAS project.

That, while preparing to undertake integrated water resource development study for BAS Sub-basin, ENTRO to continue with consultations and mobilization of the local communities through identification of relevant areas and activities for Fast Track project interventions, that could demonstrate early benefits of the regional cooperation on ground; while building confidence and trust in this post conflict region. With the same Grant from the Netherlands Embassy in Ethiopia, four (4) local/national communities based consultative workshops were held at Upper Nile State (Malakal), Jonglei State (Bor), Eastern Equatoria and White Nile States and at Gambella Regional capital for Benishangul-Gumuz, Oromiya, SNNP and Gambella Regions. In

these workshops challenges and opportunities that can be translated into fast track project activities were summarized as, annex (I).

2.2 Technical Assistance from the France Development Agency - AFD:

“Knowledge gap” is one of the challenges in the BAS Sub-basin. ENTRO submitted a proposal requesting for Technical Assistance from the France Development Agency (AFD). Now a team of international and regional consultants (Hydraulics, Hydrology, Environment, Climate and Socioeconomics) are engaged in the Knowledge Base Development work for BAS Sub-basin. This task shall be accomplished by end of April 2011. Outputs of this assignment shall add/input to the upcoming integrated water resource development study under AfDB support.

2.3 Resource Mobilization:

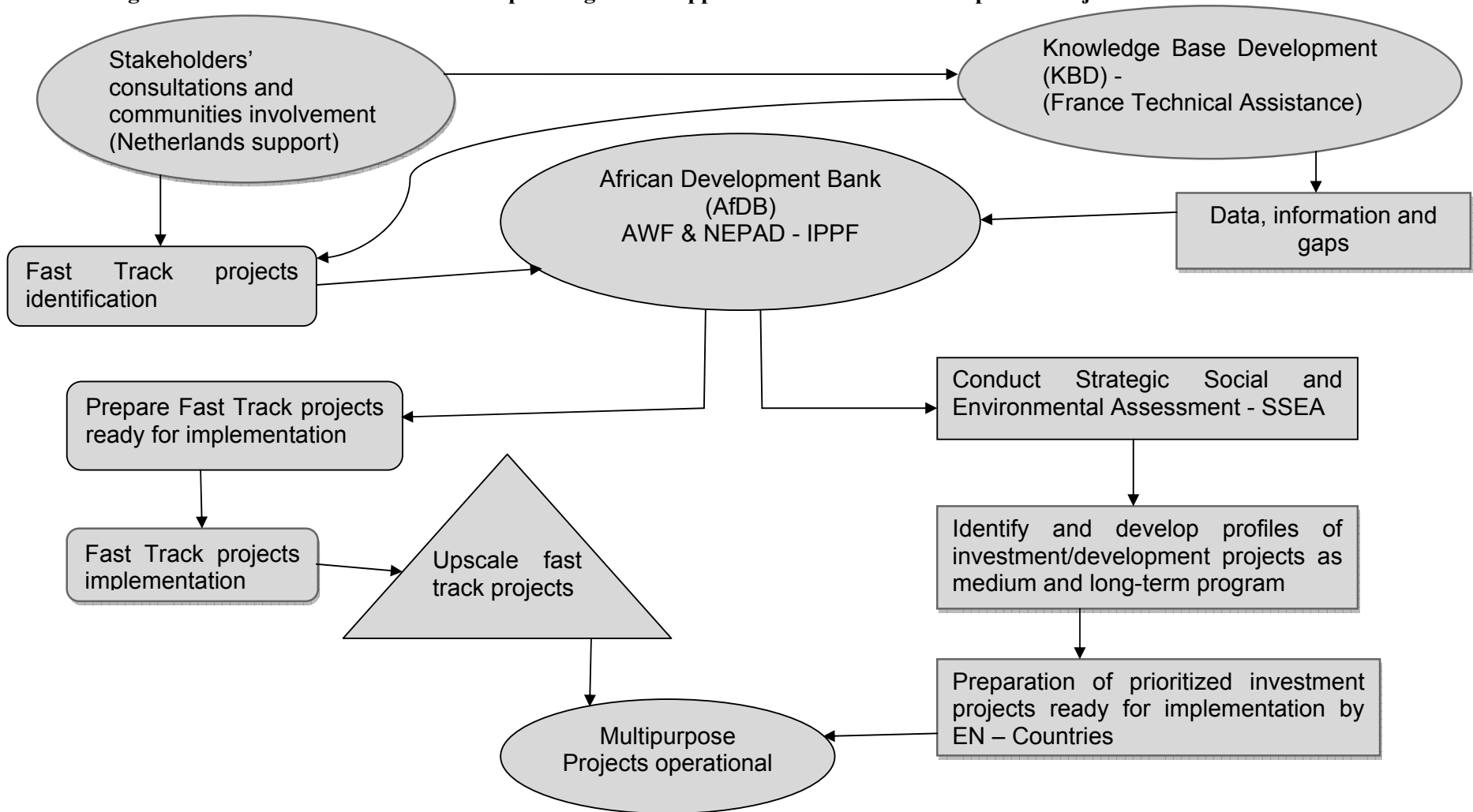
On resource mobilization to bridge the funding gap, ENTRO made informal discussions with other development partners such as the World Bank (Nile Basin Trust Fund - NBTF); The Netherlands; The France Development Agency – AFD and the Islamic Development Bank for example. They all express their willingness to support the BAS project through bridge funding, should ENTRO sign the Grant Agreement with the African Development Bank – AfDB as lead supporter.

2.4 Progress and Challenges:

Although ENTRO is nursing the Nile Basin Initiative (NBI) challenges affiliated to the CFA issue; its activities have manage to hold the Eastern Nile Region together through it already funded projects and those already under implementation most of which were supported by the AfDB. ENTRO remains grateful that, the Grant it will receive from the AfDB for BAS project will not only assert development and investment achievements, but will contribute to stabilize this region as services would be coming into this post conflict zone.

The 2008 Grant Agreement with the Netherlands which supported establishment of the BAS project office at ENTRO ended by December 2010. And the Technical Assistance Grant from the France Development Agency - AFD will end by June 2011. Therefore, the challenge remains of how to keep this project active after June 2011. We remain hopeful that the AfDB and ENTRO will be able to finalize all the processes leading into signing of this project Grant Agreement before June 2011 to keep the momentum and results already attained in this period by not allowing this project to go back into its 2001 – 2008 stall stage.

3. Linkages of the current activities with the upcoming AfDB supported BAS MPWR development Project:



4. Annex (I)

Fast Track Project Profiles; Component (II) of Baro-Akobo-Sobat MP Project Immediate Objectives as result of the Consultative Workshops:

INTEGRATED WATERSHED MANAGEMENT PROJECTS:	CHALLENGES:	DIRECT INTERVENTIONS	SUPPORTING INTERVENTIONS	DIRECT BENEFITS	REGIONAL BENEFITS	COST ESTIMATE (USD)
<p>1. Reducing Rangeland Degradation and Improving Livestock Productivity in the Pibor-Akobo-Gilo catchment</p>	<ul style="list-style-type: none"> • Climate change • Lack of drought resistant crop varieties and shortage of feed for livestock. • Lack of diversified socioeconomic activities. 	<ul style="list-style-type: none"> • Capacity building through extension education service. • Supply of Improved / drought resistant crop seeds & vegetables. • Develop Community woodland management plan & climate change adaptation strategies. 	<ul style="list-style-type: none"> • Support through Micro-finance institutions (MFI's) and capacity building. • Improved accessibility and markets and linkages • Community Woodland management planning and implementation. • Support to State-wide strategic on Land Use Planning. 	<ul style="list-style-type: none"> • Increased food security and improved nutrition & health status. • Increased options for household income generation. • Provide options and access to markets 	<ul style="list-style-type: none"> • Conservation and sustainability of resource base. 	
<p>2. Community Base Flood Management Strategy for Gambella, Akobo and Malakal areas.</p>	<ul style="list-style-type: none"> • Most of the lowland areas are susceptible to riverine and rainfall flooding. • Waterborne diseases are wide spread in the wet (flood) season. • Movement for both people and livestock are constrained leading into isolation, limiting 	<ul style="list-style-type: none"> • Construction of dikes on hotspots to control spilling into residential areas. • Construction of channels to facilitate runoff from settlement areas into the River system. • Avail access to dry lands service. 	<ul style="list-style-type: none"> • Develop flood focus and early warning strategy for this region. • Develop community base flood management strategy. • Improve access to potable water and sanitation facilities. • Undertake basin wide water resource 	<ul style="list-style-type: none"> • Access to potable water and sanitation facilities. • Control wide spread of waterborne diseases. • Improve productivity, accessibility 	<ul style="list-style-type: none"> • Control River spill and improve water quality and management. 	

	services delivery.		management strategy.	and service delivery in the areas.		
3. Develop and Support Water Harvesting in the Semi-arid areas of Kapoeta & Surma region.	<ul style="list-style-type: none"> • Erratic and variable rainfall, severe seasonal drought leading into lack of water and pasture for livestock, humans and wildlife species. • Remarkable ethnic conflicts over limited water and pasture, cattle rustling and instability accelerated. 	<ul style="list-style-type: none"> • Design and construction of rainfall water harvesting facilities in the remote rural area to bridge the seasonal drought. • Develop and improve capacities for forage / grass harvesting, storage and other planting methods. • Research work on cost-effective pasture production and construction of production structures. <ul style="list-style-type: none"> • Capacity building. 	<ul style="list-style-type: none"> • Capacity building and strengthening extension service. • Support to community level Land Use Planning and wetlands management. • Communities conflicts and natural disaster management strategy. 	<ul style="list-style-type: none"> • Reduced variability of crop production • Increased livestock productivity, reduce migration and conflicts over limited water and pasture • Increased livestock and human food supply and options 	<ul style="list-style-type: none"> • Maximize use of rainfall water to conserve water for downstream users. 	
4. Arresting Sand Dune Deposit and Restoration of River Banks White catchment.	<ul style="list-style-type: none"> • Extreme River bank erosion & loss of riverine forest and cropland. • High rates of sand delivery to White Nile River. • Over grazing 	<ul style="list-style-type: none"> • Establishment nurseries & support riverine vegetation. • Technical support to arrest sand delivery and river bank erosion. • Land use 	<ul style="list-style-type: none"> • Capacity building and extension service. • Support to micro finance institutions (MFI's). • Support to community wood and grass land 	<ul style="list-style-type: none"> • Loss of cropland and riverine forest arrested. • Increase supply of forage and range sustainability. • Increase 	<ul style="list-style-type: none"> • Secure water quality and conservation of the river system. 	

	along the White Nile River banks.	management and diversified planning.	management and planning. • Support to States strategic on land use planning and management.	livestock productivity and increased household income levels.		
5. Arrest Rangeland Degradation and Improving Livestock Productivity in Flooded and Retreat Grasslands of Machar marshes and Sobat catchment areas.	<ul style="list-style-type: none"> Lack of soil moisture retention in dry season, limiting pasture regeneration. The nature of the soil (Vertisols) and land topography facilitates water logging leading into flooding. Over grazing and extensive migration. Lack of social-economic diversification and access to external environment. 	<ul style="list-style-type: none"> Creation of water and pasture points along migration routes. Integration of the livestock into the socioeconomic sector. Support community animal health workers (CAHW). Development of livelihood alternatives, social and technical skills. 	<ul style="list-style-type: none"> Social orientation and capacity building. Facilitate development of micro-financing and grant revolving facilities. Facilitate access to potable water and resource management. Promote access to health and education services. 	<ul style="list-style-type: none"> Access to social services. Access to alternative mode of livelihood. Access to external or alternative social environment & technical skills. 	<ul style="list-style-type: none"> Improve Water management strategies. 	
6. Establishment of Management Plan for Boma-Gambella Transboundary Parks	<ul style="list-style-type: none"> Wide spread illegal hunting in these parks. Underdeveloped potentials of wildlife and tourism. Expansion of economic activities and settlement into the parks area. 	<ul style="list-style-type: none"> Facilitate establishment transboundary management concept for cooperation. Establish extension service through transboundary working group. 	<ul style="list-style-type: none"> Joint avenues for capacity building and training. Support protocols on data and information sharing on biomass, migration and habitats. Support clanging activities in 	<ul style="list-style-type: none"> Habitat and ecosystem conservation. Attain economic benefit from environment. Support transboundary survey and land 	<ul style="list-style-type: none"> Resource base sustainability and conservation. 	

	<ul style="list-style-type: none"> Habitat destruction and environmental degradation. 	<ul style="list-style-type: none"> Policies analysis for gaps and areas of commonality for transboundary management policy. 	<p>the two parks.</p> <ul style="list-style-type: none"> Support regional consultations and round table meetings. 	use planning.		
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5. Annex (II):

Some features of the Baro-Akobo-Sobat Sub-basin:

5.1 Water resources

The BAS Sub-basin is defined by the catchments of the Baro, Alwero, Gillo and Akobo Rivers in Ethiopia; the Pibor, Akobo, Gillo, Makwai and Sobat Rivers extending into the White Nile in the Sudan. However, the catchment boundary between the Baro-Sobat and the White Nile below the Sobat-White Nile junction near Malakal town remains difficult to delineate. The Pibor-Sobat catchment continues to influence the hydrological conditions on the western bank of White Nile and the Sobat-Machar marshes catchment continues to influence on the east and northeastern bank. The total area of this Sub-basin as defined above is approximately 468,216km² (ENTRO, 2007).

Grievances exist on the figures showing hydrological conditions from JIT/MIT studies (1950/54), Sutcliffe and Parks (1999) studies of the Baro-Akobo-Sobat Sub-basin. These constitute among others challenges revealing differently the Sub-basin hydrology from works of different hydrologist. Therefore with the France Technical Assistance, ENTRO is currently engaging a team of experts to explore reasons for these grievances and suggest way forward. So that, the African Development Bank upcoming efforts will concentrate on identification and preparation of investment and development projects.

5.2 Environment and Natural Resources

The main relief features of the BAS Sub-basin are the highlands of Ethiopia raising some 3,500masl; the Imatong Mountains in the south-eastern Sudan of the Pibor catchment raising some 3,187masl on Mount Imatong; the Nuba Mountains in the central-western Sudan raising some 1,500masl. The highlands foot-hills merge to form extensive flat plain catchments of the Sobat and White Nile of about 400 - 500masl, with a slope range of 10-12cm per km.

The mean annual rainfall varies from about 2,000mm in the highlands to about 750mm in the lowlands and about 250mm in the semi arid zones. The main soil types are characteristically Vertisols on the clay plains of the Sub-basin. The natural vegetation cover in the highlands between 900 and 2,500masl is Montane forest with highland bamboo (*Arundaria alpina*) and other dominant tree species (Friis, 1992) in Ethiopia. In Sudan, the equatorial rainy-forest has the Mahogany, Teak and other tree species of the Imatong catchments. On the flat plains the main vegetation type consist *Acacia* species, savannah woodlands, grassland, scrubs, and the wetland vegetation; being a belt where *Acacia senegal* predominate agro-forest Gum collection livelihood activities (October – January). The grassland vegetations are closely related to the length of seasonal flooding and thus closely related to the seasonal wetland hydrology, locally referred to as "*Toich*" (areas of pasture and water for livestock and wildlife species in the dry season).

The *Toich* vegetation comprises of *Oryza grassland* found closer to the river channel and the *Echinochloa grasslands* found further away from rivers and requires less frequently flooded the two constitute the riverine vegetation or forest essential in

defusing siltation and sedimentation of Rivers (Jonglei investigation team, 1954). The permanent wetlands vegetation comprises of the Papyrus growing deep in waters, Typha found away from river channels probably anchored to the substrate/hard grounds. It is most extensive in the Machar marshes. These seasonal and permanent vegetations or wetlands are vital areas for fish spawning and fry rising (150,000tons per annual). They also support the unique habitat of 1.3million wildlife spices, in particular the vast herds of White-eared-kob, Tiang, Antelopes, Elephants, Mangalla gazella and other spices including a wide range of Avifauna (Howell et al., 1988).

5.3 Population and Livelihood Systems

The total population in the BAS Sub-basin is about 12.6million people, distributed along the Sudan and Ethiopia borders. Between 80 to 90% of this population live in the rural areas of these countries. Rural livelihood systems in the highland areas are focus on smallholder rain-fed cropping closely integrated with livestock production. Coffee is an important cash crop in the highland areas of Ethiopia (1,100 and 1,900masl). In Sudan, at Imatong mountains tea production was prominent cash crop before the then civil war, currently there is high potential of revitalizing this crop (investment opportunity). In the rural lowlands the livelihood systems depends mainly on shifting rain-fed cultivation, while agro-pastoralism is the predominant livelihood.

Fishing is an important component of the livelihoods to many of these ethnic groups. In the dry season a good number are engaged in agro-forest activities of Gum, Honey collection and Charcoals production while other concentrate in fishing. Small-scale pump irrigation for vegetable production in the dry season is important supplementary activity mainly in the White Nile catchment.

5.4 Physical Infrastructure

The BAS Sub-basin area is relatively isolated, the physical infrastructure in most parts are yet developing. In the wet season the area becomes inaccessible due to the lack of all weather roads, especially in the South Sudan side. Communication networks, internets and telephones are limited, satellite phones are commonly used. Along the Sobat River to Malakal, river transport becomes the only options for transport and service delivery in the wet season.



ENTRO CRA, assessment mission

At the Ethiopia side of the Sub-basin, there are some all weather roads and communication network the regions to the capital Addis Ababa. In both sides of the Sub-basin smaller roads/feeder roads or dry-weather road are present making accessible possible in the dry season. Airports with navigation aid are present at Assosa, Gambella and Malakal; the rest if present are airstrips their use is constrained to the weather condition.

5.5 Institutional & Administrative Framework

In Sudan, the Sub-basin administrative units consist of States which are divided into Counties/Districts, those then divided into Payams/Localities and to the smaller administration units (Bumas). In Ethiopia there are Regional States which are divided into Wordas and those into Kebelles as their smaller units of administration.

5.6 Institutional challenges

The institutions are adequately set at both sides of the Sub-basin, however they have inadequate capacities to deliver basic services and execute their regulatory frameworks. Although these systems of decentralization gave increasing opportunities for peoples to participation in governing of their Countries, however it also increases the complexity of communication, management and stakeholders' involvement. In both countries there is need to increased awareness at lower levels on integrated water resource management and transboundary cooperation.

5.7 Poverty and environmental degradation

The Sub-basin areas are characterized by extreme poverty people live or have an average per capita income of 0.9USD per day. Poverty and the high vulnerability of people is attributed to resource scarcity, climatic variability, degraded resource base, lack of diversified socioeconomic activities, inadequate access to basic social services and low literacy level. The low levels of household assets (caw, goat) or lack of capital for investment restrain household ability to invest in resource production to bail them out of poverty.

The two theories put forward by Malthus, who predicted famine as a result to fixed resource base (land and water) to exponential increase in population; and that by Bosrup, who predicted increase intensification of resource use under increasing population pressure. The two are visible in the Eastern Nile and BAS Sub-basin in particular. However, safeguard mechanisms for vulnerable households need to be established to increase their income generating capacities. Lack of access to safe drinking water and sanitation facilities are other water resource related environmental hazards degrading water quality and catchment areas.

5.8 Seasonal droughts and floods

Much of the areas under Savannah woodland and grassland plains in the Sub-basin suffer from severe water shortages during the dry season (December - May) for humans', livestock and wildlife species. In this period pastoralist move with their livestock to wetlands areas (*Toich*) to access water and pasture, this movements often result into ethnic conflicts over these scarce resources.

Not undermining resource degradation in some parts of the Sub-basin, those in the Pibor-Sobat catchment are relatively intact. Where close relationship between the hydrology, ecology and livelihood systems is apparent. However, there is little detailed of the knowledge on this intricate interdependence. Of particular importance are the potential impacts on the flood levels and spills to the flooded "Toich" grasslands and the Machar marshes.

The Sub-basin receives rainfall once in a year (May/June – October/November) and because of the land topography and soil characteristics water logging occur around July – October where the soil become saturated causing flooding. Although quantitative data are to be obtained, most parts of this Sub-basin are susceptible to either riverine/spill and/or rainfall flooding causing economic losses to peoples’ properties and limiting access to dry and arable land. Severely as floods affects the low land areas of this Sub-basin, the higher land areas at both Ethiopia and Sudan are subjected to erosion, degrading the fertile soil for crop production and subsequently the entire land from other land resource users, increasing the poverty trend. This is



Watershed and land degradation problems in the BAS Sub-basin areas

why water resource management becomes a priority in this Sub-basin. The wetland belt at Pibor-Boma-Gambella-Machar marshes land scape has higher potential for developing water conservation projects.

5.9 Wetlands and Biodiversity

The Baro-Akobo-Sobat Sub-basin has vast and varied potentials of natural resources ranging from water, arable land, food and cash crops production, livestock, fisheries, wildlife and forest resources whose potentials if developed can support livelihoods and strengthen the regional economy to a greater extend through increase in the GDP of the EN Countries. However, prosperity through these resources is globally know to depend largely on physical infrastructure, markets, power, technical skills, handling and storage facilities which are yet lacking in this region.

Wetlands and ecotourism are more biologically, socially and economically pronounced, however they are vital for conservation of water resource base. Several water resource benefits can be attained from the interaction of water, ecological habitat (biodiversity), environment and climate change. Recent reports by Wallingford (June 2009), had indicated presence of three wetlands in this sub-basin (Pibor, Gambella and Machar marshes) which had attained more natural heritage and social pride among the communities.

The World Wildlife Conservation Society (WWCS), in the Post Conflict Environmental Assessment report presented over 1.3million population of wildlife spices at the Boma National Park in Sudan (Boma-Jonglei landscape). The current efforts spear headed by the Netherlands Horn of Africa Environmental Program is

to realize one transboundary habitat for wildlife in this Sub-basin (“Boma-Gambella Park”).

5.10 Lack of Energy and Social challenges

General there is lack of energy in the Sub-basin areas, Gambella region in Ethiopia have access to some power supply. There are some irregular thermal sources of energy at Malakal town, but due to its expensive running cost, environmental and sound pollution it is credibly unpopular. Lack of energy has been attributed by other researches as one of the reasons for economic retardation in Africa. With lack of energy as the case is in the BAS Sub-basin the forest resource bears the consequently leading into environmental degradation, climate change and small households pay the price. The socioeconomic activities leading into identification and generation of wealth, strong economy and economic assets are limited. The livelihood of populations in the Sub-basin depend on unimproved methods of small scale crop production, livestock rearing, fishing, forest gathering and some trade activities. Therefore there is need for diversify the socioeconomic activities and promotion of opportunities for acquiring of technical skills in the Sub-basin to improve levels of income and promote quality of life.

Water borne-diseases are other social challenges to livelihood in the Sub-basin, the health facilities are rudimentary limited. The literacy levels are low as education infrastructures are limited evidence by school ages enrolled. Gender issues are other unfocused social challenges in the Sub-basin areas.

6. Development opportunities:

Only a brief outline is provided here as a result of stakeholder consultation, generally there is limited knowledge on the investment opportunity in the BAS Sub-basin, therefore a need for more intensive studies in required.

6.1 Highland areas (Ethiopia and South Sudan, Imatong Mountains)

6.1.1 Agroforestry: There are a number of potential development opportunities in this sector some of which are already receiving support in the Ethiopian side e.g. tea and coffee production. Given the relatively longer distance to large markets the emphasis would be on value-addition, low volume but non-perishable products such as coffee, spices and honey in Ethiopia are potential opportunities.



Investment opportunities in the agroforest sector of the Sub-basin

There are three tea estates in Ethiopia at Montane Forest of the Sub-basin and one in Sudan at Imatong Mounts. Where there are potentials to expand production in a more equitable manner using out-growers located around the estates and mountain reach. The demand for fruits in urban areas of Ethiopia and Sudan has expanded in recent years. There is the potential for production of improved varieties of banana, mango and introduction of apples to the Sub-basin.

6.2 Energy Supply: The Baro-Akobo River Master Plan study by the Ethiopian government has identified a number of potential large to medium scale hydro-power production dams at Baro (I & II), TAMS, Gambella and Itang; the study furthered the hydro-power and irrigated schemes ready for Pre-feasibility stage. Because of the land topography in South Sudan hydro-power development opportunities are limited and the most probably option of energy production would be from burning of fossil fuel, however, limiting opportunities for development of multipurpose water structure for improving rain-fed as well as irrigated agriculture.

6.3 Agriculture: The potential for developing and improving rainfed agriculture is commendable in the lowlands areas of this Sub-basin including Sudan. Potential for irrigated agriculture at Gambella lowland in Ethiopia has identified in the Baro Master Plan is already under implementation at Alwero dam. The potential for developing irrigated agriculture at the Pibor-Sobat catchment in Sudan has not yet been investigated although there is vast suitable land for varied agricultural investment opportunities (rain-fed or irrigated).

6.4 Livestock: Developing official stock routes with water points, health/ quarantine and auctioning grounds to the north, south and eastern markets in the Sub-basin for livestock production and marketing would provide secure access and prosperity to pastoralists' livelihood and economy development. Development of value addition would provide additional marketing options; breeds and husbandry improvement



Investment and development opportunities in the livestock and fisheries sector

technology are other potential areas for investment in the livestock sector in the Sub-basin. Increased support and logistics to the Community Animal Health Workers (CAHW) has resulted into eradication of the rinderpest disease during the civil war times, this efforts could likewise improve animal health and livestock productivity in the Sub-basin.

6.5 Fisheries: There is considerable potential to develop and improve fish harvesting in the capture fisheries as well as aquaculture in the entire Sub-basin; with

improvements to capture methods, preservation, processing, storage and marketing the economic viability of the sector would be realized. Production and marketing of fresh fish remains viable opportunity for investment in the fisheries sector of the Sub-basin which has reported potential of 150,000 Tons per year under sustainable production in the Sudanese side (FAO, 1992).

6.6 Ecotourism: The Montane Forest in Ethiopia – Gambella; Imatong mountains - Boma in the Sudan and the Boma-Jonglei-Upper Nile land scape are good wildlife habitats and potential sites for tourism developed. The watershed CRA study and the consultative workshops have identified the potential for transboundary cooperation in habitat and wildlife conservation and management for Boma-Gambella National parks. This activity is being fast tracked with possibly of creating an internationally recognized “Transboundary Park” - Boma-Gambella Park”.

7. River Training: There are number of potential regional cooperation opportunities for river training in the sub-basin that require detailed investigation. One of the long standing opportunities is the embankment of the Baro and Sobat Rivers to reduce the amount of water spilling northwards into the *Machar marches* in order to increase the yield and flow of the Sobat into the White Nile. Another identified project is the construction of the Malakal Flood Control Structure at the Malakal Cataract to reduce ponding back of the Sobat River. Both projects are aimed at reducing water loss through evaporation and increasing river flow downstream of the White Nile.