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Eastern Nile Technical Regional Office

WATERSHED MANAGEMENT FAST TRACK PROJECT, SUDAN DETAILED PROJECT PREPARATION STUDY

INTERIM TECHNICAL ASSESSMENT REPORT

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Abbreviations

ADS	Area Development Scheme
CBO	Community Based Organisation
CDF	Community Development Fund
CPA	Comprehensive Peace Agreement
CRA	Cooperative Regional Assessment
CSO	Community Steering Committee
DNP	Dinder National Park
EIA	Environmental Impact Assessment
ENSAP	Eastern Nile Subsidiary Action Programme
ENTRO	Eastern Nile Technical Regional Office
FAO	Food and Agriculture Organization
Finnida	Finnish Development Agency
FNC	Forest National Corporation
GEF DNPP	Global Environment Facility Dinder National Park Programme
IDEN	Integrated Development of the Eastern Nile
IDP	Internally Displaced People
IWRM	Integrated Water Resources Management
JAM	Joint Assessment Mission
LFA	Logical Framework Analysis
MOIWR	Ministry of Irrigation and Water Resources
NBI	Nile Basin Initiative
NC	National Coordinator
NCWR	National Council for Water Resources
NELSAP	Nile Equatorial Subsidiary Action Programme
NFC	National Forestry Corporation
NFP	National Focal Point
NGO	Non-governmental Organisations
Nile-COM	Nile Council of Ministers of Water Affairs of the Nile Basin
Nile-SEC	Nile Secretariat
Nile-TAC	Nile Technical Advisory Committee
NRM	Natural Resource Management
NSDC	National Social Development Coordinators
NTEAP	Nile Transboundary Environmental Assessment Project
O&M	Operation & Maintenance
OM	Operational Manual
PID	Project Identification Document
SAP	Subsidiary Action Programme
SIA	Social Impact assessment
Sida	Swedish International Development Cooperation Agency
SOS WFP	SOS SAHEL Women's Forestry Programme
SWOT	Analysis of Strengths, Weakness, Opportunities and Threats
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Organization
VPC	Village People's Committee

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1 Objectives

1.1 Introduction

This is an interim report (working document) of the detailed technical assessment of integrated watershed management interventions. This report will be accompanied with complementary interim reports on institutional, environmental and socio-economic aspects of the project although some of these aspects are discussed in the present report. The report forms part of a multidisciplinary consultancy assignment aimed at assisting the Government of Sudan to prepare a detailed fast-track integrated watershed management projects in three target areas, namely Lower Atbara, Bau Locality and Dinder National Park Area.

This report is based on the findings from field visits up to April 2007 and thorough review of secondary information.

The interim report includes an analysis of potentials and constraints and provides logical scope for project interventions and proposes a menu of possible activities.

Annex 1, attached to this report, comprises a full description of the respective project area and Annex 2 provides a set of thematic maps for each area. A draft LFA is attached in Annex 3.

1.1.1 ENSAP Vision

The Project Identification Document (PID) for ENSAP, approved by the Eastern Nile Council of Ministers in March 2001, establishes the long-term goals and objectives for the first ENSAP investment program for the Integrated Development of the Eastern Nile (IDEN).

ENSAP has the objective to:

"ensure efficient water management and optimal use of the resources through the equitable utilization and no significant harm; ensure cooperation and joint action between the Eastern Nile Countries seeking win-win

goals; target poverty eradication and promote economic development; and to ensure that ENSAP results in a move from planning to action"[1].

The long term objective of the Eastern Nile Watershed Management Program is to improve the **standard of living of the populations** residing within the selected watersheds of the Nile basin, **reduce soil and water loss**, improve agricultural productivity increase food security, decrease sediment transport and reduce siltation of reservoirs and canals, reduce erosion and morphological changes along the rivers, and decrease pressure on natural resources.

To achieve the above objectives the countries have -among other efforts - embarked on two parallel programmes, explicitly the Cooperative Regional Assessment (CRA) and the Fast Track projects. While the CRA is an effort for identifying long term opportunities for cooperative actions, the fast track watershed projects aim at demonstrating early results of on the ground improved watershed management.

1.2 Sudan Fast Track Watershed Project- Justifications and Objectives

The proposed fast-track watershed management project is intended to demonstrate rapid local benefits as well as to contribute to sustainability of any future multi-purpose investments. While multi-country benefits will come primarily from improved water management and reduced erosion, it is recognized that this cannot be achieved without the support and action of the people who occupy the land of the watersheds, and draw their livelihoods from it. Therefore, the primary focus of the project is improved rural livelihoods, with water and sediment management also as critical outcomes.

The development objective of the fast track watershed management project is to improve and diversify incomes, as well as diversify agricultural and forest products and improve yields through more efficient/sustainable land and water management; more reliable access to water, conservation of biodiversity and natural habitats, and reduction of erosion and soil nutrient loss and decreased pressure on natural resources.

It is furthermore desirable that the fast track project deliver visible results within two to three years from project implementation that can demonstrate the value of local watershed management in the country in the context of regional cooperation and yield lessons for strengthening similar interventions within Sudan across the Eastern Nile Basin. In other words the project will focus on demonstrating community managed activities resulting in local and regional socio-economic and environmental benefits.

[1] Eastern Nile Subsidiary Action Program (ENSAP) – Project Identification Document, Eastern Nile Council of Ministers, 2001.

1.3 Specific Objectives of the Detailed Project Preparation

In order to achieve the above specified objectives careful project planning is required. To this end, the Consultancy is expected to analyze institutional, environmental, social, economic and technical aspects of proposed watershed management interventions in the three selected areas and produce a detailed Project Implementation Plan (PIP) and associated procurement plan in an investment-ready format.

The consultancy is furthermore expected to ensure consensus and common understanding of the project components and implementation framework among the various stakeholders.

2 Approach and Activities undertaken under Detailed Technical Assessment

2.1 Study organisation

The objectives of the detailed assessment were (a) to carry out more detailed assessment by visiting more villages to achieve a satisfactory representative coverage of all the villages in each project target area, (b) to ensure consensus and common understanding among all stakeholder groups of the key issues to be targeted under this project in the project target areas, and (c) to delineate focal areas or villages for implementation of the watershed management fast-track project on a pilot basis.

The detailed assessment was carried out in DNP area, Lower Atbara and Bau locality by a multi-disciplinary mission between 10th and 27th April 2007 with additional visits - before and after these dates -by various national team members to stakeholders to collect missing information.

Activities carried out included:

- Development of selection criteria for selection of project sites
- Field visits and consultations with stakeholders by multi-disciplinary Team
- Collection of secondary and primary data
- LFA and multi-disciplinary analysis and screening
- Presentation of justifications and recommendations in Interim Reports.

2.2 Rationale for selection of project locations

Historically the majority of development projects in Africa have failed to produce enduring significant benefits for those that they were intended to help. Frequently these failures can be ascribed to political instability, civil unrest or war. These occurrences have usually been outside the control of the project but have often occurred due to the failure of governance at national and sub-national levels. However there have been many other failures which cannot be ascribed to poor governance but rather to poor project evaluation or poor implementation. This fast track project proposal since it will be dependent on cooperation and joint funding between central government, state government, local authorities and benefiting

communities assumes that the governance issues have been dealt with prior to project initiation so that the risks associated with this aspect have been minimised.

A rationale is therefore required in order to ensure that the risk of project failure due to poor project evaluation or poor implementation are minimised. Project evaluation is the process by which likelihood of project success is evaluated. This involves an assessment of the proposed activities in relation to their socioeconomic and natural environment.
In many cases projects have failed due to the fact that the beneficiaries are not interested in the type of activities proposed by the project. Thus in Sudan beneficiaries of training in the preparation of JAM consider this activity unattractive and are most unlikely to implement it. In other cases project beneficiaries have engaged in project led activities simply in order to derive the benefit of the project funding and when the project withdraws these activities cease.
In some cases the project led activities are contrary to the local customs and traditions of the beneficiaries and the level of take up has been very low. In order to avoid these problems it is necessary that the projects focus on activities that have already achieved some level of take up in the local society.
Often the funds or resources that are associated with project development can lead to corruption and or nepotism so that it is necessary to put in place measures to prevent this.
Successful project implementation is most likely in communities that have shown to be capable and adaptable in the implementation of project led change so that areas with a track record of success in project implementation should be prioritised for fast track projects.

This leads to a number of relevant criteria that must be in place before a project can be considered for fast track implementation.

1) Issues relating to governance must be settled before project initiation. This means that areas with serious conflicts of interest and about the status of land must be excluded from the project areas.
2) Projects should focus on activities which are already being carried out in the area and attempt to increase the efficiency and rate of take up of those activities which can result in the project objectives being met. Areas with previous project success can be prioritised since these areas will have the necessary adaptability to deal with project led changes. Thus areas with no experience in proposed activities may be excluded.
3) Areas where there is a strong history of poor governance, corruption, nepotism or maladministration should be excluded from fast track projects since these problems cannot be rectified in the time framework of the project.

2.3 Data Collected

During the detailed assessment in April, the Team visited approximately 20 villages and interviewed over hundred village members and 50 government officials and experts, in addition to the villages visited and local community members interviewed during the previous mission in February.

During the present as well as the previous missions, a total of at least 10 villages have been visited, and a total of 50 government officials and experts and 50 local community members have been interviewed in Lower Atbara. Similar number of consultations in the Dinder area. In Bau locality during the course of assignment at least 16 villages were visited and 25 officials and experts and 70-80 local community members were interviewed.

The participatory assessment of present and alternative livelihood practices involved working with the target groups and communities in selected sample areas in a more detailed manner, analysis of existing land and water use practices and root causes for non-sustainable land-use practices and identification of those practices that require significant changes.

The detailed assessment mission enabled the Consultant to understand core problems and find “project areas” where there seem to have good potential for fast track introduction of small-scale watershed management and development and potential project interventions to be included in the final PIP within each representative geographical area.

The technical detailed assessment after the first screening of areas – based on the before stated selection criteria – included assessment of a variety of productive activities and alternative livelihood practices to define technical solutions which are attractive to the target groups, operational, adaptable and consistent with the goal of sustainable development. Various technical solutions were studied for each sample area and put in the context of the local characteristics and prevailing situations.

There was a common consensus and understanding among all stakeholder groups of the environmental problems caused by various livelihood practices, at least when explained. The local people were well aware of the problems and constraints because these affected their livelihood directly or indirectly. Their perception of potential solutions to the problems was also complementary to the proposed interventions although the willingness and conditions to contribute to changed behaviour varies between the groups and individuals.

Additional and refined geographically linked data was collected and satellite images were interpreted for mapping purposes and in order to improve the holistic understanding of the Status Quo and trends in the three project areas.

Statistics and economical data were also collected to deepen the understanding of root causes and problems and as inputs to detailed analysis in order to justify proposed interventions.

2.4 Maps Showing Routes of Field Visits

3 Proposed Objectives and Key Framework Components

This section gives an overview of proposed project objectives and key project components as a framework for the detailed technical assessments. Detailed justifications and background to this structure is given both in this Technical Interim Report and in the Institutional Interim report.

This project includes a more diverse set of activities than other previous and on-going projects in Sudan, and as such constitute a *framework process* rather than a project. However, for simplicity it is still called a project. The Project is committed to moving as quickly and as possible, however without jeopardising sustainability, towards implementing concrete developments in the project areas that will contribute to the primary development goals of Sudan. However, as decades of experience globally have demonstrated, there are no easy or simple solutions to such complex and deeply entrenched problems as widespread poverty and environmental degradation, let alone vulnerability to the forces of nature or to the forces of unequal international trade. There are many fronts on which to work both simultaneously and in careful sequence in order to secure the necessary conditions to generate sound investments and to sustain meaningful development.

The present detailed project preparation has evolved through a process of extensive consultation and feedback amongst the main project partners and stakeholders in the three project areas and at Federal level. It naturally builds on and complements the information gathered, outputs achieved and lessons learned during previous and current projects and government efforts.

3.1 Overall and Specific Programme Objectives

A detailed analysis of key problems. root causes and objectives has been undertaken as described in separate sections, resulting in the emergence of concrete and specific project objectives well in line with the broad range of project objectives stated in the ToR.

The overall objective of the Fast Track Watershed Project in Sudan is:

"ensure efficient integrated land and water management (watershed) and optimal use of the natural resources through the equitable utilization and no significant harm and to target poverty eradication and promote economic development."

The specific project objectives are proposed to be formulated as to:

"i) strengthen relevant local institutions, stakeholders and systems at all appropriate levels for the integrated and sustainable management of water resources in the Lower Atbara, Dinder and Ingessana project areas, and ii) to stimulate, support and demonstrate fast track appropriate development-oriented investments in the project areas that contribute to poverty reduction and environmental sustainability."

3.1.1 Main outcomes supported by the Project

a. Strengthen the role and capacity of localities and supporting stakeholder in the delivery of pro-poor investments and services to promote productive and environmentally sound livelihoods with local community participation.
b. Strengthen local participation - community and/or a specific watershed user - in the identification of basic livelihood needs within a framework that encourages environmental responsibility and transparency in priority setting and allocation of resources.
c. Establish a intersectoral and cooperative framework for *efficient integrated and partcipatory land and water management (watershed) and optimal use of the natural resources* involving state ministries, Localities, NGOs and local communities.
d. Local watershed management and development interventions delivered and demonstrated on the ground.
e. The Government's commitment to the empowerment of local agents of change (Localities, NGOs) and develop social capital at the local level by strengthening the role of local partners in planning and implementation of improved livelihood activities demonstrated.

3.1.2 Performance indicators

Progress towards the above outcomes would be measured and monitored based on the following key performance indicators:

a. Improvement in the diversification and intensification of livelihoods and reduction of environmental degradation caused by target communities and user groups;
b. Increase in the share of public investments implemented by Localities and NGOs;
c. Increase in the share of the State budgets elaborated and disbursed on the basis of participatory plans for local development.

3.2 Key Framework Project Components

The proposed components of the new project are divided into three general output areas (each with a number of sub-components):

Component 1: Institutional Strengthening in order to strengthen the capacity of *relevant local institutions and supporting stakeholders* to efficiently, effectively and sustainably fulfil their defined roles and responsibilities

Component 2: Critical Development Projects which are deemed necessary to create a foundation for a successful Fast Track Watershed Management Project.

Component 3: Integrated Watershed Management and Development (IWM&D) Fund with the objective to support local IWRM&D initiatives at community level with a strong poverty reduction and environmental focus, that will simultaneously deepen local participatory IWRM processes

The first key framework component of the project, and is closely related to the first part of the project objective, namely to "*"i) strengthen relevant local institutions, stakeholders and systems at all appropriate levels for the integrated and sustainable management of water resources in the Lower Atbara, Dinder and Ingessana project areas*. This component is outlined in detail in the Institutional Interim report.

The second and third components are central to the second part of the programme objective, which is "*to stimulate, support and demonstrate fast track) appropriate development-oriented investments in the project areas that contribute to poverty reduction and environmental sustainability*". These components constitute a focus on more concrete environmental and development challenges in the three project areas, and include discrete yet inter-related development projects, which are outlined in the sub-sections on "Assessment of land and water management interventions".

The Programme Management Structure is outlined separately in the Institutional Interim Report.

Draft Logical Framework Analyses for all Project components are included in Annex 3. More detailed indicators for each component will be developed during the preparation of the PIP.

3.2.1 Component 1: Institutional Strengthening and Project Management

Institutional development and capacity building – alongside stakeholder participation – should be acknowledged from the outset as being critical to the project's success and sustainability.

There are various institutional and technical gaps that need to be addressed in the Fast Track Project related both to Locality core business and to the evolving ILWRM&D framework. Linked to such gaps, there are concerns about the limited human and financial resource constraints, and hence vulnerability, of Localities in

fulfilling all its responsibilities. It will still be some years before Localities can become financially strong.

Regarding institutional strengthening at Locality level, the focus of support proposed here is primarily related to specialised i) technical training e.g ILWRM, GIS applications and infrastructure design and construction and ii) participatory planning and support to community managed projects.. But there will also be capacity building inputs in relation to watershed resources management and development more broadly, for example to increase understanding and capacity in relation to integrated, poverty-oriented approaches to ILWRM.

Training, technical assistance and capacity building would also be provided to localities, NGOs and local Community-Based Organizations (CBOs), to improve their technical skills in the identification, planning, programming, management and delivery of social subprojects. In addition, this component would establish the eligibility of target localities to receive funds from the project through conducting a training program aimed at building their capacity in the areas of project management (e.g., transparency, accountability, financial management, procurement), and community participation and empowerment (e.g., participatory planning process and inclusion of marginalized segments of the population in decision-making). Once the project validates the attainment by these localities of the above Minimum Qualifying Criteria (MQC), they will be eligible for receiving funds under the project, for the benefit of the target beneficiary communities using NGOs, CBOs, private sector, and social sector ministries.

Also technical and managerial capacity building at federal level is required. As an example, the design of water resource dams are presently carried out at federal level, by the National Water Cooperation. During field visits several examples of either poor design and/or poor construction were found. It does seem efficient that certain specialised technical services are provided to the states from federal level, as it is also the case for the federal research institutes. The relevant federal agencies and institutions need to be identified and their roles in project preparation in and implementation need to be clearly identified along with their liaison with state level organisations, in order to ensure good quality in the final product.

3.2.2 Component 2: Critical Development Projects

The Project will support concrete Critical Development Projects which are deemed necessary to create a foundation for a successful Fast Track Watershed Management Project. The critical development projects are of cross cutting nature rather than specific watershed interventions however they constitute important supporting interventions which should be undertaken in parallel or prior to the specific watershed interventions. Hence, these projects are not suitable to be directly financed under the Fast Track Watershed Project. Examples of critical development projects are road infrastructure, establishment of operative Locality offices and staff

quarters and strengthening of micro-finance institutions to support project interventions.

3.2.3 Component 3: IWM&D Fund

Integrated management of water resources necessarily requires appropriate legal and institutional frameworks and technical and management capacities amongst a range of formal national and basin-level institutions. However, much of the day-to-day responsibilities for – and various effects of – IWRM occur at local catchment and community levels. This is particularly evident when considering such threats to the basin's water resources posed by uncontrolled gold panning or environmentally damaging land use practices. That is why, in addition to coordination amongst relevant sector agencies, stakeholder participation at all appropriate levels is such a critical aspect of IWRM&D. In order to deepen such participation and provide early concrete benefits to communities within the basin, attention will be given to supporting and encouraging local, community-based IWM&D initiatives.

The IWM&D Fund will support concrete Projects which have been prioritised by stakeholder in each project area. They are intended to address urgent needs, and to contribute to concrete improvements both in the area's water resources and in the overall quality of people's lives. While designed with a consideration for appropriate institutional capacity, stakeholder participation, and integration with relevant cross-cutting issues – all of which have implications for the efficiency, effectiveness and sustainability of investments – most of these projects, as well as various other programme components, include some degree of infrastructural or hardware development on the ground.

The proposed project will contribute both directly and indirectly to economic growth, sustainable livelihoods, environmental security, poverty reduction, and improved health and social development for different communities in the three project areas.

These small-scale investments are intended to link local communities more closely to IWRM processes, provide practical experience and lessons both in IWRM and related development activities, and contribute to poverty reduction, gender equity, improved health in general and especially in relation to environmental sustainability. This component is an effort that supports community-led development through partnerships among local stakeholders, including: localities, communities, NGOs and community-based organizations, on the basis of subprojects submitted by local communities and developed through a consultative, participatory planning process.

To support such initiatives, a flexible fund is needed, yet one based on clear selection criteria that concretise the principles and strategies of IWRM&D. This could include support for such activities as shelterbed and homestead tree growing projects,

achieving 10% tree cover on rainfed mechanised farms, development of drinking water supply, development of an appropriate livelihood project (such as shallow wells, pumps and improved small-scale irrigation systems), or an activity aimed at improved health and sanitation (such as ecological sanitation). The projects should have a particularly strong emphasis on poverty reduction and other cross-cutting issues as mentioned above, and should entail at least a basic environmental and social impact assessment prior to approval.

The maximum size of a community project typical subproject under this component is $200,000 equivalent. Community contribution is proposed to be 10% up to a ceiling of $10 000. The contribution can be in cash or in kind depending on the economic strength of the beneficiary. The size and the cost-sharing will be debated further in the Stakeholder Workshop planed for August 2007. All subproject proposals have to satisfy specific selection and eligibility criteria as stipulated in the project's Operational Manual (OM). Each project is implemented through a three partite agreement between the PIU, the Local Government and the CBO.

The mechanism for managing and monitoring this small fund will similar but less elaborated that the CDF project as the maximum size of a typical community project is much smaller. This implies that it is anticipated that the Project implementing units, will manage the Fund on a day-to-day basis.

Monitoring and management will also be undertaken by the Programme Implementation Unit, which will be responsible for transferring funds to the selected communities in agreed tranches, based on transparent reporting. Formal auditing of the Fund will be undertaken. The Local Project Management Committee will play a critical role in guiding and monitoring the implementation of the Fund, and will constitute a review panel for assessing and approving applications for individual projects or groups of projects, based on defined selection criteria to be finally agreed upon during the Inception Phase but to be reviewed as the project proceeds. Important links need to be made between these pilot projects and the piloting of the micro-credit project component i.e. a community that is involved impacted by a WM&D Fund intervention should be prioritised for the micro-credit component.

3.3 Project Management

The proposed project is proposed to be implemented under the auspices of the Ministry of Irrigation and Water Resources (MIOWR) in Sudan supported by a small but flexible Project Steering Committee. The primary implementing agencies are proposed to be Project Implementing Units linked to the Ed Damer Locality for the Lower Atbara Area, the Bau Locality for the Ingessana Area and the Dinder National Park Management Office for the Dinder project area. The DNP Joint Committee would also be involved as a special steering unit, although a number of other public

sector agencies and stakeholder organisations will also be involved with key aspects of management and implementation.

4 Background Subject Studies

4.1 Introduction

This section provides background information on a few cross-cutting subjects as a general foundation for the more detailed studies in each project area.

4.2 Agricultural Analysis

This section analyses agricultural production in general in Sudan.

The recent agricultural policies in the Sudan have focused on mechanized large-scale, rainfed agricultural ventures achieving increased grain production through expansion of the cultivated area only, and not through increased per unit yield. The total harvested area increased steadily from about 4.5 million hectares in 1960s to about 20 million ha in 2000, with great year to year variations of harvested area, and therefore total yields, revealing a fragile balance between production and need (Figure 1). 42 % of the rainfed agriculture is under large-scale mechanized agriculture and the remainder is under small-scale traditional cultivation (Ministry of Environment and Tourism, 1996). Rainfed traditional farming system includes nomadic, transhumance (moving with livestock and growing short-maturity subsistence crops), and sedentary agriculture which also includes a significant number of livestock. Livestock provide an important capital asset and are a risk management tool for pastoralists and farmers in times of drought. The non-nomadic small farmers typically have 10 to 15 feddan on which they produce food crops as well as cash crops such as karkade, sesame, and water melon seeds. The total cropped area in this system is estimated at 18 million feddans. Gum arabic is harvested in the woodland forest areas. This system exists to some extent in every state. It is most prevalent in the states with arid and semi-arid environments.

The government also allocated large tracts of land (between 50,000 and 1 million feddans) to Sudanese and foreign investors (mainly from the Gulf countries). Land preparation, seeding, and most threshing on these farms are mechanized, whereas weeding, harvesting, and some threshing are done by seasonal labour.

Per unit yields of all crops are steadily decreasing, currently reaching rates far below their genetic potential (Figure 2). Several factors may be contributing to these poor yields. The government institutions turn a blind eye to the malpractices of the mechanized rainfed agricultural production, and its commitment to the small-scale rainfed producer seems less firm. Rainfed agriculture looks unprofitable and represents an inefficient use of land resources. Perceptions of resources conservation and sustainability of rainfed areas are still lacking, and if the government continues with business as usual, prospects for rainfed agriculture production will be bleak and degradation of land resources will continue.

As a result of the poorly managed rainfed agriculture in the Sudan, the production bases have been degraded, the standard of living has fallen and ethnic conflicts have become fiercer in rural areas and the rate of migration from rural to urban dwellings has increased. The main environmental implications are a decline in soil fertility and deterioration of its physical condition, the soil surface has become vulnerable to erosion and the decline in annual rainfall in the recent years has become more persistent, perhaps due to the degradation-induced drought hypothesis.
A study by Ayoub (1999) showed that loss of soil fertility and rainfall variability were among such factors. In 1984/5 in Qadarif, Sennar and Blue Nile areas sorghum and millet yields were reduced to less than 50 per cent of pre-drought levels, largely due to low rainfall and its bad timing. The droughts of the 1970s and 1980s triggered short-term cycles of famines in many parts of the country. Long-term rainfall data, during the periods 1903-93 (Ayoub, 1999) and 1960-1998 (Abdalla and Mustafa, 2005), show below average rainfall for the last three decades in all sub-regions of food production in the Sudan.

Figure 1. Sorghum and millet production, consumption, and sorghum donations (Source: FAO, 2006)

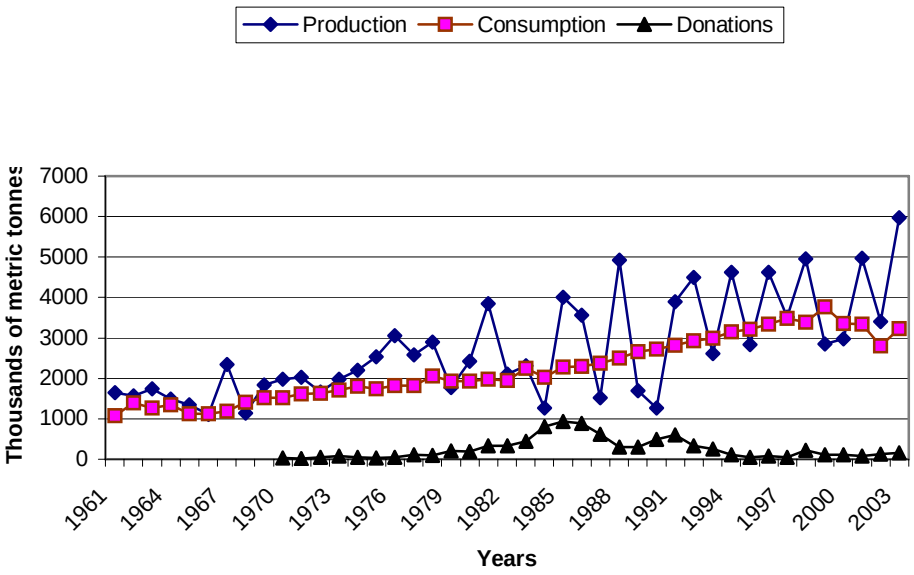
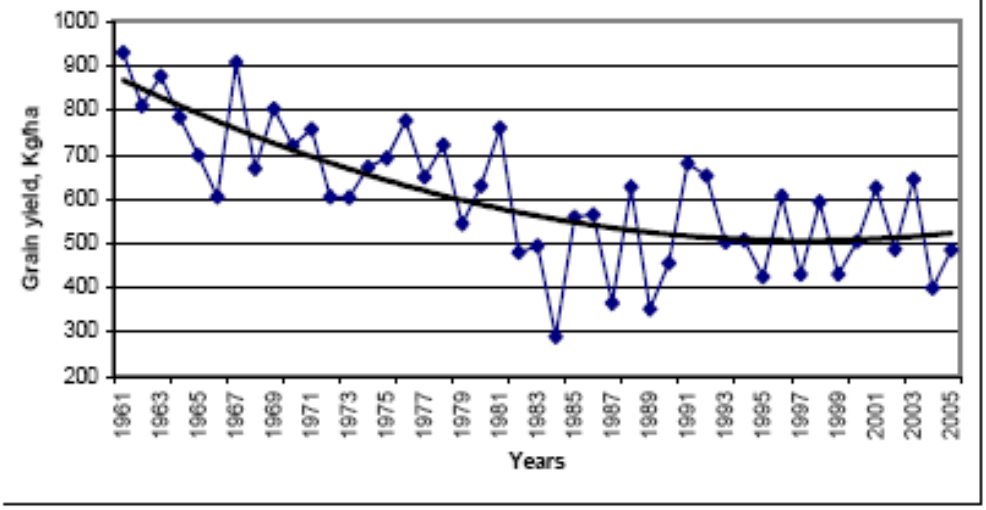
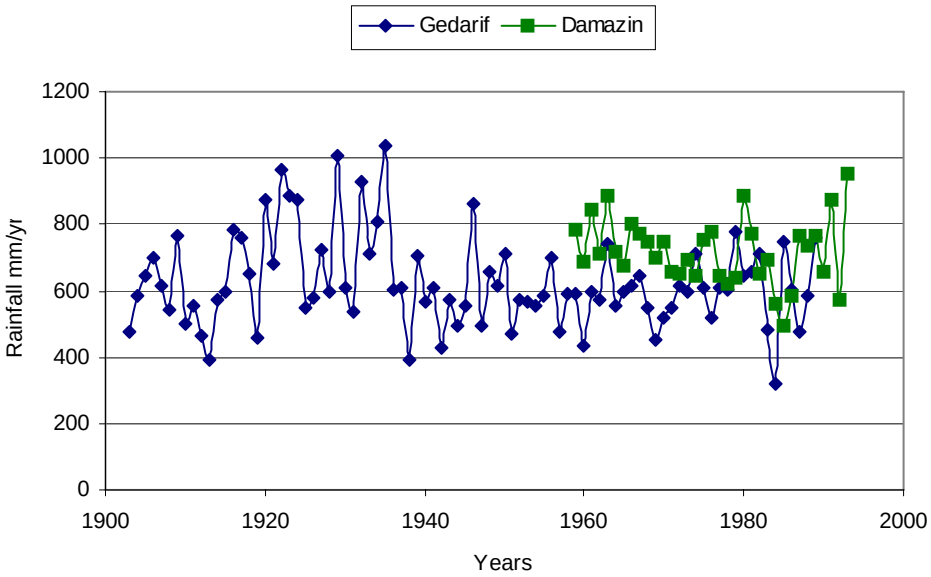


Figure 2. Yields of cereals by cropping season (source: FAO, 2006).



Sustainable livelihoods are, therefore, not possible in many parts of the country without drought mitigation. Figure 3 shows annual rainfall variabilty in Gadarif and Damazin. In Gadarif variability takes place around 600 mm per year while in Damazin the average is around 700 mm per year. The vulnerability of te agricultural system is best illustrated by the rainfall variability. Drought risk reduction must be seen as a broader developmental goal, rather than a short-term preparedness. It must focus away from event management towards on-going hazard and vulnerability reduction, which promotes sustainable development. Such management will make the environment more resistant to the impact of drought by enhancing soil moisture retention. Mitigation approaches should be participatory involving stakeholders, creative and constructive leading to sustainable livelihood in communities at risk of drought. This will require enhancing technical skills and institutional supports needed to survive future droughts.

Figure 3. Annual rainfall variability in Gedarif and Damazin



Soil degradation poses a long-term threat to food production of the country. This is clearly reflected in the decline of the per unit yields of the major cereal crops (Figure 2). In the rain-fed area, nutrient outputs currently far exceed their inputs. The present use of fertilizers in the Sudan is disturbingly low, about two kg per feddan of nutrient on cropland (WRI et al., 2006). This is less than one-fifth of the world average fertilizer use, a quarter of that of Africa and less than half of that of sub-Saharan Africa. The rain-fed agriculture receives hardly any significant amount of fertilizers. If this attitude of soil mining continues, the rain-fed production system will head for total collapse. The commercial farmers who practice mechanized rain-fed agriculture mistrust fertilizers as too expensive to be worth the risk of using them. This is primarily knowledge problem which could be overcome through increased extension work and technology transfer (both fertilizers use and soil moisture conservation). Clearly, the food production system will be seriously challenged in coming decades to feed a continuously growing and increasingly affluent population. Agricultural land should be given high level of protection afforded to a strategic asset.

Many wild plants and animals are important subsistence renewable resource in rural areas**.** They are sources of food, medicine and raw material. The main threat to these wild plants and animals is their habitat loss through fires, deforestation, encroachment of mechanized agriculture, and overgrazing.

Women may be producing about 60-80 per cent of food in the subsistence agricultural sector. This role is poorly understood and their specific needs are ignored. Women's role in agriculture should be realized if food security is to be sustained.

The Sudan needs to be put in a long-term strategy to set the country on the path to recovery and growth. Strategies must be two-way processes within and between national, state, and locality levels.

Water harvesting techniques offer greater promise. Irrigated sector must produce more food with less water. Mixed farming is more suited to tropical regions than monoculture. Monoculture needs more inputs, and faces the risk of complete wipe out by droughts, pests and plant diseases.

Conservation agriculture, no till or low-till, farming system should replace intensive ploughing. The Arab Authority for Agricultural Investment and Development (AAAID) has demonstrated the no till (zero tillage) farming system to Agady (Blue Nile State) farmers who showed willingness to adopt the technology (AAAID, 2004).

Maintenance of chemical soil fertility is an indicator of sustainable land management. Fertilization with nitrates besides increasing yield can decrease infestation with *Striga* weeds on sorghum. However, maximum use should be made of leguminous plants (such as cowpea) and of the recycling of the organic wastes. The best effects can be obtained with a combination of organic and inorganic fertilizers. Less fertilizers will be required if leguminous species included in the rotation and animal wastes are recycled. Such organic material will improve soil structure and its water-holding capacity. Mulching, applying organic material to the surface of the soil, not only supplies nutrients, but also reduces moisture loss and soil erosion and reduces need for weeding. When crop residues are applied for mulching, it may create conflicts with their uses as fodder.

Studies indicate that the amount of moisture stored in the soil and nutrients available are significant measurable factors affecting production in the rainfed areas. Therefore, every effort should be made to store as much moisture as possible in the soil and to reduce evaporation loss to the minimum by means of sound cultural practices. While the incidence of drought may not be reduced, its effects can be mitigated through proper drought management strategies.
Pesticides may increase crop production significantly, but can also cause ecological problems that are detrimental to crop production and vector control. The lack of public awareness of their potential danger has made pesticides major human health hazards.

The genetic potentialities of all crops grown under rain are far from being reached. The size and persistence of such yield gaps suggest that there is wide scope for improving farmer's management skills.

The project should concentrate on small-scale farmers. Some people call that traditional agriculture be promoted. It is more sustainable, less dependent on imports and subsidies and benefits a greater number of people. The project should attempt increase yields of small–scale farmers by introducing a "green revolution" strategy. Such strategy should be based on high-yielding varieties, combined organic and chemical fertilizers, soil moisture conservation by organic mulching and minimum

tillage. Some of the negative social and ecological consequences of rainfed mechanized agriculture were due to the complete removal of tree cover. Recommended measures for soil conservation such as the 10% shelterbelts and contour ploughing should be taken into consideration.

The miracle sorghum variety “Hageen dura” produced by the Agricultural Research Corporation and ICRISAT can be promoted among small-scale farmers. A rotation system should be followed that will suppress the notorious *Striga* (buda) weed in a diversified agricultural system that may have many advantages: increased ground cover protects the soil from erosion, insurance against climate variability and drought, farm work will be better spread over time, and more varied diet become available. Diversification may be more labour intensive, but creates greater self-reliance.

The current experience shows that cropland expansion to meet the growing food needs is a minor source of growth in output. It also takes land from other uses. Yield increases should be the principal tool for boosting production. In essence, rising yields should be effective substitute for land expansion.

The number of livestock, a cornerstone of many households' economies, often exceeds rangeland carrying capacity in the Dinder and Ingessana areas. Overgrazing as a result of overstocking and range fires are the most widespread causes of rangeland degradation. During the last 20 years since 1983, the total number of livestock units (LSU) has doubled in the Sudan, reaching a value of about 43 million LSU, at the same time ranges conditions deteriorated. Figures 4 and 5 show carrying capacity, livestock density and range conditions. In the arid and semi-arid zones of the Sudan, in which Dinder and Ingessana areas are included, the carrying capacities are over-exceeded by 70% and 45% in the arid and semi-arid zones, respectively.

Figure 4. Indicative potential carrying capacity and livestock density (Ayoub, 2006).

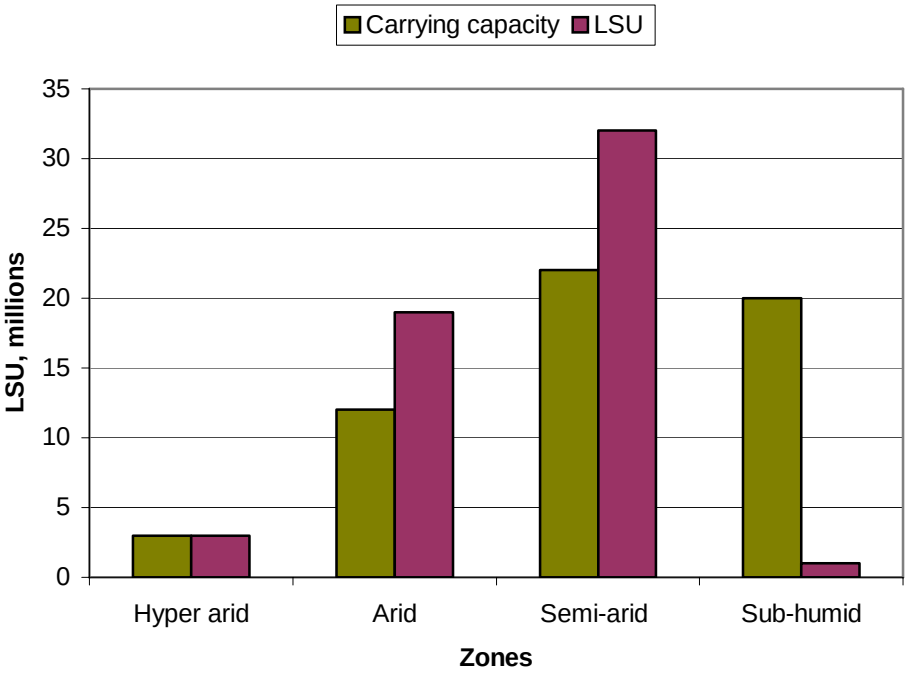
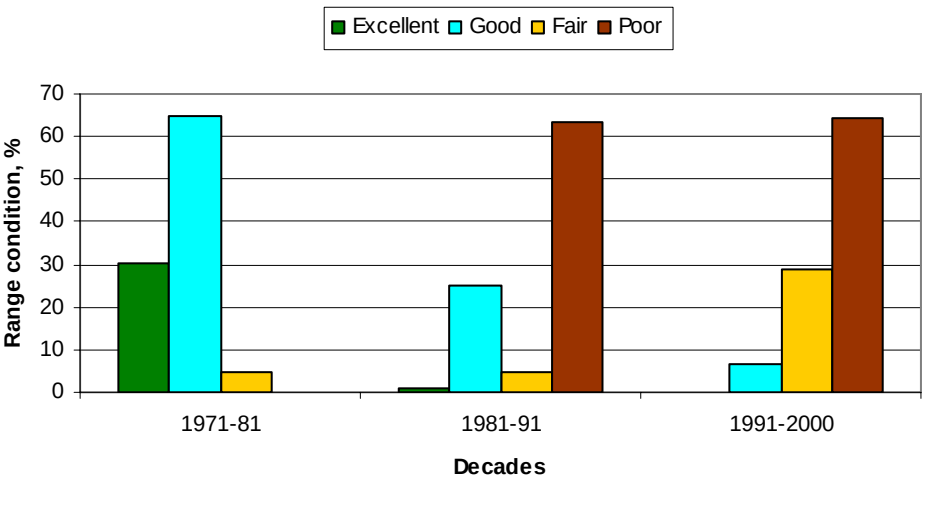


Figure 6. Range conditions by decades (Source: Hassan, 2001)



Hassan (2001) combined data from different sources and showed that range conditions deteriorated rapidly within three decades. 64 per cent of the range changed from good to poor in less than two decades. Excellent range condition has

almost disappeared by 1981. The number of animals that could be grazed on a piece of land should be set by the condition of the rangeland. Restoration of overgrazed land should take place. It will take enormous effort to stabilize livestock populations at a sustainable level, and to restore the Sudan's degraded rangelands.

Range fires, deliberately or carelessly set, consume annually over 30% of the forage resources, estimated to be about 300 million tonnes (DECARP) reducing further the rangeland carrying capacity. The damage caused by allowing fire to run through the rangelands and woodlands should be brought to an end. If reversal of this policy of inaction on a wide scale was undertaken, considerable tracts could yet be saved, and to some extent, restored.

4.3 Alternative energy

More than 70% of the total Sudanese population lives in rural and isolated communities characterized by extreme poverty. The unavailability and the acute shortages of the conventional energy supply (petroleum and electricity) to rural people have forced them to use other available energy sources like biomass.

4.3.1 Energy conservation

Charcoal stoves are very familiar to Sudanese society. As for the stove technology, the present charcoal stove can be used, and can be improved upon for better efficiency.

4.3.2 Improved cooking stoves

It has been learnt from previous efforts in Sudan, that women involved in income generating activities are more interested in energy saving stoves as a means of saving time and labour. Efficiencies of at least 20% can be achieved with most improved stoves, implying an energy saving of around 25% compared with open fires. Improve stoves can also reduce smoke in the kitchen and its negative impacts upon health by enabling the fuel to be burned more efficiently.

These stoves are now being produced and marketed in Sudan, and training on how to construct the stoves is available. However, the women have not been completely satisfied with the stoves. Some complain that they are unable to use the stoves to prepare specific Sudanese recipes. Empirical studies have been shown that problems such as these could be avoided if women were more involved in all stages of the stove technology development processes. Local traditional stoves were tested, improved, invested, and commercially used in Sudan (traditional muddy stoves, bucket stoves and tin stoves). Construction of stove could also be one of the income generating activities for women especially young girls who have dropped out of school.

4.3.3 Biogas

Presently, Sudan uses a significant amount of kerosene, diesel, firewood, and charcoal for cooking in many rural areas. Biogas technology was introduced to Sudan in mid 1970s when GTZ designed a unit as part of a project for water hyacinth control in central Sudan.

Anaerobic digesters producing biogas (methane) offer a sustainable alternative fuel for cooking, and lighting that is appropriate and economic in rural areas. In Sudan, there are currently over 200 installed biogas units, covering a wide range of scales appropriate to family, community, or industrial uses. The agricultural residues and animal wastes are the main sources of feedstock for larger scale biogas plants.
There are in practice two main types of biogas plant that have been developed in Sudan; the fixed dome digester, which is commonly called the Chinese digester (120 units each with volumes 7–15m3). The floating gasholder is known as the Indian digester (80 units each with volumes 5–10m3). The solid waste from biogas plants adds economic value by providing valuable fertilizer.
Biogas technology cannot only provide fuel, but is also important for comprehensive utilization of biomass forestry, animal husbandry, fishery, agricultural economy, protecting the environment, realizing agricultural recycling, as well as improving the sanitary conditions.

4.3.4 LPG

This energy term will be of particular interest to both urban and rural households and all the income groups due to the simplicity, convenience, and lower air polluting characteristics. However, the market price of the fuel together with that of its end-use technology may not enhance its early high market penetration especially in the urban low income, rural areas, but there are some experiences e.g. in Lower Atbara which could be build upon, and it is accepted by the community.

4.3.5 Solar Energy (PV System)

Sudan has abundant solar energy resources due to the clear sky. The favourable climatic conditions have brought about a rapid development of solar energy technology in the past three decades (solar water heaters, PV for lighting, solar cookers, etc.). The low income of farmers and high cost of PV devices make the popularization of PV systems for lighting difficulty. The presence of the PV system in Sudan and the Sudan energy strategy and policies, and the implementation of the national 1000 villages solar energy supply, and the past long experiences in Sudan encourage looking at the option of introducing solar energy as one of the project activities. Lessons learned from previous experience of solar energy in Sudan which should be considered, are:

- PV technology is proven, and a number of applications economically viable i.e. pumping for village water supply, lighting, medical fridges, communication… etc.

- Rating awareness of technology: capabilities, limitations, cost and maintenance requirements of systems are critical for ensuring acceptability. (significant demand created in rural energy project sites: ready to pay capital, installation and running cost)
- Should be demand driven i.e. priorities set by beneficiaries in response to needs.
- Should be linked with ongoing development, (preferably income - generating) activities and should be coordinated with other energy.
- Well established distribution channels, local availability of spare-parts and after sales services (trained manpower) are important elements of sustainability.
- Reliability of systems (proper sizing) is crucial for raising awareness and ensuring acceptability.
- Access to credits on suitable terms, especially by individuals and private sector is crucial for PV commercialization.
- For large investments (manufacturing) encouraging regulatory, financial and legal measures are prerequisite (investment act).
- Institutional infrastructural support to ease procedure, ensure standards, set guidelines for importation and/or manufacture, government accreditation and further development
- A number of private companies already in business but: Market need to be developed, currently limited to organization and institutions, Lack of encouraging policies, and financing difficulties.
- Financing institutions not involves: Unaware of market opportunities, Lack of encouraging policies, Small investment & high admin. Cost, Current financing systems not suitable to rest (high capital but low running cost) new appropriate and financing models needed.

4.4 Micro-finance analysis

4.4.1 Overture

In Sudan, a growing focus on poverty alleviation has developed during the last few years, as reflected by the establishment of several social funds; specialized institutions such as the Savings and Social Development Bank (SSDB) and the Social Development Foundation (SDF); and the launching of several poverty alleviation initiatives, including a strategy for poverty alleviation developed by the Ministry of Finance. Nevertheless, the government's efforts in developing

microfinance policies remain limited. NGOs and rural development projects have continued to be the main providers of microfinance to the poor in Sudan. These initiatives, however, have limited coverage and impact when compared to the size of the problem of poverty. Hence, the need for incorporating microfinance in the country's formal credit policy has emerged.

To complement the above initiatives, the issue of designing a future vision and strategy for integrating microfinance into national policies was brought up by the Central Bank of Sudan (BOS). The idea resulted from the building conviction that microfinance could be an effective tool in poverty alleviation endeavours, in addition to being a lucrative business that could prove attractive to commercial banks.

International experience has demonstrated that even a small amount of money can have a significant impact on the lives of the poor. The experience of Sudanese NGOs and some social funds has also shown that microfinance can be used as a tool for financing the basic services needed by the poor, including health insurance, medical care, education, and clean potable water.

Microfinance arose as a global economic development approach intended to benefit low income women and men. In Sudan, the growing focus on poverty alleviation has increased interest in the role microfinance can play as an effective tool for decreasing poverty. However, current microfinance initiatives in Sudan have limited coverage and impact when compared to the size of the problem of poverty, and thus the huge potential of microfinance remains largely untapped. A clear vision for the development and expansion of the microfinance sector and a strategy for integrating microfinance into national policies are required.

The formulation of such a vision and strategy must be built on a sound and informed understanding of the specific conditions of the microfinance sector in Sudan. The success of microfinance programs in Sudan has varied considerably between MFIs, according to the variation in approach and the level of financial discipline adopted by each. NGOs, social funds, and rural development projects have succeeded in responding to the credit needs of the poor and the grass-roots level. However, some NGO-MFIs are restricted in their geographical coverage and have a limited funding base and limited sustainability, due to their dependency on donor assistance. Other MFIs have experienced difficulties in shifting from a grants-based approach to a market-oriented approach to microfinance. Subsidized credit and low repayment rates have adversely affected the financial and operational performance and sustainability of some MFIs. Furthermore, banks operating in microfinance have had limited success in terms of targeting, outreach, lending volume and lending portfolios. Lack of training and experience in microfinance has been cited as the major factor limiting the development and expansion of bank micro-lending programs.

Suggestions are made for improving MFI outreach, as well as client access to their services. A supportive infrastructure is recommended for the development, including capacity building, microfinance associations and other institutions of information exchange, apex organizations (credit guarantee facilities), and an umbrella agency to facilitate coordination among stakeholders. Changes in the policy and legal environment are recommended to create a more enabling environment for small and micro enterprises. An important element in this regard is the establishment of smaller and more innovative financial intermediaries that are able to develop products for underserved segments of the market.

4.4.2 SMEs in Sudan

There is a lack of reliable data on the size and proportion of small and micro enterprises in Sudan. The few efforts exerted to survey small enterprises (studies by the Ministry of Industry and UNIDO) have been confined to small-scale industries. The Industrial Survey Report, issued in March 2005, states that the total number of manufacturing industries in Sudan is 24,114. Out of this number, small scale industries (those employing less than 10 workers) represent 93.10 percent, equivalent to 22,460 enterprises. [2]

As for their social contribution, Professor M.H. Awad of Khartoum University, argues that artisans and 'small' entrepreneurs in Sudan provide two-thirds of the basic household needs for the majority of the population. They provide food, beverages, furniture, utensils, tools and equipment, and various types of services, including maintenance, transportation, and construction (Issue No 20, Industry and Development Magazine, 2005). In order to obtain an appreciation of the significant role that micro and small enterprises play in the Sudanese economy, a number of qualitative indicators could be cited.

As stated above, small and micro enterprises provide vital, affordable, and accessible goods and services to the poor in Sudan, who currently represent the majority of the population. According to the findings of the Sudan-Millennium Development Goals Report (MDGs), issued in December 2004, there is no reliable data and information on the magnitude of poverty in Sudan. The data available, the report reveals, is provided by non-poverty specific and outdated surveys that were mostly confined to northern Sudan, and, at best, some areas under government control in the south. The data also represents the non-oil period. Hence, given the quality of available data, money-metric measures of poverty are of limited use. However, by referring to non-income indicators of poverty (including access to services, infrastructure, assets and social capital; unemployment rates; and changes in food requirements) the MDG report concludes that there is a high incidence of poverty, in spite of recent economic growth.

The Liberalization Policy instituted in February of 1992, followed by the implementation of the Restructuring Program, contributed to a drop in the real income of workers and salaried employees, who were forced to engage in micro

UNDP/World Bank study (The Microfinance Experience of Egyptian Commercial banks). The number in microfinance enterprises in Egypt amount to not less than 1.5 million

and small enterprises to supplement their meagre incomes. Those who lost their jobs as a result of privatization or restructuring had to follow suit. Due to the liberalization and privatization policies, the employment opportunities offered by the public sector became quite limited. The only opportunities available were either in the private sector or through self-employment. Unemployed graduates, and sometimes students, on full or part-time basis (e.g. petty trade and services), joined the sector and were engaged in self-employment.

Shifting to agriculture, approximately 67 percent of the Sudanese population derive their livelihood from agriculture, which accounts for 36 percent of the country's GDP; represents more than 90 percent of non-oil exports; contributes about two-thirds of all employment opportunities; and supplies approximately 60 percent of the raw materials needed by the industrial sector (2001). The agriculture sector is also responsible for the country's main food staples. [3]

Finance to agriculture in Sudan does not match its contribution to the GDP, particularly finance to the traditional sector. Due to the concentration of banking branches in urban areas, mainly in the central and northern parts of Sudan, the access of producers in the traditional sector to financial services remains quite limited. Producers in this sector depend mainly on informal credit sources, usually with high finance costs.

The majority of micro and small enterprises are financed by informal and semi-formal sources (such as individual savings, grants and loans from family, friends, NGOs, and social funds). The involvement of the formal banking system is minimal, primarily because these enterprises are rated by the formal financial system as unbankable. This is despite the fact that a significant amount of liquidity is circulating in the hands of thousands of small entrepreneurs, operating in a number of big popular markets. The banking system has apparently failed to tap these potential resources.

There are several constraints that limit the interaction of the formal financial system with micro-entrepreneurs. One such constraint is that the working hours of the local markets continue until the evening, while banks close their doors in the early afternoon (12:30 pm). It is apparent that bankers are still unaware of the huge potential of micro and small enterprises. Professor Malcolm Harper of Cranfield University, UK described this situation as a 'benign paradox". Although bankers are seeking profits, he stated, and dealing with small businesses has proven to be both profitable and lucrative, they remain reluctant to do business with such group of entrepreneurs.

The percentage of small loans extended by the formal banking sector to "productive families" and small producers in Sudan, during the period from 2002 to 2003, did not exceed 3 percent, according to Bank of Sudan reports (Farah,

[3] During the last 10 years there has been a deterioration in the production of cereals such as sorghum and millet. The main reasons behind this deterioration are a combination of climatic conditions and the financial modes adopted towards different farmers in the traditional sector of the economy.

2005). The percentage of micro loans (not exceeding SD 500,000) was less than 1 percent during the period from 2003 to 2004, as shown in the following table:

Table 2: Percentage of Micro-loans in the period from 2003 to 2004 in Sudan

	Amount of loans in SD million			
Year	**Microfinance**	**Total amount of loans**	**% of Microfinance tototal**	**No. of projects financed**
2003	2,935	332,805	0.88	7,628
2004	4,111	479,415	0.86	9,444

Source: Statistics provided by the Bank of Sudan, 2006

The demand for microfinance among women has grown during the few past years. In addition to their poverty and meagre share in resources, women represent the major victims of wars and armed conflicts. The phenomenon of female-headed households characterizes the families of IDPs in the poor urban settlements in the outskirts of Khartoum.

In the absence of the male breadwinners (husbands, fathers, brothers and sons), women have to take care of themselves and their family members such as children, elderly people and other dependants. As a result, women became the neediest group in desperate need of external support. This is one of the main reasons why NGOs emphasize targeting poor women in these locations.

IDPs encounter problems in finding adequate shelter, water, health services, children's education and livelihood. Furthermore, the planned resettlement of IDPs and migrants implemented by local municipal authorities has created a huge demand for "consumption loans" to be used in the purchase of land plots, the construction of low cost buildings, and for home and business environment improvement (home-based production or services). The experiences of the Urban Upgrading and Poverty Alleviation Project (UPAP), the SDF, the Port-Sudan Association for Small Enterprises Development (PASED), SSDB and the Solar Energy Project (implemented by the United Nations Development Programme (UNDP) with the Savings Bank), have demonstrated the viability of providing microfinance to finance home improvement, and to supply poor urban quarters with their basic needs, such as electricity, water, health services and energy, on a cost-recovery basis. Extending microfinance to communities is done through grass-root community intermediaries/community based organizations (CBOs).

4.5 Mapping and GIS

4.5.1 Thematic maps

A set of thematic maps for the three project areas is provided in Annex 2.

The data relating to the three project areas have been obtained through available GIS data at various scales, non-digitised data, descriptive data and tabular data for the three project areas. This has enabled us to get an overview of the three project areas to support the sample area selection process and to identify information gaps.

The GIS-data generally has a geographical projection in WGS 84. Some layers are projected in UTM 36N. A lot of the previously non-digitised data has been scanned and georeferencd according to common features in the available digitally projected data. This procedure along with all maps have been compiled in ArcGIS 9.2

The GIS-layers and supporting information to be digitised and incorporated in the database include:

Data Layer	Source	Suitability/ Information Gaps
Locality boundaries, State boundaries and International boundaries	Website gateway to official Sudan information: www.unsudanig.org	Information has been reconfirmed by counterparts
Boundary of Dinder National park	Dinder National Park management plan	Information has been reconfirmed by counterparts
Selected infrastructure (roads, airports and railways, major towns and selected reservoirs and groundwater points)	GIS polygons from CRA database. Other information retrieved from printed topographical maps, MOIWR GIS databases and Loclities.	No major information gaps
Rivers and reservoirs	Detailed information from national study reports (e.g. DNP mgt plan). Some GIS polygons from CRA database. Tabular data on river flows from DNP mgt plans.	No major information gaps
Terrain/ Digital elevation data at 90 metre resolution	From CRA database (based on SRTM) 	Detailed enough to support selection of sample sites.
Soil mapping at 1:1,000,000 scale	From FAO database. Some information obtained from national experts and studies.	No information gaps
Soil suitability	No relevant maps have been identified.	descriptive information obtained from national agricultural research stations
Geology mapping at	From CRA and verified by	No detailed maps of

1:1,000,000	national maps	project sites have been found. The scale is of sufficient scale for watershed project planning. More important for this project is to obtain detailed data on geo-hydrology.
Land use mapping at 1:250,000 scale	From the AFRICOVER supplemented by land use plans for Atbara, Dinder and Ingessana Areas.	Detailed maps have been enhanced by remote sensing
Remote sensing	Landsat from the Enhanced Thematic Mapper (ETM+), Compressed Mosaics from https://zulu.ssc.nasa.gov/mrsid/	Cirka from yr 2000, Pixel size: 14.25 meters
Remote sensing, continued	Remote sensing from http://earth.google.com/	Recent images at high resolution, but only for parts of the study areas
Temperature data at 900 metre resolution	Detailed tabular data from national meterological stations. GIS polygons from CRA.	Data cross-checked with various sources.
Rainfall data at 900 metre resolution	Detailed tabular data from national meterological stations. GIS polygons from CRA.	Data cross-checked with various sources.
Population data and habitation patterns	Available population and habitation data is outdated. National Census is on-going.	Correctness of digitised data is uncertain. Updated and digitised data on habitation patterns will be necessary as soon as the national population census have been made public
Soil erosion, gullies and erosion potential/hazard	Recent studies and field observations reveal that soil erosion is not a key problem in the three project areas. On the other hand, sedimentation is, caused by soil erosion mainly in Ethiopia.	Erosion potential/hazard mapping proposed to be undertaken for Ethiopia.
Biodiversity and environmental assessment	Descriptive information available in studies and has been reconfirmed by observations in the field.	Environmental baseline assessment and digitisation of data to be undertaken.

4.5.2 Remote sensing

The landuse maps over the project areas have been complemented with Remote Sensing Landsat images from the Enhanced Thematic Mapper (ETM+). Current Landsat coverage is free available (circa from yr 2000) and downloadable from https://zulu.ssc.nasa.gov/mrsid/

Compressed Mosaics are here available with the following specifications:

Spectral Bands: Three Landsat ETM+ bands, each sharpened with the panchromatic band.

Band 7 (mid-infrared light) is displayed as red

Band 4 (near-infrared light) is displayed as green

Band 2 (visible green light) is displayed as blue

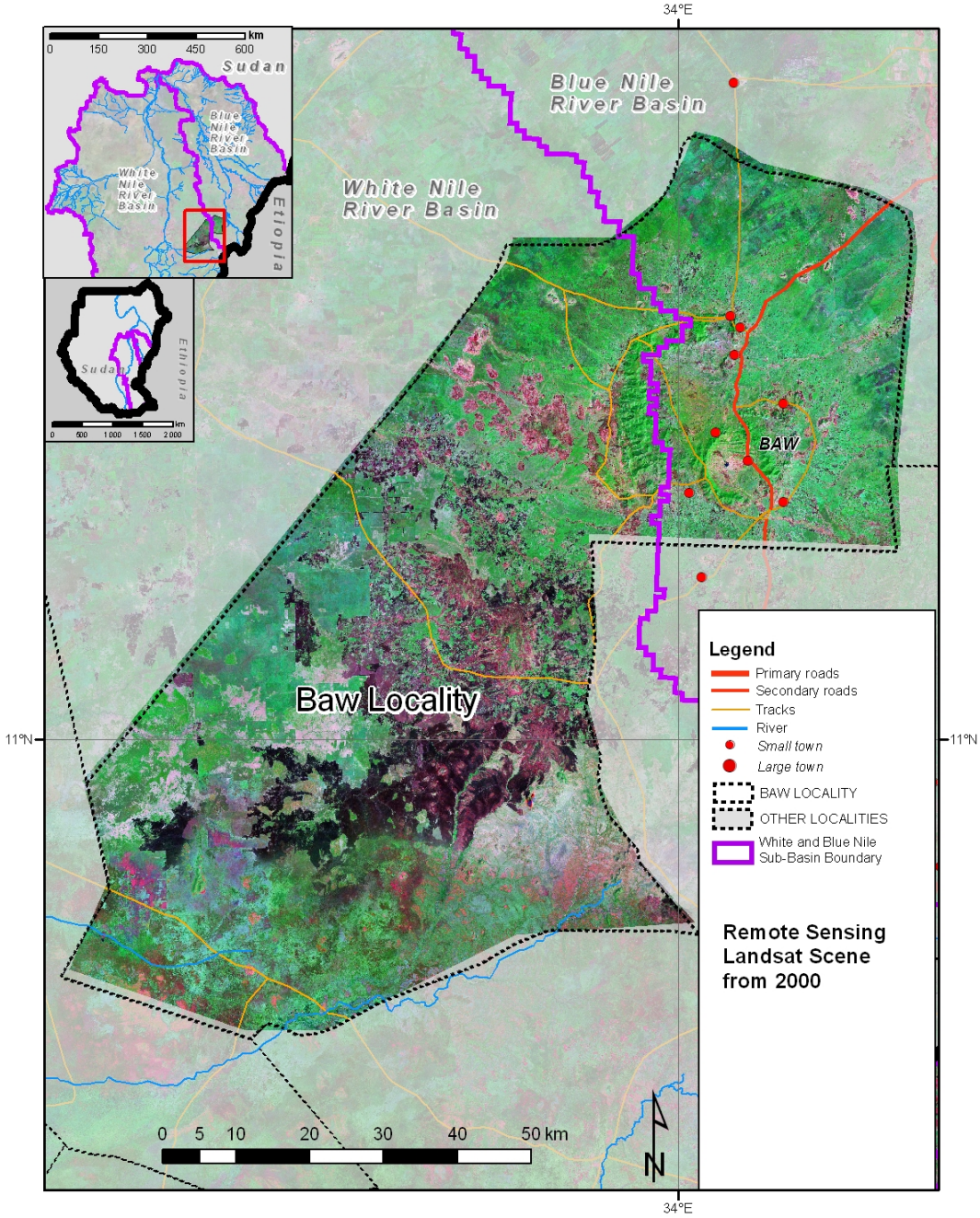
Coverage: The GeoCover Landsat mosaics are delivered in a Universal

Transverse Mercator (UTM) / World Geodetic System 1984 (WGS84) projection.

Pixel size: 14.25 meters

Example over one study area is shown below:

INGESSANA PROJECT AREA
WHITE NILE and BLUE NILE SUB-BASINS
REMOTE SENSING



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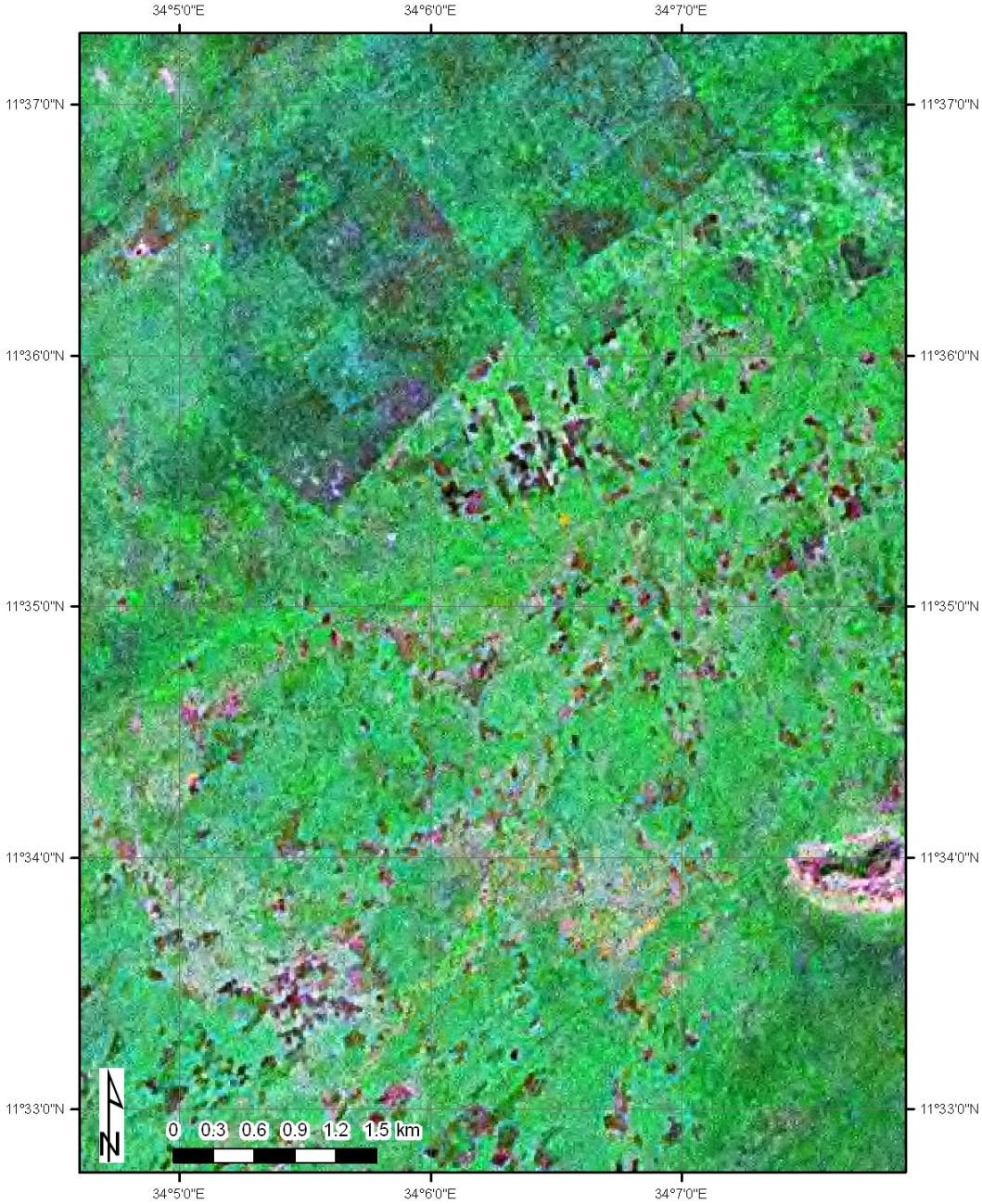
Another source for readily available RS data is Google Earth (http://earth.google.com/). As a comparison, the Ingessana area is shown with an exported image from Google Earth.

It can be noted that the overall quality of freely available satellite images are generally good over the study areas (as shown in Annex). The benefit of using the Landsat mosaics is that the resolution throughout is generally good and that that the export/import functionality works with modern GIS software, allowing for all general GIS capabilities, like overlay with customised thematic data, zooming and panning in the image etc.

Using Google Earth has the benefit that this viewer is a shareware with the only requires being a modern computer and a rather fast connection to the Internet. Generally speaking, the images over Sudan might be of poorer resolution (that the e.g. the Landsat ETM+ mosaics mentioned) but on the other hand one might be lucky to find good imagery over local areas.

Examples of this are shown in the following maps where the same area over northern Ingessana is zoomed in and shown both with the Landsat ETM+ mosaics and with an exported image from Google Earth. The maps clearly shows the generally good and uniform coverage using the Landsat ETM+ and the Google images with local superior resolution.

DETAIL WITHIN INGESSANA PROJECT AREA
WHITE NILE and BLUE NILE SUB-BASINS
DETAIL FROM LANDSAT REMOTE SENSING



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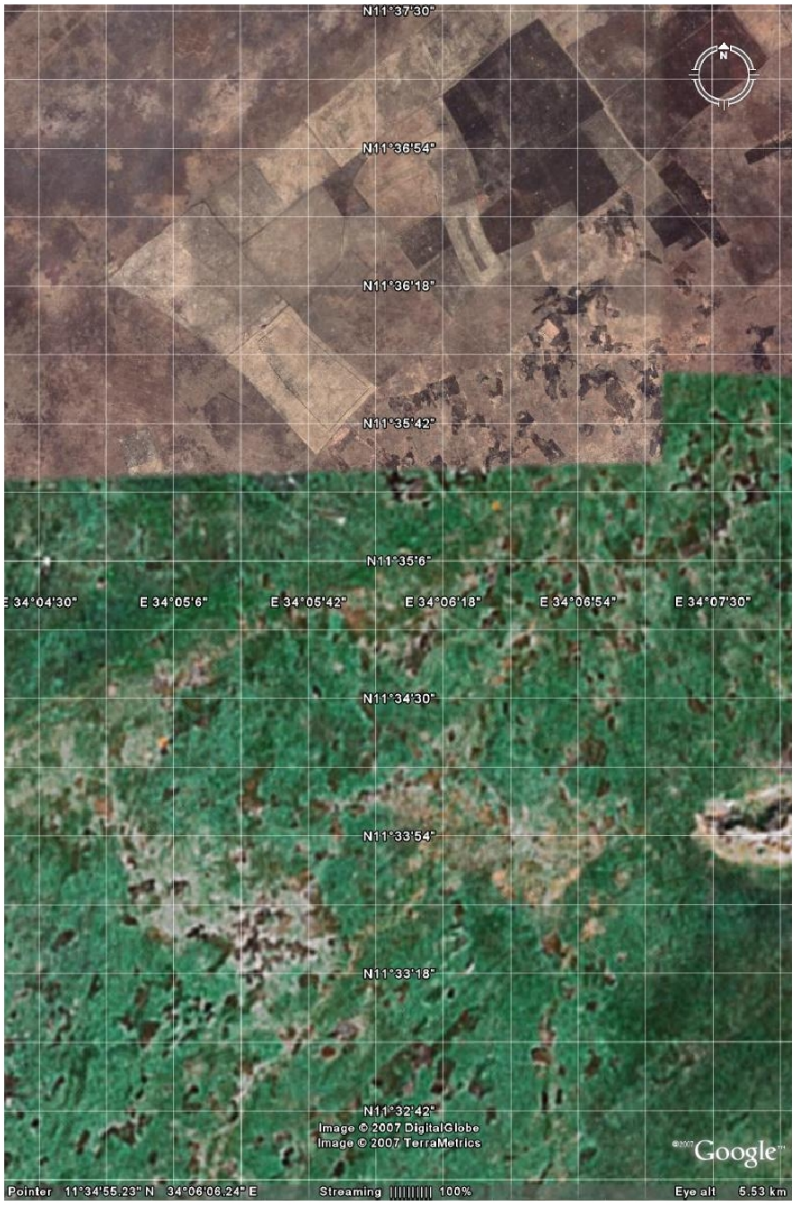
DETAIL WITHIN INGESSANA PROJECT AREA
WHITE NILE and BLUE NILE SUB-BASINS
DETAIL FROM GOOGLE EARTH



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4.5.3 Proposed Project Components

It is proposed that the present landuse of the project areas should be mapped in detail using remote sensing. This work could be undertaken by the Remote Sensing Authority in Khartoum (Dr. Amna Ahmed Hamid). If the authority does not have proper satellite images in their possession, funds should be made available in the Project Budget to purchase images and undertake the mapping with the right resolution and of recent date.

One option is to present the landuse mapping online with a shareware viewer, for all stakeholders to use. Simple GIS-tools can be built-in, like Zooming, Panning and selective overlay. Along with this landuse mapping and user friendly GIS tools, a capacity building component should be managed by the Project. Both Locality level and National level could be trained in using simple GIS-viewing tools etc.

Advanced training in GIS is general needed in Sudan. In order to achieve efficient IWRM additional GIS training of relevant personnel at the MOIWR, the Agricultural Research Centres and the Water Research Centres is proposed however not as a component under the Fast Track project.

5 Detailed Technical Assessment for Atbara

5.1 Brief Description of Lower Atbara Project Site

5.1.1 Definition of project area

The selected project area is the Lower Atbara area, downstream of the Khashm el Girba Dam. The project area has been defined to include the two administrative units of Atbarawi and Sidon within the Ed Damer locality and focuses on both the northeast and the southwest side of the Atbara River.

Atbara town attains its importance as the headquarters of the Sudan railway system and an important commercial and agricultural centre, while Ed Damer, 13 km to the south of Atbara, is the headquarters of the Nile State administration.

5.1.2 Key Characteristics

The dam at the rapids of Khashm el Girba was built in 1962 for water storage. The Khashm el Girba Dam enabled 200,000 hectares to be irrigated from the Atbara River. These schemes changed the hydrological pattern of the lower Atbara i.e the selected project area.
The Atbara district is arid receiving approximately 75mm of rain per year. Away from the river there is little vegetation cover and the region has the appearance of being totally arid. Apparently there has been severe drought in the area during the last five years. A wide region close to the river is flooded annually when the Khashm el Girba Dam is opened from August to October. Flood recession farming is practiced in this area and there are some attempts to hold back floodwater in order to improve the growing season as well as some areas where irrigation water is pumped directly from the river or from wells in the channel aquifer. Pastoralists are mainly located in the far south of the project area between Shababit to the Kassala border.

Ed Damer is accessible throughout the year via tarmac roads which are in good condition. There is intense urban-rural interaction, contact and communication within the Atabarawi Administrative Unit, in contrary to the southern parts of the Sidon Administrative Unit. Although few roads exist, with majority of travel being off-road, transportation within Ed Damer Locality is relatively easy. Travel can be disrupted short periods of rainfall and sand storms but only for short periods. Access to markets is good.

The key environmental concern is desertification and sand dune encroachment which is aggravated by some of the current land use practices as described below. The main concern among the stakeholders is the poor access to water for irrigation.

5.1.3 Institutional framework in Lower Atbara

The institutional structures of the River Nile State and Ed Damer Locality at different levels are set up as follows.

At the State level there is a Wali (Governor). Under him there are eight ministries. These are the Ministries of Agriculture, Health, Education, Finance, Youth and Sports, Physical Planning and Public Utilities, Welfare and Ministry of Local Governance. The Nile State also has six localities, explicitly: Ed Damer, Atbara, Shindi, El Matama, Barber, and Abu Hamad.

- Ed Damer Locality constitutes the following structure:
- El Muhtamad (Commissioner)
- Executive Manager
- Four departments for: Agriculture and Planning, Finance and Works Affair, Education, and Health, Welfare, Youth and Sports.
- Each Locality has a number of Administrative Units. In Ed Damer Locality there are 6 Administrative Units. These are: El Engas, El Zaidab, El Nile, El Damer town, Atbarawi (targeted area), and Sidon (targeted area).

There should be an agriculturist at each of the administrative units indicated above, however this goal has not been achieved due to lack of transport and facilities on the units infrastructure. The State Ministry of Agriculture is targeting to achieve that every 1000 feddans be supervised by a university graduate in agriculture. To that goal they have raised the number of graduate intake in the ministry to reach 30 candidates who are employed now. The total number of agriculturalists in Ed Damer locality is round 40 personal. This staff has one car and 4 motorbikes. Some of the staff have neither offices nor desks.

River Nile State's Forestry Service has 140 members of staff. This consists of 1 director, 6 deputy directors, 15 inspectors, 9 technicians, 9 rangers and 116 forest guards and nursery labourers. Among the 40 directors, forest inspectors, forest technicians and rangers, three are BSc degree, three diploma and 34 high school certificate holders.

5.2 Selection and screening of focal area studies

5.2.1 Selection criteria and ranking

All corners of the Lower Atbara have been visited and supplemented with more detailed studies in specific areas. In order to obtain detailed understanding of the core problems and linkages between "sub groups – livelihood practices- environmental degradation- potential driving forces for change", the Consultant undertook detailed case studies in representative focal areas.

Based on suggestions from the Ministry of Agriculture, Animal Resources and Irrigation, Ed Damer Locality Office and NGO representatives (LADC) it is proposed that the Lower Atbara should be divided in three representative areas combining socio-economic and agroecological characteristics.
According to the local officials and experts in Lower Atbara, Lower Atbara can be divided into two distinct agro-ecological zones: (1) the area between Atbara town and Sidon town, which they referred to as Lower Zone of Lower Atbara, and (2) the area further away from Sidon town towards Kassala, which they referred to as Upper Zone of Lower Atbara. A refinement was then suggested after considering the socio-economic aspects resulting in the following representative areas;

Area 1: Between Atbara Town and Sidon Town
Area 2: Between Sidon Town and Shababit
Area 3: Between Shabait and Kassala border

Area 1, by virtue of it being close to Atbara and El Damer towns, has access to better market and services. As a result, most of the people are settled agriculturists and practice irrigation. They produce at least two crops per year using both flood water and pump irrigation. In Area 2, the population can be divided in 50% semi-nomadic and nomadic and 50% settled agriculturalists practising mainly rain-fed and flood recession farming. They grow only one crop a year using flood water during the high flow season. Some mechanised farmers are leasing land from villages.
Area 3, however, is very much more deprived and arid than the Area 1. The population in Area 3 is mostly semi-nomadic and nomadic (more than 90%). There is high level of illiteracy. The problem of degradation and threat to people's livelihood are more severe in the Upper Zone.

Consensus was reached at the Ed Damer Locality Office that the Consultant Team should undertake interviews with El Dabura village representing Area 1 and Baaluk Village representing Area 3. Interviews with villages in Area 2 were undertaken in February.

The specific selection criteria for the Lower Atbara were:

- Extent of linkage between watershed degradation and prevailing livelihood practices.
- Extent of vulnerability/ resource dependency

- Importance/Influence
- Extent of willingness of the target groups to participate (i.e. those with present unsustainable livelihood practices should be committed to the called upon process of change).
- Extent of institutional capacity to support and implement projects at State and Locality levels.
- Extent of previous exposure to development support
- Extent of development potential for alternative livelihoods
- Extent and probability of external risks

During the detailed assessment a number of potential interventions areas were evaluated and incorporated in a screening matrix using the same set of selection criteria.

Each criterion has been assigned a value between -2- to +2. In case any criteria receive -2, the area will be deselected. An example of the screening process is presented below.

Multidisciplinary Screening of target areas
Lower Atbara - Ed Damer Locality- Atbarawi and Sidon Administrative Units

Potential beneficiaries/ Users of natural resources and environmental services

Selection Criteria	*Small holder Area 1: Atbara to Sidon*	*Comments*	*Small holder Area 2: Sidon to Shababit*	*Comments*	*Area 2-3: 90% Nomads*	*Comments*
Linkage - degradation and livelihood practices.	1	Inefficient use of water. Tree and dome cutting.	2	Overgrazing and extensive tree felling	2	Overgrazing and extensive tree felling
Extent of vulnerability/ natural resource (N.R.) dependency	1	N. R. depend but good base for diversification	2	More dependent on N.R. than Area 1. Only one cropping season.	2	Very high. Lack alternatives.
Imortance/Influence	-1	Not the most vulnerable group.	1	Vulnerable area. Broad benefit. Easiest to apply IWRM perspective	2	A previously ignored group/area. Pastoralist interestee in alt. livelihoods.
Extent of willingness and capacity of the target groups to participate	2	High	1	Understand the reason for project but not very proactive. Still expect Government driven and implemented support.	1	Willingness and awerness high. However, weak organisational skills and high illiteracy rates.
Extent of institutional capacity to support and implement projects at State and Locality levels.	1	High due to proximity	1	Average. Sidon Administrative unit may need to be better staffed.	1	Would require full time extension service in the area but the willingness of Government is high.
Extent of previous exposure to development support	2	Experience from ADS, FAO and NGO activities	1	Some experience from ADS, FAO and NGO activities	-1	No experience
Extent of development potential for improved or alternative livelihoods	2	Potential for forestry interventions, improved agriculture (incl. Improve irrigation) and micro-finance opportunities.	2	Potential for improved river harvesting through a new intakes and for intensified both rain fed and irrigated agriculture. Sidon Town as a market	1	Generally poor but project interventions possible as an integral part of the planned irrigation scheme.
Extent and probability of external risks	-1		-1		-1	
Total Points	**7**		**9**		**7**	
Ranking	**2**		**1**		**2**	

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It is recommended that only one pilot integrated watershed management fast-track project is implemented in a representative village in each zone. Yet, the justifications (i.e. screening matrix with accompanying notes) will be discussed and approved by the counterparts at National, State and Locality levels in connection with the coming visits and workshops.

5.2.2 Livelihood practices, Environmental concerns and Root causes

This section mainly discusses livelihood practices with negative environmental impacts. In addition, it deals with environmental degradation which is caused by external factors and not by the local population, however still relevant since there is an urgent need for population to adapt to new environmental conditions.

Under each sub-section it also discusses some of the root causes which must be addressed in order to succeed with the called upon towards a more sustainable and efficient watershed management in Sudan.

Hence, watershed management interventions under the fast track projects need to be initiated in parallel with a broader range of actions taking place under national and international efforts, CRA and other on-going initiatives.

5.2.2.1Deforestation

Most of the trees have disappeared because they were removed for irrigated agriculture. In addition, due to reduced river flow i.e. reduced agricultural productivity, farmers became much more engaged in tree cutting than agricultural activities.

It is clear that there are few perennial grasses or other plants in the area away from the river. This is likely to have been caused by the very heavy grazing pressure. The livestock density appears to be an order of magnitude above what could be sustainable supported by the environment. There are very large numbers of sheep, goats, cattle and camels which effectively remove all palatable vegetation. As a result there is little prospect of an economy based on free ranging livestock production. Deforestation as well as overgrazing generally will cause increased soil erosion due to wind as well as flowing water.

5.2.2.2Soil erosion and desertification

About 70% of the State land is classified as desert.
The topography is generally flat and rainfall is low, therefore erosion due to flowing water is likely to be of limited impact over most of the area, in addition the surface soils are mainly silty sand/sandy silt with some gravel, which although easy to move is unlikely to be carried over long distances by slowly flowing water which will in most cases infiltrate the surface relatively quickly.

On the other hand there is strong evidence of windborne erosion which is aggravated by deforestation caused by tree felling and overgrazing. Sand dune encroachment is recognised by the authorities in Sudan as a handicap to development. According to villagers, many villages have already been buried by the sand dunes and they expressed that the fate of the remaining villages will be the same in the near future.

5.2.2.3 Biodiversity Issues

The major concentration of biodiversity is in the riverine zone where the vegetation supports a variety of bird species as well as indigenous plants and trees. This is however also the zone of highest intensity human use due to the water availability so that the natural vegetation all along the river is heavily altered with only small remnants of natural animal and plant communities.

It is important that some of these areas continue to be protected against conversion to agricultural use.

Lack of alternative practices combined with that to sustain biodiversity has not been one of the Governments priorities which is visualised by that this area is poorly regulated, enforcement is weak and integrated and sustainable planning is in its beginning. These are some of the root causes not only for biodiversity alone but also for related deforestation and desertification aspects.

5.2.2.4 Water availability

Water availability to sustain biodiversity and agricultural production is a problem since the river is no longer flowing all year around. Efficient usage of available water is another concern. For instance, in most irrigation areas, there is a mixture of crops being grown in the same flood area. This results in an irrigation regime which is suitable for the most water demanding crop and over-irrigation of all other crops. There is therefore scope for large improvements in irrigation efficiency.

The same is valid for ground water i.e. over exploitation of ground water sources could also become a problem in the future. There are on-going developments in the region which use or plan to use large quantities of ground water. Ground water is tapped both from the deep aquifer in the Nubian sandstone, which is likely to be recharged in remote highland areas and from the alluvial shallow aquifers along Atbara river, which is being recharged directly from the river bed. However, the impact from developments under the fast track project would be marginal. The procedure for mapping and registration of ground water use is not working properly.

The main cause of water shortage is the lack of structures to capture the water during the flood season. Hence, there is a clear need to invest in the development of water regulating structures albeit in a sustainable manner. This implies that for long term sustainable development of the area the water balance has to be carefully considered. At present there is no water balance analysis undertaken for the sub-

basin or the Atbara basin as a whole. Aspects to consider in the planning of regulation structures are:

- Low maintenance
- Little or no operation
- Community participation/ownership
- Minimisation of evaporation loss

5.2.2.5 Agriculture and rangeland productivity

Agriculture and rangeland productivity are low mainly due to that the available resources are not fully and sustainably utilized. In summary, the agricultural practices are poor in land preparation, very late in sowing, using low yielder seeds, poor in pest control, using nil or minimal fertilizers, following narrow cropping system, and little awareness of modern agricultural technologies.

As mentioned above, decline rangeland productivity is closely linked to that the livestock density appears to be an order of magnitude above what could be sustainably supported by the environment.

Lack of access to extension services, lack of cooperation between local government, research institutions and private sector, lack of access to finance for privately initiated small scale investments to improve or diversify agricultural production. There are governmental financed pro-poor investments however still ad-hoc and not always based on integrated watershed planning. The pastoralists, more than others in Lower Atbara, lack alternatives to present livelihood practices due to little knowledge of the agricultural sector and high illiteracy rates which makes it difficult to advance into other off-farm activities in the modern society.

5.2.2.6 Problems and objectives tree

As indicated above, the root causes to the above environmental concerns discussed above are many. It is furthermore realized that improved watershed management cannot be achieved without the support and action of the people who occupy the land of the watersheds, and draw their livelihoods from it.

For the purpose of the Fast Track Watershed Project in the Lower Atbara, the Consultant proposes to translate these various but interlinked causes into two i.e.: 1) low awareness of consequences of deforestation and overgrazing and failure of the government to manage these problems and 2) lack of integrated, sustainable and pro-poor watershed development planning as well as policy formulation necessary to promote alternative and sustainable practices.

In order to reverse the situation, the fast track watershed project is proposed to be directed by the overall project objective and the following specific objective:

"To combat desertification and reduce people's vulnerability by offering alternative, more reliable and environmentally sound livelihoods to the people most dependent on the meager natural resources in the Lower Atbara".

The activities to be included to achieve both component and project objectives are discussed below. The project objectives and related activities are also presented in the attached Draft Project Logframe.

5.3 Assessments of Land and Water Management Interventions

The analyzed findings from the above activities together with multidisciplinary screening of the proposed interventions has enabled the Consultant to propose a menu of possible technical, social and economic interventions that could be undertaken as part of the project in the context of watershed development.

For Lower Atbara it is proposed that focus should be on linkages between i) desertification and watershed management and ii) watershed degradation and post-dam uncontrolled and unsustainable livelihood practices which have developed as a result of lack of alternatives.

The objective of this task is to assess the technical, economic, financial, social and environmental feasibility of the proposed measures and interventions aimed at improving the livelihoods of the local target groups as well as the use and management of natural resources in each micro-area and resulting in local and regional benefits.

The proposed measures to be assessed by the assignment have been divided in several intervention areas as listed below:

1. Water resources development, harvesting and storage
2. Agriculture and Rangeland
3. Reforestration/Afforestration
4. Development of alternative incomes, revolving funds and marketing services

Guided by the IWRM/Watershed Management Concept, the Consultant have undertaken assessment of feasibility and acceptability of the proposed measures and how intervention options need to be tailored to the Lower Atbara, taking into account local bio-physical conditions, previous experiences, and community priorities and needs voiced during consultations. Based on the ToR and detailed assessments of feasibility the Fast Track project is proposed to focus on the following intervention areas.

5.3.1 Water Resource development

5.3.1.1 Water resources assessment

The area presently irrigated is small, only around 24,000 feddans (approximately 10,000 ha) at Atbara and Sidon localities, while the potentially irrigable area is far larger. Flood plains in Lower Atbara is 200,000 feddans; high floods irrigate 110,000 feddans while low floods irrigate 30-50,000 feddans.

It is worth noting that at present, high floods inundate 110,000 feddans, which is more than 4 times the area presently under irrigation, and corresponds well with the area that is presently being planned for irrigation.

Combining above figures with total area of planned irrigations schemes/schemes under construction gives the following information:

Total area presently under irrigation: 24,000 feddans
Total area for planned irrigation schemes to be irrigated from Atbara river: (Makabrab Scheme = 15 000 feddans; Adaama scheme = 70 000 feddans and Lablaba/Hawi schems = 30 000 feddans, a total of 115,000 feddans.

Wheat is used as reference crop to estimate crop water requirements. Wheat requires 8 irrigations and 10 cm of water for each irrigation, ie the total volume of water required for irrigation is around 112,000 m^3.

Taking into account the losses due to evapotranspiration and loss to ground water, the need for storage volume might be around 250,000 m^3.

It is believed that it is feasible to establish diversion structures to store this volume of water. The required storage volume and other characteristics of the system and the topography will determine dimensions of the structures involved.

Ground water assessment has not been possible for water withdrawn from the deep ground water holes (Nubian sandstone) due to lack of updated information on groundwater points and yield. There are five non-government agricultural investment projects totalling an area of about 250,000 feddans Two are Saudis (total area 150,000 feddans), two are Jordanian (total 69,000 feddans), and one Sudanese (are 4,000 feddans). These schemes mostly grow food crops, fodders and vegetables for local and foreign markets. Nile water is the main source for irrigation, but one or two schemes use ground water which is abundant.

Information has been obtained from MOIWR ground water departments and Consultants observations in the field. One of the available groundwater aquifers in the area that is being tapped at present is the deep aquifer in the Nubian sandstone. This

aquifer is likely to be recharged in remote highland areas. The groundwater that is being withdrawn is therefore fed by regional groundwater flow from far distances.

In addition, there is an important use of groundwater in the alluvial shallow aquifers along Atbara river. There are several examples of wells that are being drilled into the alluvial deposits to moderate depths (approximately 20 m), but also several in-stream simple wells being dug to shallow depths (typically a couple of meters). The later are important sources of irrigation water, equipped with motorised diesel pumps. Both the shallow and deep wells in the alluvium are being recharged directly from the river bed.

It is not recommended that this project supports drilling of deep ground water points for irrigation and other productive uses under this fast track project. The regeneration of deep aquifers is very limited and relies on a regional groundwater flow from great distances – therefore it is not possible to enhance local infiltration to enable large-scale groundwater abstraction. Furthermore, deep drilling is costly, requires extensive technical studies and is therefore justified mainly for drinking water supply but not for productive uses as formulated under the fast track project. Instead promotion and development of shallow wells are recommended for conjunctive use with surface water. Measures to increase ground water recharge from river Atbra or seasonal small streams/khors should be design e.g. through rehabilitation of some channels which was used to supply flood water to low lands on both the eastern and western areas around the bank of the river or through construction of low weirs across the river bed. Water harvesting interventions should be designed particularly on the western part of area.

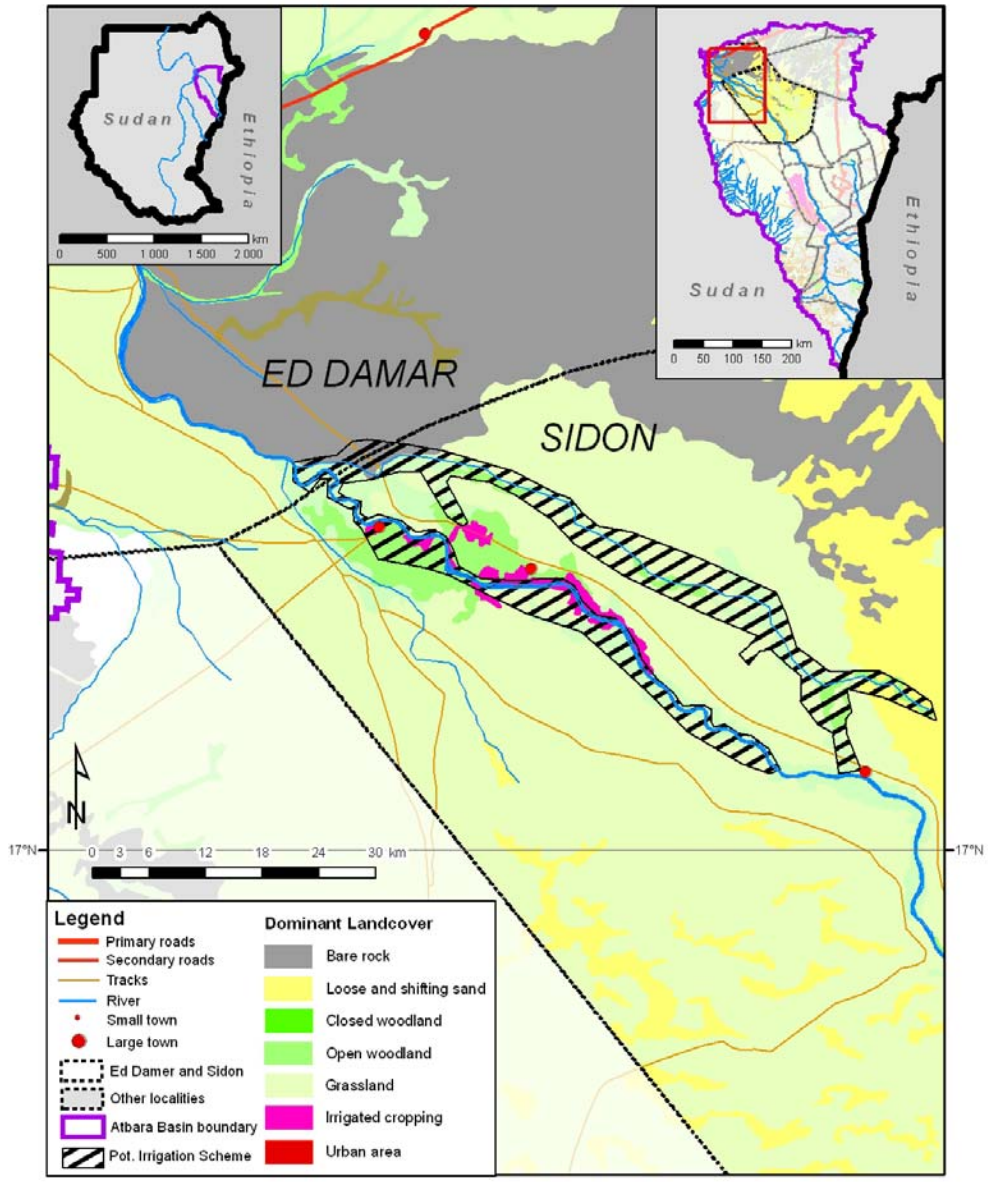
5.3.1.2 Water resources development and storage

Abundant water is available from the river during the flood period, even during relatively dry years, and this is proposed to be captured to extend the growing season by means of both in-channel and off-channel storage structures. The Consultant was assisted by the local authorities and experts to identify low lying areas prone to flooding by the Atbara river and also natural narrow valley outlets where weirs could conveniently be constructed. It may even be a possibility to construct a weir on the Atbara itself. By means of weirs and diversion structures it will be possible to divert and store flood water for use in irrigation, thereby enhancing the irrigated area. Two such dams are already in the early planning stage in the Nile River State; one between Atbara and Sidon village (Omarab dam), and one between Sidon village and Shahabit village (Kalalat dam). By means of these structures it will be possible to raise the water level during low floods thereby diverting more water and, by means of canals divert flood water to a suitable storage ponds. From there it can be pumped to the farm land under irrigation.

As an example the rehabilitation of the flood irrigation scheme named Adaama in Area 2 (approx. 70 000 feddans) is proposed to be included as a project component.

The project planning should be participatory and the scheme organisation and ownership must be clear prior to construction. Proper SEIA is needed. Hence, the project should be phased so that the ownership and organisation of operation and maintenance is clear (clearing of intake channels etc). The location of the scheme is indicated in the map below..

LOWER ATBARA PROJECT AREA
POTENTIAL IRRIGATION SCHEME
(From map obtaind in field - scanned and digitised)



Even ground water irrigation from shallow wells or the river bed in combination with flood irrigation is recommended for this area.

It can be concluded that natural groundwater recharge outside the river is very limited. In the arid climate the potential evaporation is far greater than the precipitation and the only recharge that can occur is when soil moisture is high during short periods after rains. There is however a potential to enhance this natural recharge from water harvesting in the low, and often wide, wadis and valleys, if shallow weirs would be constructed in order to hold the rain water runoff. Water harvesting resulting in prolonged periods of higher soil moisture would benefit the groundwater recharge. Grazing and cropping periods would become longer.

Water harvesting in combination with reseeding of local legumes and grasses in wadis to improve and diversify agricultural production is hence proposed. There has been an FAO project on reseeding wadis in lower Atbara which is ending 2007. Negotiations are underway with donors to extend the project. Seeds (bersim bari, tagtag, deresa and tagar, collected from Kassala State) have already been spread in an area of 150,000 feddans. Spreading is done manually. After the seeds are spreads, terraces of 40 cm high are made for wadis water harvesting. It is recommended that the Fast Track Watershed Project should be coordinated/cooperate with the ongoing FAO project and build on lessons learnt from previous activities. However, the extent of cooperation and the size of this project component depend on the outcome of the FAO and donor negotiations.

For long term sustainable development of the area, institutional strengthening on integrated land and water planning, licensing procedures, mapping and registration and information collection and management of water resources availability and demand in order to ensure the water balance of the area are also required.

Project coordination with planned governmental irrigation and water harvesting projects such as the Adaama scheme and Lablaba/Hawi, as well as the extension of the FAO wadis project will be undertaken in June.

5.3.2 Crop diversification and intensification

Agricultural activities, crop production mainly irrigated with limited rainfed in wadis and nomadism, are central to rural development and poverty alleviation in Lower Atbara. Obviously resource scarcity is determining the level of productivity of each agricultural system as well as natural resource management.

There are two major elements that should be looked at if the aim is the intensification and diversification of agriculture in Lower Atbara area. These are availability of natural resources and, access and control of these natural resources. Lower Atbara lies wholly in a semi-desert environment. In such arid zone reliable agriculture is

possible through irrigation and nomadism. Percentage of currently irrigated area with respect to cultivable area is low.

Agriculture in Lower Atbara area is relatively intensified because of land and water scarcities. After the drop in the levels of income and the failure of the traditional agricultural technique to cope with the new situation after the construction of Khashm el Girba dam, irrigation pumps and tractors were introduced with new production relations based on water supply (Abdel Ati, 1979). Agricultural productivity became higher compared to other areas in the State because of the high fertility of the soil and availability of irrigation water for longer periods. Average individual holdings of the relatively wealthy people increased to 2-5 feddans in the riverine soils, and 10-20 feddans in the karu or basin soils. Crops yields increased, wheat crop for example, produces one to one and a half tonnes per feddans and faba bean produces about one tonne per feddan. Similar yields are also obtained from dry beans and chick peas. Those who could not adapt with the new situation out migrated as seasonal labours, and others changed their occupations from agriculture to handicrafts or wage labour (Abdel Ati, 1979). Still, Lower Atbara area remained one of the poorest areas of the River Nile State and most of the production is for local consumption, except for some vegetables which go to Atbara and Ed Damer markets. This is mainly because the available resources are not fully and sustainably utilized. The weather conditions are suitable for much winter crops and many varieties of vegetables. These crops are of high nutritive and economic values.
Hudeiba Research Station is pioneer in *on-farm research trials* in the Sudan, but it is only recently that it has established applied research farms in Lower Atbara area during the seasons 1992-97. They were also involved in an FAO project in Lower Atbara where they established demonstration farms and worked with farmers. According to the scientists of Hudeiba Research, the agricultural practices of Lower Atbara farmers before their interventions were: poor in land preparation, very late in sowing their crops, used local varieties which were low yielding, poor in pest control, using nil or minimal fertilizers, following narrow cropping system which gave little choice of alternative crops especially summer crops, and farmers were not aware of many of modern agricultural technologies that would raise their production.

To deal with these problems, the Researchers at Hudeiba tried the following:

1. Diversification and intensification of the cropping system,
2. Finding of new technologies that would raise the yields and increase farmers income,
3. Enhancement of agricultural development in Lower Atbara area.

To achieve these objectives, the research team did the following: improvement of yields of crops such as sorghum, faba bean, dry beans and wheat by applying the technological packages of research findings for each crop (such as use of high yielding varieties, recommended cultural practices, and pest control), introduction of cash crops to increase farmers income. These new crops were lentils, chick pea, potatoes, garlic, and some spices, widening crops choices in the summer growing season by introducing new crops such as ground nuts, sesame, and sunflower. By these measures crop diversification and intensification were achieved, promoting field days where farmers exhibited their products for other farmers to see. and farmers

schools so that they may adopt the technical packages of different crops to raise their crops production.
Hudeiba scientists concluded that a big number of farmers with whom the research scientists were working in Lower Atbara area adopted the technical packages of different crops and got increases in yields from 30% to over 100%. Many women in Abaka and Goz El Halag villages in Lower Atbara established citrus trees which are currently producing. Demonstration farms have been established for seed production. Several field days were set in which many farmers, Ministry of Agriculture staff, research scientists and others participated.

Interactions of the universities and research institutions with the farmer and the farmers organizations and the private sector are crucial in promoting intensification and diversification in Lower Atbara. More participatory research has also to be encouraged.

To maximize the benefits from agricultural research, agriculture information systems and transfer technology units need to be started and links made to the local, national, regional and international research systems. There are many research results which can be transferred or extended but the community is not benefiting from them because the technology is not being transferred or made available to the beneficiaries and the stakeholders. The authorities in Ed Damer Locality lack facilities at the moment to cope with the burden of reaching farmers. The Ministry of Agriculture, jointly with scientists from Hudeiba Research Station, organize what they call *governmental agricultural schools for farmers* that run during the crop growing seasons. In each of these schools about 30 farmers are trained both theoretically and practically on a field attached to the school. They are taught a package of cultural practices for each crop. The technical information comes from the findings of the Hudeiba Research Station. There are more than 26 such schools in the State. Sidon and Atbarawi Administrative Units (our target areas) each has one Farmer's School. Women have also their schools where they are taught food processing and some agricultural practices.

Due to the problem of water scarcity, irrigation systems have to be developed by harvesting Atbara River water into the basins, and harvesting of wadis waters to improve and diversify agricultural production. Farmers have to be encouraged to adopting new irrigation techniques, such as drip and sprinkler irrigation instead of using basin irrigation. Another driver for using less water is the saving in pumping costs, which are among the most expensive inputs, be it from the river or from deep aquifers. As water resources are scarce, irrigation efficiency would be one of the main inputs to consider for agriculture intensification and diversification. Currently irrigation efficiency is quite low and rarely exceeds 50%. Production systems might be intensified by improving irrigation efficiency through a better resource management and through introduction of new technical innovations especially irrigation water saving techniques.

Another requirement for intensification and diversification of agriculture in Lower Atbara is the use of improved seeds. Only an estimated 10 percent of farmers use certified seeds. Improved seed technology is essential for bridging the gap between yields in demonstration trials and farmers' fields. Until recently, seed production and certification have been handled by the government through the Seed Multiplication Administration of the Ministry of Agriculture and Forestry. It was an inefficient operation. Seeds were neither of good quality nor disease free; they were also expensive. National seed production was therefore limited to field crops, while horticultural crop seeds were usually imported. In a move to improve production of good-quality seed and boost the use of improved seed, the Seed Multiplication should be promoted.

Department in the Ministry of Agriculture and Forestry was semi-privatized in year 2000 and entrusted to a new joint (public -private) ownership company. The government donated physical assets to the newly formed Arab Sudanese Seed Company representing a share of 42 % (World Bank and Sudan Government, 2003).

The role of women in crop production is minor in the Lower Atbara area. They play bigger role in animal rearing, particularly sheep and goats. By introducing more efficient and easily controllable irrigation system (sprinkler or drip), women will be more attracted to agriculture.
A livelihood that would attract women and children would be the collection of senna (*Cassia acutifolia)* leaves and pods. Senna is a wild plant native to arid and semi-arid areas of the Sudan, Lower Atbara area included, and survives as a perennial crop with occasional irrigation. The crop has an important export market in the pharmaceutical trade in Europe and elsewhere, and the Sudan senna is one of the best known Ayoub, (1975). Senna can be reintroduced as cash crop in the area either as irrigated crop in the basins or in the wadis when water harvesting is introduced.

Water harvesting, crop intensification and diversification, and improvement of cultural practices in agriculture in Lower Atbara will create sustainable economic base and will lead to stabilization of human population in the area.

Following the new national strategy for agriculture launched in 2001 and the recognition that extension is a critical factor in improving agricultural production and food security, the restructured Ministry of Agriculture and Forestry upgraded its Extension Department into a Technology Transfer and Extension (TTE) administration with the objective of bridging the gap between research and farmers. It plans to establish parallel administrations in the state ministries responsible for agriculture (8 of which have been already established) for the easy flow of information. For example, several federal centers for technology transfer and 50 extension stations (with federal and state financing, connected with the agricultural schemes will be established. It is also planned to merge extension services for rainfed and irrigated crops (World Bank and Sudan Government, 2003).

Authorities at the State Ministry of Agriculture in Ed Damer believe there should be an agriculturist at each of the administrative units of the State. In addition, they are targeting to achieve that every 1,000 feddans to be supervised by a university

graduate in agriculture. The total number of agriculturalists in El Damer locality is around 40 persons. This staff has one car and 4 motorbikes.

Prospect of joint projects: Mr. Ali (the Deputy Director of Agriculture) insisted that locality contribution to the project will be nil. Federal and State governments may be able to contribute by 10% to any project as a maximum. However, he said Ed Damer Locality can provide in-kind contribution in the form of offices and desks and perhaps petrol to the vehicle could be considered by the state.

5.3.3 Pastoralists and nomads livelihood

Nomadism was practiced in the Sudan by the Beja tribes in the Red Sea and the people of the Butana region since Meroitic times, 540 B.C., but it spread to many parts of the country when the Arabs entered the country in large numbers after the tenth century. Nomads in the Sudan (mostly Arabs and Hamitic groups) are estimated at about 15% of the population, who utilize about 850,000 km2, one third of the total area of the country, mostly in the arid and semi-arid zones. Large tracts of land which would otherwise be difficult to be used by settled people are extensively used by nomads. These are usually unimproved natural resources of water and vegetation.

Lower Atbara falls within the semi-desert zone where annual rainfall is between 75 to 150 mm. This zone has some grazing potentiality where the nomads use their mobility to raise a large number of camels (15,000) and sheep (80,000). The Rashayda, Bushariyeen and Kamalab are the main nomadic tribes in Lower Atbara area. The Rashayda livestock is mainly camels and some sheep, the Bushariyeen own more sheep and less camel, while the Kamalab tribe owns sheep and goats. These nomads spend most of the time between July and November in the Butana, the area between River Atbara and the River Nile some hundreds of kilometres south of Ed Damer in Um Shadida, El Basaay, and Um Masareen. After November, when the Butana grazing areas are exhausted, most of the nomads cross Atbara River at Baaluk village to the eastern side of the River and graze their livestock in the three major wadis, El Hudi, El Hilgi, and Abu Adar. They stay there until the crops grown along the River Atbara are harvested. They then come to the fields to feed their herds on crops residues. The farmers and the herders have mutual interests and a sort of symbiotic relationships, which rarely develop into conflicts. Many nomads have adopted a semi-nomadic (transhumant) livelihood whereby they move with their animals over more or less regular routes, settling for part of the year in permanent home areas. Frequently this takes the form of women, children, elderly and a few animals staying behind (milk, transport) while the men move with their herds.

Farmers along the Atbara River have some livestock which is integrated in irrigated agriculture, contributing a significant proportion of farmers' incomes in the area. The house keeping of animals, mostly sheep and goats, is mostly done by women. This change may, however in the future, become a source of conflict between farmers and nomadic herdsmen in view of the fact that farmers increasingly see investments in animals as a coping strategy against uncertainties in agricultural production.. Police records do not show incidents of conflicts among the nomads and between nomads

and farmers. Generally, livestock in Lower Atbara look weak, and we were told that many of them die because of lack of feed, drinking water and diseases. These diseases are mostly transmitted by ticks, which are endemic in the area. Loss of animals is great, and many herders are leaving the business as labourers in towns or in irrigated farms.

The southern Butana area is mainly traversed by the Shukriya tribe who are mostly camel and sheep owners. They move southwards up to southern Gedarif during the dry season.

Water harvesting interventions for moisture conservation for increased pasture or availing water for livestock will greatly enhance the livelihoods of nomads and pastoralists, however the detailed assessment has considered the fact that the carrying capacity of the Lower Atbara region is a matter of concern. Water harvesting opportunities are described above under the water resources section. The Consultant has also consulted the IFAD project in Butana for information exchange

Improvement of livestock conditions by providing easily accessible drinking water points and more nutritive fodder is suggested which could be combined with the project component on water harvesting and reseeding of local legumes and grasses in wadis as described in the above section.

Settlement of some pastoralists in Area 3 is an additional possible intervention. The population in Area 3 is mostly semi-nomadic and nomadic (more than 90%). The population is aware of the poor natural resources of the area and realise that there is a need to diversify livelihood practices. To this end they are very much interested in be involved in agricultural practices. Two irrigation schemes (i.e. Lablaba/Hawi schems = 30 000 feddans) are planned by the Government and supported by the local nomadic population.

According to meetings held with Ed Damer Locality staff, the chairman of the "Company for the Development of Lower Atbara" (successor of ADS) and the nomadic communities in Baluuk, the nomadic and semi-nomadic population is concentrated in the part of Lower Atbara closest to the Kassala border, i.e. Shababit and below (Area 3). It is assumed that about 90% of the population in this area is nomads or semi-nomads. At the same time, they are the most deprived population group in Lower Atbara and the environmental problems are the most severe (desertification, excessive tree cutting, sand dune encroachment). It also appears from the above that major animal routes between Butana and Lower Atbara pass through this area. Interventions to address nomads' livelihoods should focus on this area.

During our visit in Atbara we were strongly advised to visit Baluuk and surroundings as this area due to its remoteness has been neglected by NGOs and government alike. Baluuk and the surrounding villages are inhabited by Bushariyeen nomads. They practice a mixture of herding and agricultural production. The latter they resort to as it is increasingly difficult to make a living from herding alone and only if water availability in the Atbara river allows for this which is not the case every year.

Apparently, before the dam was built, the area was rich in natural resources. The major problems now are lack of water for consumption and production and poor access to and quality of socio-economic services and facilities (hardly any child goes to school and illiteracy rates are very high).

We met the community in Baluuk (both men and women) who suggested that the watershed project supports two planned small scale irrigation schemes in the area for which the government has conducted a number of studies but not yet provided funds. Lablaba and Hawi schemes would benefit 12 villages. The advantage of the schemes would be that an already ongoing voluntary re-orientation among the Bushariyeen nomads towards a more sedentary lifestyle and agricultural production could be strengthened[4], that women - who have expressed a wish for this and who are currently completely dependent on their husbands - could make an income from vegetable production, and that water could be made available for environmental activities such as establishment of shelterbelts to halt sand dune encroachment and tree planting in and around homesteads.

The physical establishment of the scheme should go hand in hand with the promotion of improved and appropriate agricultural production methods etc. among the beneficiaries developed together with them and through participatory research *(to be detailed by our agricultural/biology experts).* This should take into consideration nomadic peoples' attachment to their animals which goes beyond their material importance. Herding is a way of living and a cultural practice and will only change slowly. There is a risk that improved agricultural production and increased income will result in an increased number of animals. The number should be stabilized by awareness rising on the environmental consequences of large and concentrated herds but alternative options such as zero grazing, fodder production and focus on the quality of livestock rather than quantity should also be promoted. Most nomads are illiterate and in the long term basic education could also contribute to change behaviour and preferences. A Fulani herdsman in Dinder told us: "We need education to better understand the environment. If people are educated they look for work outside agriculture and animal rearing and that would reduce the pressure on the environment". Therefore it is important to improve access and quality of education facilities (semi-nomads) and mobile schools (nomads).

These above interventions could build on the organizational structure left behind by ADS in all 51 village clusters (covering all villages) where voluntary development societies, and village development committees were established. The structure of women's groups established under the SOS Sahel project could also be revitalised. During the various missions we have met many of these organizations and found that their planning and managerial capacities are weak and that they would require intensive retraining and capacity development. It appears that the semi-nomads in the

[4] This could also be reinforced in the future by the IFAD supported Butana project that will restrict access to the Butana grazing areas. Already now it appears that poorer herders do not go to Butana every year and that they are competed out by richer herders who transport their animals to Butana by truck.

Baluuk area to a certain degree have resented the ADS structure and prefer their traditional structure (sherks etc.), and there is a need to bring the two together. The locality authorities also advised on the need to avoid former projects' high overhead costs which resulted from the fact that project staff and locality counterparts resided in Ed Damer which necessitated frequent and expensive travels. The implementation and sustainability of the proposed schemes would also require the permanent presence of agricultural and forest extension staff in the administrative units which is currently not the case.

5.3.4 Reforestation/Agro forestry:

During the present as well as the previous missions, a total of eight villages have been visited, and a total of 33 government officials and experts and 43 local community members have been interviewed in Lower Atbara by the Forestry Expert alone, representing adequate sampling to confidently draw conclusions about the project area.

For the Upper Zone, there is a potential of making the pilot watershed management project an integral part of the government planned irrigation and resettlement scheme in Lableba.

For the forestry component of the integrated project, similar forestry and agroforestry interventions as proposed in the Inception Report are recommended for all three zones since all zones are threatened by sand dune encroachment and there is an urgent need to increase forest cover to meet the forest products demand of the local people and to combat desertification. The forest and agroforestry interventions proposed are: (1) shelterbelt plantation in order to prevent sand dune encroachment on villages and croplands, (2) Joint Participatory Forest Management with local communities and FNC in order to preserve, restore and sustainably manage the degrading riverine state forest reserves, (3), tree planting around individual homesteads and institution compounds in order to increase tree cover in the area, and (4) introduction of alternative energy sources and energy efficient cooking stoves to decrease the pressure on woody biomass and forest reserves.

The choice of indigenous tree species for plantation establishment may, however, differ due to the difference in aridity between the zones. The design of shelterbelts may also be different due to the difference in the extent and degree of sand dune encroachment. The modality of local people's participation in the project may as well be different due to the difference in the local people's level of poverty and literacy.

It is recommended that the tree and shrub species to be used in shelterbelts must be indigenous species of economic value for reasons stated in the Inception report and repeated hereinafter. "There is now a growing international concern about the impacts of introducing exotics into areas outside their native range. The concern includes reduction of local biodiversity and introduction of pests, diseases and weeds. As a

result, the focus in many countries has more recently shifted to indigenous tree species. Interest in indigenous trees in drylands of Africa has developed particularly rapidly with increasing awareness of the value of adaptation to the capriciousness of the prevailing climates, reflected in innate resilience often lacking in exotic alternatives (Teklehaimanot, 2004). The Expert strongly believes that it is very important that indigenous biodiversity is maintained as maintaining a large number of different species is key to resilience in drylands such as Lower Atbara. The advantage is that indigenous trees are resistant to indigenous pests and diseases."

It is, therefore, recommended that the following species are reconsidered for inclusion in shelterbelt plantations in Lower Atbara area. These include *Acacia nilotica*, *Faiderbia albida, Hyphaene thebaica*, *Ziziphus spina-christi* and *Balanites aegyptica*

Concerning the issue of *Acacia nilotica*, there are nine subspecies of *Acacia nilotica*. *A. nilotica* ssp *nilotica* and ssp *tomentosa* are restricted to riverine habitats and seasonally flooded areas. Subspecies *subalata, leiocarpa, astringens* (synonymous *adansonii*)*, indica, cupressiformis, hemispherica* and *kraussiana* occur in wooded grassland savanna and dry scrub forests (Wardill, et al., 2005). Among the nine subspecies, three subspecies occur in Sudan (ssp. *astringens*, *nilotica, tomentosa*) (Khristova and Karar, 1999). Thus, there is a subspecies in Sudan (ssp. *adstringens*) that can be grown in shelterbelts without flooding. Subspecies *astringens* is one of the typical subspecies for dry habitats. It grows up to 17 m in height. This means it is best suited for shelterbelt. It is also best suited for areas under severe water stress such as Atbara area. It has morphological characteristics beneficial for adaptation to drought. Typical characteristics for ssp. *astringens* include high root-shoot ratio and relatively small leaf size (Kallio, 2004).

The primary role of shelterbelts of protecting villages and farmlands from sand dune encroachment should have priority over its productive role. But additional economic benefits that can be derived from the trees and shrubs grown in shelterbelts cannot be ignored.

Shelterbelts need continued management and maintenance to ensure maximum efficiency. Many shelterbelts projects have, however, failed because of lack of management and maintenance. Proper management of shelterbelts means adequate maintenance of the balance between their protection efficiency and the derivation of products from the trees and shrubs grown in them. This should be carefully considered in the design of shelterbelts. To this end, the use of native tree species of economic value in the establishment of shelterbelts may be more attractive to local communities than the use of exotics. They will participate actively in the management and maintenance of shelterbelts if they realise that they are deriving additional economic benefits from the trees and shrubs.

As presented in the Inception Report, the native tree species recommended for shelterbelts such as *Acacia nilotica* and *Faiderbia albida* are known to yield large amounts of pods which can be collected by farmers or nomads for stall feeding of livestock. Non-wood products that can be harvested and processed from *Hyphaene*, *Ziziphus* and *Balanites* can provide a range of opportunities for generating income to local communities. During the course of the management and maintenance of

shelterbelts, there will always be older trees that need to felled and replaced. There may also be trees that are accidentally broken by wind or sand. The wood produced in these ways can meet the fuelwood and timber requirement of the villagers. All of these productions can be achieved without affecting the protective role of shelterbelts (FNC & SOS Sahel, 1998; Stigter et al., 2002).

Regarding institutional aspects, it was found that both FRC and FNC have past experience in project activities similar to the proposed forestry and agroforestry interventions. FNC has been involved in a number of shelterbelt and community forestry activities. For example, the experience of FNC in shelterbelt establishment and management activities in the Northern State through the assistance of SOS-Sahel and UNSO is well documented (FNC & UNSO, 1993; FNC & SOS Sahel, 1998). FNC also has experience in homestead tree planting activities, for example, in the River Nile State, Atbara area with the support of SOS Sahel. This was evidenced by the Expert when he visited El Debura village in Lower Atbara.

It is, therefore, concluded that the involvement of both institutions as partners in the planning and implementation of the watershed management project is very well justified and appropriate as effective project planning and implementation requires the engagement of such institutional stakeholders with past experience.

5.3.4.1 Energy Alternatives

Improved forest and tree management: One intervention improving energy availability, where woody fuels have become scarce, is by planting fast growing trees to provide a constant fuel supply (community forest) with a program of awareness on forest management. Such interventions are detailed under forestry activities.

Peri-urban areas: The inhabitants of these areas obtain water from borehole wells by means of water pumps, which are driven by diesel engines. The diesel motors are associated with maintenance problems, high running cost, and environmental pollution. Alternative methods are pumping by PV electrical.

According to the ministry of Electricity by April 2008 all of the River Nile State will be electrified (Merowe Dam will add 1250 mega watt to the national grid) and Atbra transfer station is on its final touches, if this is the case then lightning and may be some of the water pumps will be electrified.

In rural Lower Atbara: Among the renewable energy sources for Atbara area, biomass seems one of the most interesting because of its share of the total energy consumption of Sudan is high at 87%, and the techniques for converting it to useful energy are not necessarily sophisticated. Implementation of biomass-based energy programmes will not, of course, be a definitive solution to Atbara energy problem, but it will bring new insight for efficient energy use in the household sector, especially in remote area of Sidon. The estimates are based in the recoverable energy potential from the main agricultural residues, livestock farming wastes, forestry and wood

processing residues, and municipal wastes. The solid waste from biogas plants adds economic value by providing valuable fertilizer.

LPG is already introduced by a number of NGOs in some of the project areas, it found acceptance by the community but still there is some misconception on using LPG. Other obstacles are the poor means of transportation which could increase the cost. This may be solved if the Atbara –Port Sudan High way is established and the internal roads are constructed.

5.3.5 Alternative incomes and revolving funds

5.3.5.1 Revolving funds experience

The revolving funds first attempt in Lower Atbara to mitigate the impacts of the Kashm Al Girba Dam and the New Halfa Agricultural Scheme in Upper Atbara was within the ADS program Area development schemes (ADS). The basic philosophy was that beneficiary communities, supported by a rural credit facility, known as the "*Sandug*", engage in self-managed small scale income-generation activities of their own choice. *Sandug* is the Arabic term for a fund, a term traditionally used in local Sudanese parlance to mean an informally established revolving fund for mutual self-help within communities (like the Susu in West Africa). Choices of investment activities are influenced by the beneficiaries' own perceived needs and priorities rather than the dictates of government or development agencies. Beneficiaries are organized into Village Development Committees (VDCs) so that they can gradually assume full responsibility for the planning, implementation, management and monitoring of community development activities at the village level. In Lower Atbara, villages were organised in 51 clusters with democratically elected VDCs. This implies that there is a good foundation for introducing both revolving funds and micro-credit under the fast Track Project in the Lower Atbara area for the community inputs discussed under forestry, energy and agricultural project activities. The appropriate mechanisms suitable for the Fast Track watershed project are discussed in section 9.

5.3.5.2 Market Opportunities and Constraints

A number of positive opportune aspects have emerged. While all productive sectors including, lower Atbara face obstacles, developments such as the new Investment Law have been well received by the private sector. In meetings with chambers of commerce and business sector associations, together with individual businessmen, there was considerable support for much of current government policy. Adds to market opportunities is the proximity to markets, thus the best option is probably to educate population of intensified and modernised agriculture.

Entrepreneurs raised concerns on issues such as the government's capacity to implement policy, poor contract compliance, uncertain land tenure policy, weak arbitration conditions, and the Judiciary's inability to resolve commercial disputes in a timely manner, which will continue to discourage marketing and international investors. The principal constraint facing the commercial development of the lower

Atbara market activities is the lack of working capital/access to credit, as well as the isolation and lack of business acumen of the producers involved. The immediate target is always the local market, but with a reasonable marketing approach, promoting regional and other urban markets could also be accessible.

6 Detailed Technical Assessment for Dinder

6.1 Brief Description of Dinder Project Site

6.1.1 Definition of project area

The project area for the Dinder National Park will include all of the areas in the park and those areas outside the park that have a major influence on and/or stakeholder interest in the park. In reality this means the villages that surround the park up to a distance of approximately 10km from the park boundary, but also including all of the areas used by the transhumant pastoralists that seasonally make use of grazing resources both in and around the park.. This includes areas of the three states surrounding the park, Sennar, Blue Nile and Gedaref. It is expected that most of the project implementation will take place outside the park in order to alleviate the pressure on the park caused by unsustainable, inefficient and inequitable resource use outside the park.

6.1.2 Institutional Framework in Dinder

The Dinder project site falls into three different states and three localities.and being a national park the core area falls under the direct control of the central government and the ministry of the interior. The executing agency is the General Administration for National Parks and Wildlife Conservation. The relevant institutional framework includes the committee of the three states known as the Dinder Park Committee under the minister of the environment which is to coordinate the efforts of the three states. In addition the states have their own ministries of agriculture and environment and water resources who are involved. Finally the localities immediately surrounding the park are also responsible for management of their region.

6.1.3 Key Characteristics

The Dinder National Park and its surroundings are characterised by a recent severe degradation of the wildlife and agricultural resources of the area. This is due to a variety of driving forces.

1) *A rapid increase in the population both on the boundaries and inside the park has occurred as a result of immigration. Two immigration episodes appear to have occurred one during the 1960s and the second during the 1980s. These episodes are linked to unrest and war in other parts of the Sudan and involve the settlement of refugees. These refugees now feel permanently settled in the region and there is little chance of them returning to their places of origin since most of them are now born in the region.*

2) The area surrounding the park has become settled by farmers using both rain fed and mechanised agriculture to grow mainly staple grain crops such as sorghum, sesame and millet. This has resulted in land which was formerly open grazing land being converted to arable land. This has caused a severe reduction in the amount of grazing land available. Many of these farmers are not resident in the area and use day labour from surrounding villages to grow their crops. The yield of these farms appears to have steadily decreased since the 1960s.

3) As a result of the loss of land to settled agriculture and the increase in the size of the regional herd the effective density of livestock far exceeds the carrying capacity of the environment and this has led to a severe fall in the condition of the rangeland. To the north and west of the park in areas of lower rainfall settled livestock farming is essentially impossible so that transhumance is the only system able to support significant herds in areas where the permanent water supply is limited. This overstocking has led to a strong dependence on the grazing resources of the park for the support of the nomadic pastoralists

4) The park staff are not properly equipped nor trained to carry out the functions which they are now required to do. In particular the staff is too small (similar sized parks elsewhere have staff of five times or more the size) to carry out its multiple roles of wildlife protection, infrastructure maintenance, ecosystem management, community liaison, monitoring and tourism. Furthermore the transport resources hamper effective movement.

5) The transport infrastructure of the park and surrounding areas is very poor with the result that movement both within and outside the park is difficult or impossible during the rainy season. This leads people to be disconnected from the outside world and its markets for produce and tourism for a significant period of the year. Inside the park the poor road network means that rangers cannot effectively control the park and restrict the access of pastoralists and poachers.

6) The high demand for firewood both for local consumption and for export to the large cities has resulted in the effective deforestation of almost all of the area surrounding the park as well as large areas of the park itself. This has led to a degradation of the habitat and a loss of important resources for local communities including, firewood, shade for cattle, tree fruit crops and other NTFPs.

7) The poor availability of surface water during the dry season and the restricted availability of ground water has resulted in the population becoming restricted to areas having some form of water security. This largely means areas along the rivers where the channel aquifer may be tapped by digging shallow wells

and around mayas (water bearing depressions) fed seasonally either by rivers or by rainfall. As a result of sedimentation from upstream (Ethiopia) the mayas have become less able to carry water through the dry season. This has a strong impact on farmers, pastoralists and wildlife. Villages are concentrated around water bearing structures or artificial impoundments (hafirs). The movement of cattle is restricted by the availability of water which means that rangeland potentially available to them is limited. Wildlife populations in the park are also restricted during the dry season to the areas of permanent water.

6.1.4 Scenarios for Development

6.1.4.1 Project Interventions

6.1.4.1.1 Taking Control of the Park.

The current situation of the park is that the parks managers do not have the resources nor the training to assume management control of the park. In order for any project to succeed it will be necessary for the parks management to achieve this. It is proposed that the project supports the parks management in several ways in order to achieve this. The staff numbers are at present inadequate to carry out even their minimum function of law enforcement. What is needed is more staff with a higher individual capacity and a dedication to the job of national park management for the benefit of the people of Sudan. It is therefore necessary that the number of rangers involved in law enforcement is approximately doubled. These should be supplemented by a significant corps of rangers and permanent staff dedicated to wildlife and ecosystem management (including fire management) and infrastructure maintenance. These rangers will require both training and equipment to enable them to do their job. It is likely that the best form of training will be to import expatriate counterparts for staff particularly at the non commissioned officer level in order to train these officers to carry out their role. Appropriate counterparts would likely be sourced from South Africa, Kenya and Tanzania. Rangers would need to be equipped with vehicles capable of moving on and off road during the wet season in order to be able to intercept pastoralists and poachers. In addition in order to allow for rapid response it will be necessary for rangers to be equipped with excellent communications infrastructure and during the peak season a spotter aircraft or helicopter may be needed to ensure control. Habitat management in the park supported by the project should involve the restoration of forest cover in the 5km transition zone on the south bank of the Rahad river and ensure that the Mayas in the core zone have sufficient depth to maintain water throughout the dry season. The rest camp at Galego should be largely demolished and be rebuilt on simpler lines using tents under shelters directly overlooking the river bank in the same location. Another rest camp should be built at a suitable location on the south bank of the Rahad river where development has not yet cut off the access to the river by wild animals.

6.1.4.1.2 Reform of Agricultural and Pastoral Practices

It will be necessary to reform agricultural practices both within and ouside the park. Within the park the project should eventually supply villages with sufficient irrigation water resources to eliminate their dependence on rain fed agriculture. Crops selected for growing under irrigation should be of high value and suitable for export to markets in Gedaref, Wad Madani and Khartoum. The income from these crops should be sufficient to allow farmers to purchase the staples such as sorghum which they need in order to survive. The access to the transition zone by villagers should be restricted in order to allow for habitat recovery. In particular livestock should eventually be restricted in number and also to a grazing distance of 2km form the river while the resource use in the range of 2km to 5km from the river should be restricted to the collection of dead wood and non timber forest products including gum Arabic. Irrigated farming should be concentrated up to 500m from the river, rain fed farming should be allowed up to 1km from the river and grazing animals should only be allowed up to 2km from the river. Animals directly used for transporting NTFPs can be allowed access to the entire 5km transition zone. It will be necessary to introduce this reform gradually over a five year period.

Magano village in its present locality and its present size offers little risk to the integrity of the park and it should therefore be allowed to remain however since its main problems are associated with water supply the project should assist the village by the development of runoff collection systems from the Magano rock and underground covered water storage cisterns in the clay soil to limit evaporation this will stop the need for the population to leave the village and to move into the park during the dry season.

Outside the park in Sennar State the pressure for arable agriculture is much lower with little rain fed production close to the park. In this area it will be possible to support projects aimed at the development of a sport hunting business. The area outside of the park should be reforested with an appropriate mix of species, mayas should be dug out and as forest cover develops wildlife from the park will naturally invade this area. This area can also be used for cattle grazing and the project could support projects aimed at improving the condition of the rangeland by seeding and management.

The north bank of the Rahad river appears to hold the key to the problem with pastoralists since most of the pastoralists entering the park are thought to come from the groups who practice transhumance between southern Gedaref State and the Butana region. It is here that the encroachment of mechanised agriculture and rain fed agriculture has been most complete so that very little land remains for grazing. Present proposals for movement corridors of 150m width are entirely inadequate and are likely to lead to erosion. What is necessary is corridors whose widths are measured in kilometres and which provide a real grazing resource during movement. In order to achieve this it will be necessary to significantly reduce the amount of rain fed agriculture in order to allow for pasture development. The project should therefore support activities which reduce the amount of rain fed agriculture by substituting it with high value irrigated agricultural crops for export to primarily national markets. This can be achieved by providing irrigation water probably stored in off channel storage dams filled from the river. Extension services supported by the project and small capital grants and loans can be used to assist farmers to convert to small scale irrigated systems. As far as possible irrigated agriculture should be concentrated in the first 1km form the river and a small amount of rain fed agriculture should be

allowed up to 2km from the river. The area to the north of this for a further five km should be reforested to an open savannah woodland, gum Arabic production and shea butter production could eventually be encouraged. Water points for the watering of cattle could be provided and the rangelands could be improved to provide better grazing to attract the pastoralists out of the park.
In the Roseires locality of Blue Nile State it is unlikely that the project could offer support for activities since there is still no consensus on the location of the park boundaries. Community demands to rescind the expansion of the park appear to be strong in the Kadalo area, In these circumstances there is a high risk that project interventions would be located in inappropriate places.

6.1.4.1.3 Transport Development.

The transport infrastructure in the region needs to be improved so that all weather roads connect the park and its environs to the outside world. Within the park all weather roads are required so that parks management can patrol effectively and so that tourists can have access to key areas of the park at all seasons. Outside the park all weather roads are needed ion order to connect the farmers to the markets for higher value perishable vegetables that would be produced following agricultural restructuring. The development of this transport infrastructure will be a major cost and exceed that funding available to the project. It should therefore be the major central government contribution to the capital requirements.

6.1.4.2 Scenario Outcomes

In order for the project to be a success and to make a real difference to the people in and around the park it is necessary that all the project interventions listed above should be carried out. Failure to carry out one or more of the interventions will lead to negative outcomes for all but a few of the stakeholders. The specific scenario outcomes possible are indicated in the grid below and are described thereafter.

Agricultural Reform Succesful			Agricultrual Reform Failure		
	Transport Infrastructure			Transport Infrastructure	
Taking Control of the Park	Connected to the World	Unconnected	Taking Control of the Park	Connected to the World	Unconnected
Failure	The Poachers Paradise	The Lost Eden	Failure	The Lost Eden	The Lost Eden
Control Achieved	A Park with the People	An island in a sea of starvation	Control Achieved	Tourism in a sea of desolation	A park for the Few

Scenario 1. A Park with the People.
In this scenario the park becomes integrated with the needs of the people surrounding the park. The park is renowned as a biodiversity asset internationally and attracts large numbers of tourists who supply employment for neighbouring communities. Pastoralists do not enter the park since the balance of benefits has

shifted in favour of grazing in enriched and watered areas away from the park. The local people grow high value food for export to the cities and also for supplying the tourism trade in and around the park. The future od the park is secure and because of the income stream from tourism the government is able to make investments in management of the park for the conservation of its biodiversity assets.

Scenario 2 The Poachers Paradise
In this scenario agricultural reform has been succesful and the roads have connected the region to the outside world but the parks management have not been succesful in achieving control. This allows poachers unrestricted access to the market for bushmeat so that there is widespread slaughter of wildlife and the park loses its large game being left only with small antelope and its bird fauna intact. The vegetation recovers due to the lack of cattle but fire set by poachers continues to influence the vegetation negatively.

Scenario 3. The lost Eden
In this scenario the park management fails to take control and other factors ensure that agricultural reform fails so that cattle continue to access the park in great numbers accompanied by poachers. The vegetation is destroyed. The trees are cut down for firewood. Starving people enter the park to practice agriculture in increasing numbers and within a short time the biodiversity assets have been destroyed.

Scenario 4. An Island in a sea of starvation.
In this scenario the park management take control of the park and are able to protect its resources by force alone. Local communities carry out the programme of agricultural reform so that pastoralists have land available for cattle grazing. However the failure of the road infrastructure to connect to the markets means that tourism cannot be developed and that the high value crops grown by local people cannot access the market. The shortage of cash from tourism or food sales means that people cannot afford to buy staple grain products and there is widespread starvation. A very few tourists access the park during the dry season and benefit only the concessionaires who hold on to the camps in the park.

Scenario 5 A park for the few.
This scenario is essentially the same as scenario 4 but since agricultural reform was unsuccessful the people remain at a subsistence level dependent on a few staples to support them.

Scenario 6 Tourism in a sea of desolation
In this scenario the transport infrastructure is developed and the parks management takes control of the park but there is no agricultural development. Outside the park there are insufficient resources for pastoralists who then either come into conflict with settled agriculture or lose their herds to starvation. The farmers continue to depend on the production of staple foods such a sorghum and therefore their livelihoods are scarcely touched by the improvement in communications except that young people find it much easier to leave and become remittance earners. The park is able to attract tourist who can access it the year round and people directly involved in the business of the park make a reasonable living compared with those outside.

6.2 Rationale Selection and screening of focal areas

6.2.1 Selection criteria and ranking

- Potential Impact of Area on availability of Pastoralist Resources outside the park.
- Previous exposure to development support
- Relationship between park staff and population
- Distance to park boundary or extent of trespassing from the community/group
- Capacity of Village Development Committees and CBOs
- Number of inhabitants/population density
- Diversity of population (ethnic groups, land users, sedentary and nomadic pastoralists etc)
- Degree of degradation
- Accessibility i.e. likelihood of project activities to be operational during all seasons

6.2.2 Livelihood practices, environmental concerns and root causes

6.2.2.1 Cattle invasion

The entire park is subject to the incursions of cattle. Estimates of cattle invading the park at various times are variable but it seems possible that up to a million may be present at peak times when alternative grazing is not available elsewhere due to restrictions placed on the movement of cattle by rain fed agriculture. In adition to the grazing cattle are also brought into the park to seek shade since shade trees are almost absent outside of the park. Cattle entering the park are accompanied by herders and originate both from settled villages along the borders of the park and also from more distant areas when accompanied by nomadic and semi nomadic pastoralists such as Fulani and Mbororo.

The impact of these cattle on the park is likely to be enormous, they will compete with the wild ungulates for food, are likely to transmit diseases to wild animals and cause large scale changes to the grass sward. In particular grasses of poor nutritive value will replace highly palatable species and cause a progressive reduction in the quality of the habitat for grazing ungulates. In addition these poor nutrient content grasses are usually dense and tall and act to hide the few remaining palatable species from the more selective grazers such as Oribi and Red Fronted Gazelle.

6.2.2.2 Fire

The impact of fire on the vegetation is likely to be as significant as the impact of cattle. Fire is a normal part of the ecology of these savannah systems, world wide. And it should be noted therefore that the Savannah systems of the park are well adapted to fire and that many of the trees and plants are resistant to fire while others will be adapted to regenerate either by resprouting from the base or by regenerating from seed. However increases in the frequency of fire and also changes in the seasonal timing of fire will have large effects on the vegetation. In the case of Dinder the high frequency of fires appears to have led to a serious reduction in the perennial grasses. This high frequency of fires is attributed to human influences including fire setting on purpose as well as accidental fires caused by honey hunters.

6.2.2.3 Poaching

Poaching seems to be an important factor in the wildlife population dynamics. Several informants admitted to bush meat being an important part of the diet at certain times of year.

6.2.2.4 Drying out of the Mayas

The mayas are undoubtedly one of the key biodiversity resources of the park and are important for both birds and mammals. Siltation of the mayas is apparently due to silt being brought down from the Ethiopian highlands and therefore little can be done by the park management to address this situation, at this point in time. However the impact of this siltation is principally to reduce the depth of water which is collected in the mayas to the extent that it no longer remains in the maya for the full length of the dry season. Potential evapotranspiration in the area is approximately three meters during the dry season so that only pools deeper than this would retain water to the end of the dry season.

6.2.2.5 Water availability

Water availability in the region is generally poor. Even areas close to the river become dependent on shallow wells dug in the river bed by the end of the dry season. This lack of water availability has significant effects on people's livelihoods and living conditions. The collection of clean drinking water for human and livestock consumption is a major problem. In particular in the case of the pastoralists the limited distribution of water points for cattle severely restricts the areas that they are able to use for dry season grazing and this has important impacts both on the range condition and the livestock. Livestock become effectively starved while the range condition close to watering points deteriorates as a result of overgrazing.

The limited distribution of drinking water is also a major factor restricting the distribution of settlements to areas close to the river where water is most likely to last the dry season, this also means that the human impacts on the environment are concentrated along the river. Since the Rahad river forms the northern boundary of

the park the settlement of people and their livestock in this area has an impact on the biodiversity resources of the park.
Inside the park itself the limited water storage capacity at the Magano village site means that the village is abandoned during the late dry season and that the villagers move to Tabia in the core region of the park with their livestock.

6.2.2.6 Biodiversity Issues

The biodiversity of the park is high and of Global significance. The park forms the northern limit of the range of a number of species in the Sudan Savanna zone and is home to some species that only occur in the park within Sudan. Some of these species are globally rare such as the roan antelope and tiang.
The bird fauna of the park is also particularly diverse and the mayas in the centre of the park are an important resource for migratory birds. These mayas are in the process of being registered as a RAMSAR site. The flora of the park is poorly described but it seems likely that the plant diversity is high and it is expected that a number of rangeland species that have been eliminated from areas outside the park due to the conversion to mechanised farming will occur only inside the park.
There are at least three rocky outcrops of the type found at the Magano village inside the park of which two do not appear on the habitat maps of the park. These rocky outcrops appear to be from the same formation that occurs further south in the Ingessana district but within the park they are unique and of a very limited extent. It is likely that a number of animal and plant species are restricted to these outcrops which should be surveyed in order to establish this before any activities that could affect them are carried out.
Wildlife populations in the park are strongly affected by the availability of water and as a result of this become strongly concentrated along the rivers and around mayas during the dry season. Cattle entering the park for grazing during the late dry season are also dependent on these water resources and as such compete with the wildlife for grazing in the core area of the park and probably along the Rahad river.
The very heavy presence of cattle inside the park was witnessed by seeing two large herds in the core area during the visit in April. The April visit also revealed that wildlife does not appear as widespread in the park as originally assumed and that large ungulate distribution is largely limited to areas close to the park headquarters at Galegu which are clearly better protected than other areas. As a result of this limited distribution it seems likely that the populations of ungulates given in the park management plan are overstimates and that actual populations are much lower than this. However little seems to be known about the situation in the northeast quadrant of the park since it is rarely accessed by parks staff although it is also likely to be the part most frequently accessed by pastoralists from the Gedaref state and Ethiopia.

6.2.2.7 Relationship Park Management and communities

Rahad River Villages.

The ten villages which have been developed inside the park during the last forty years have exerted a considerable influence on the vegetation and wildlife in their zone of influence which extends approximately five kilometres into the park. These villages have developed rain fed agriculture up to two to three kilometres away from the river and beyond that up to the limit of their agreed influence firewood collection and livestock grazing have so influenced the vegetation cover that there is almost no tree cover and the field layer has been severely modified.

The villagers here recognise that they are using the resources of the national park and are therefore prepared to negotiate agreements about how they can use these resources.

The villages established along the north bank of the river have a more limited direct impact on the park, however livestock from these villages regularly enter the park for grazing.

Blue Nile State Villages.
The village of Magano which prior to the park extension was located on the border of the park is now the only village which lies deep inside the park. The village is not suitable for year round occupation due to seasonal water shortages and at this time the villagers move to Tabia in the core area of the park along the Dinder river where water is available. The presence of this community in the heart of the park during the late dry season is undesirable since it is likely to have a detrimental effect on wildlife resources due to disturbance and in the long term there is an increased risk of both poaching and disease transmission from domestic livestock to wild animals.

The other villages in Blue Nile State lie just outside the extended boundary of the park however the agricultural activities of these villages extend well into the park. This includes the grazing of livestock and rain fed agriculture. This means that although these areas have now been included in the park for more than twenty years they at present contribute nothing to the functioning ecosystems of the park. They carry few trees and once again the Google earth image reveals that the majority of this area is still divided into rectilinear field shapes. Trees are almost absent in this Zone.

Sennar State Boundary
There are no villages in Sennar State that lie inside the park. The nearest village is approximately 7km away. The boundary between the park and the village lands in this area is abrupt since trees have been cleared right up to the park boundary.

6.2.3 Problems and objectives tree

In summery, the main root causes to above problems are i) the difficulty to control the area and ii) the lack of natural resources outside of the DNP. With this background the specific objective proposed for Dinder Project is:

"To reduce the pressure on the DNP and its biodiversity assets by offering alternative livelihoods to those who at present encroach on the park".

6.3 Assessments of Land and Water Management Interventions

The objective of this task is to assess the technical, economic, financial, social and environmental feasibility of the proposed measures and interventions aimed at improving the livelihoods of the local target groups as well as the use and management of natural resources in each micro-area and resulting in local and regional benefits.

The proposed measures to be assessed by the assignment have been divided in several intervention areas as listed below:

1. Water resources development, harvesting and storage
2. Environmental and Biodiversity
3. Agriculture and Rangeland
4. Reforestration/Afforestration
5. Development of alternative incomes, revolving funds and marketing services

Guided by the IWRM/Watershed Management Concept, the Consultant have undertaken assessment of feasibility and acceptability of the proposed measures and how intervention options need to be tailored to Dinder, taking into account local bio-physical conditions, previous experiences, and community priorities and needs voiced during consultations. Based on the ToR and detailed assessments of feasibility the Fast Track project is proposed to focus on the following intervention areas.

6.3.1 Water Resource development

Water resources are the most limiting factor to both people and wildlife in and around the park. The lack of water limits the distribution of people, their livestock and wildlife. This dependence on water brings people into direct contact and resource use conflict with wildlife and with other users of land and water resources.

Water resource development should be carried out in such a way as to reduce the conflicting demands for water from different user groups and also to improve the efficiency and value of agriculture. This should be carried out in four principal ways. It should be noted that the potential water supply to the region from the combined resources of the rivers and from rainfall interception far exceeds the requirements of all users in the region. The major problem associated with the water supply is storage and in some cases short distance transport.

1) Water storage resources should be developed in areas such as Magano (where seasonal water shortage leads to emigration) by developing evaporation protected covered storage cisterns which are large enough to meet the supply requirements of the affected populations. These cisterns can be adequately

filled by the rainfall runoff from surrounding areas which may need to be appropriately channeled. The present systems of large shallow Hafirs is inadequate since most of the water is lost due to evaporation. In particular in the areas of clay soils these should be relatively easy to construct. Although this solution concept will be developed and tested for Magano, it will be useful for numerous other villages located at the foot of rock outcrops, in particular in the Ingessana area.

2) Water resources along the river should be improved by developing both in channel and off channel storage dams of adequate depth. Details of these need to be developed for each site of implementation, but it seems likely that a minimum effective depth of ten metres will be required. These dams should have a large enough capacity to meet local agricultural demand as well as the demand for drinking water. The dams could be spaced at distances of approximately five kilometers along the settled bank of the river. In this case each dam would need to be able to supply enough water for the irrigation of 300ha as well as drinking water for the associated people and livestock. For the Rahad river, dams will most conveniently be located where chors enter the main river channel.
3) Cattle watering points should be established away from existing settlements at distances of five to ten kilometers from the river in order to provide access to less densely used rangelands and to reduce the pressure of cattle on the surrounding areas. This can be done by digging out deeper watering holes within existing mayas that currently dry out completely or in some cases by piping water from the river or dam system. Within the park the digging out of deeper waterholes in the existing Mayas will perform the same role for the wildlife.
4) Rehabilitation of mayas that are in the process of drying out will be carried out by construction of low weirs, over which water (from the surface, low in sediment content) will flow in and fill the maya at the peak of the flood season. During flood recession the same weir will act as an impermeable dam, that prevents the water in the maya from flowing back into the river. It is envisaged that this weir in most cases can be a relatively simple earth fill structure with rock protection against erosion.
5) A network of small scale irrigation structures to distribute water from off channel and in channel dams will be needed in order to supply irrigation water over distances of up to 3km along the river and up to 500m from the river. This will allow users to access water for irrigation. Small bore pipelines should be laid to connect villages to these dams for the provision of clean drinking water.

6.3.2 Reforestation/Agro forestry:

The Dinder area has become severely deforested particularly in areas surrounding the park but also within the park on the northern boundary with the Rahad river and also on the southern boundary in the Roseires locality. This has an important impact on wildife and cattle as well as on biodiversity in general and soil stability as well as reducing the availalbiltiy of NTFPs and fire and service wood for local communities. There is therefore a need to provide forest cover in the region for environmental and

human benefits. It is proposed that the project supports two types of reforestation programme but that in both cases the tree species selection is focussed on trees that have human as well as environmental value.

1) Close to the river and where irrigation water is available reforestation should take place principally with trees of an agroforestry use. Thus the selection of tree species should include trees already successfully cultivated and known in the area such as citrus trees, mangoes and date palms. This component of the project should be administered at the village level and be supported technically by the department of agriculture. In this case the establishment of trees at an individual level could be supported by microgrants while the establishment of a nursery for these species could be supported by (a suitable loan mechanism)
2) Away from the river and in the national park and at distances of up to ten kilometres from the park boundary in Gedaref and Sennar state reforestation should be carried out with species such as Acacia senegal and Acacia seyal which can both be used to produce a gum Arabic for export as well as being useful for firewood and servicewood. Balanites aegypticus is also an important provider of fruit. Reforestation should commence with these species and then other species should be allowed to colonise naturally in the long term. In Sennar state this work should be administered at the village level, possibly in a public private partnership in areas that are designated to become hunting concessions. Technical support and execution should be carried out by the department of forestry. In Gedaref state the work should be administered by the Department of Agriculture with technical support from the Department of Forestry. Inside the Dinder National Park the work should be administered by the General Administration for Parks and Wildlife and be executed by the Department of Forestry.
3) It is recommended that alternative energy sources for cooking such as LPG and improved energy saving cooking stoves which could decrease the pressure on woody biomass and forest reserves are introduced in all the three pilot villages in the three zones.

6.3.3 Crop diversification and intensification

The focus on crop production in the area is on staple grains such as sorghum, millet and sesame. These are supplemented by a limited production of vegetables for local consumption. The result of this is that the local diet is seasonally deficient in fresh vegetables, which contributes to poor health. Fresh vegetables would need to be imported at these times from other parts of Sudan at prices which cannot be met from the production of sorghum. This is particularly the case since the yields of Sorghum achieved (even under irrigation) are well below what can be achieved elsewhere in the world.

The focus on crop production must move away from extensive production of staple grains to the intensive production of higher value vegetables and fruits, such as tomatoes, beans, onions and melons. These should be produced under irrigation and

the timing of production should be matched to seasonal demands in the large cities. This type of production will ony be possible if the project is able to establish adequate supplies of irrigation water available throughout the year and it is assumed that this prerequirement is met. The project will support this change in production pattern in a number of ways.

1) Agricultural extension agents will train target communities in the establishment of irrigation structures and methods which can efficiently optimise the yield/water use ratio. Irrigation schemes aimed at the optimisation of water use should be developed for each vegetable variety grown. These agents will also train communities in the tending and harvesting of the crops.
2) Micro -credits and revolving funds will be made available to farmers in order to allow them to purchase appropriate inputs
3) Cooperative marketing of products will be supported in order that transport to markets can be optimised and that large scale supply can achieve improved prices for producers.

6.3.4 Pastoralists and nomads livelihood

Dinder National Park falls within the semi-arid and dry sub-humid zones of the Sudan, with rainfall ranging between 600 and 800 mm in the northern part, and 800 to 1000 mm in the southeastern part of the Park (HCENR et. al, 2005). The Dinder river runs in the centre of the Park, and the Rahad River runs along the eastern border of the Park, both flowing from the Ethiopian plateau. The annual discharge of the two rivers is about 3 billion m^3 of water. About another 6.2 to 7.13 billion m^3 come to the DNP as annual rainfall (calculated using Park area of 8,900 km^2 and annual rainfall of 700 and 800 mm). Perhaps one-third of the rainfall is lost through evapotranspiration (although the annual PET is probably about 3000mm, this is lower in the rainy season and the high rainfall intensity allows for overland flow to runoff in rivers) and a similar amount or more is lost as runoff to khors and low-lying areas.. All this amount of water starts flowing around middle of May and ceases to flow in November. Such huge torential flow of water can cause a lot of soil erosion and sediment and debries transport. The sandy river and khor beds are left with some pools (mayas) which might hold water up to the next rainy season. They are the main source of drinking water and green fodder during the dry season. These mayas also form happy breeding-grounds for mosquitoes. In fact, much of this Park area and of the Rahad-Dinder gezira is extremely ill-drained and includes many khors and depressions which are infested by insects even after the rains are over.

Recent preliminary archaeological investigations have revealed many archaeological sites, some of them apparently closely associated with mayas such as Abdel Ghani, Ras Amir, Gererrisa and Farsh El Naam. These sites reveal the geographical extent of the Meroitic Kingdom and its possible relationship with the kingdom of Axum (HCENR et. al, 2005).

The soils of the DNP are Vertisols and Entisols. The Vertisols are the most extensive one while Entisols are abundant in the eastern parts of the Park towards the foothills

of the Ethiopian plateau and along riverbanks. Both types of soils are good agricultural lands. *Acacia seyal-Balanites* ecosystem occur extensively on these deep, cracking Vertisols.

Evidence of repeated fire incidences is clear in this ecosystem. Many of the fires originate outside the Park as early as September by nomads and farmers. Other fires are set inside the Park by poachers, tresspassing nomads and honey gatherers. The Wildlife Protection authorities in Khartoum admitted that institution was weak, and that there was opportunity for capacity building for rangers, and monitoring using air crafts. In addition to policing, they be trained on managing the Park and tourism business. The Park staff seems to be helpless towards these practices, there are no fire fighting devices and even by that time (September) the roads are not yet passable. There is need for firelines to protect the Park. Fire should be used in a restricted manner as a management tool. The present patrolling roads should be modified (to be widened to about 20 m) to do the purpose of firelines as well as roads. Due to repeated fires, the range in the Park is predominated by annual grasses with low nutritive value. There are eroded areas in the Park, which need to be reforested to reduce further erosion and sediment transport. Rivers and khors banks are severely eroded. They need protection measures. Also there are signs that some roads in some areas become parts of drainage systems and develop into gullies.

The Director of Forestry in Singa complained that while 80% of the DNP was forest, no foresters were employed in the Park, and that no cooperation existed between the Park and the Forestry Directorates in the three states sharing the park territories. Degradation in the catchment areas and repeated fires increased rates of erosion and eventual siltation of mayas (HCENR, 2005).

The price of firewood is decreasing due to the spread of gas cookers. It went down from 120,000 to about 60,000-70,000 pounds per m^3 . This will reduce the Park encroachment by charcoal makers and firewood collectors.

Officials of Rangeland and Pasture, and Animal Wealth directorates in Singa complained that they face two major problems: mechanized farming blocking animal routes, and drinking water for livestock. They said political bias was in favour of mechanized farmers. The pastolalists themselves feel that they are marginalized. They pay taxes but they receive minimum of services. We were told that the Wali of Sennar State was preparing a law on animal routes and demarkated mechanized farm. The plan is to keep animals in their own states by providing them services and improving pastures. In the Blue Nile State, nomads have better demarcated animal routes which in most cases are about 2 km wide.
For nomads, their livestock means everything. They are their source of food and cash, and social status. Nomads would do everything they can to feed and water their herds. DNP is their safe-heaven where they can have water and fodder during the dry, hot weather.

A meeting was held with the leaders of the pastoralists organization (Masar Non-governmental Organization) in their offices in Gedarif town. Some government officials also attend the meeting. The following can be concluded from the meeting:

Livestock population around the Park is difficult to tell, but rough estimate puts it between 5 to 10 million heads, mostly cattle and sheep. It should be noted that this number of animals is well above even the most optimisitic sustainable stocking levels (1LAU/2Ha probably more reasonable 1LAU/10ha) and as a result range degradation is inevitable).
The majority seems to be on the eastern side of the Park in Gedarif State. The Director of Rangeland and Pastures in Gedarif State complained that no much grazing area was left for the livestock. He added that in 1950s about 86% of the State was rangeland and woodland, in 1991 rangeland was reduced to 6% and forests were reduced to 18% of the State area. Now all this land is distributed as rainfed agriculture. The State livestock stays two months in Butana during the rainy season, and ten months in the southern part of the State during the dry season. The livestock walks this north-south journey on eight routes. Each journey takes about 15 days. The average width of a route is only about 150 metres, and that creates problems with the farmers. The Director of Rangelands and Pastures said that recent studies showed the need for a resting place for livestock on each animal route every 25 km where the animals could have drinking water (hafirs), some fodder and trees for browsing and shade. He added that a committee had prepared a plan for three routes that included the above-mentioned components. In the southern part of the State, most of the farmers are small-scale farmers who can not tolerate the presence of large number of animals in the area. For this reason herders are compelled to either enter the Park with their livestock or cross the border into Ethiopia, where they face even severer punishment. Land use has to be re-planned in the State putting into consideration the huge numbers of livestock, and the poor yields obtained under mechanized rainfed agriculture. One of the proposals in the meeting was that 45,000 feddans with drinking water points (hafirs or excavated mayas) be reserved for pasture in the southern part of the State for summer grazing.

The primary concern for governments of all authorities visited is to develop policies to check overgrazing, a problem recognized by all. The development of water resources in the form of hafirs was thought to spread the burden of livestock over a wider area and in this way would reduce overgrazing. This approach could work only if livestock populations were stabilized. But, uncontrolled by state governments, the livestock population is rising steadily in the arid and semi-arid zones of the country. The inevitable result is more overgrazing. Land tenure system was the next to be tried. Three land tenure systems were progressively established in the Sudan. These are: 1) government lands that are not subject to any public use; 2) government lands subject to public use such as tribe or village or group of individuals; and 3) private lands registered in the name of individuals. The rangelands of Sudan are considered government properties, with the recognition of tribal rights to use these rangelands. It was recommended in the mid-1950s that rangelands had to be allocated and registered to tribal owners. This recommendation was considered crucial, because until individuals or groups knew that the benefits of new or improved ranges would be theirs, all efforts to develop rotational grazing would fail (Wallach, 1989).

Taken the above information in consideration, it appears that the bulk of herds and thus the "nomadic problem" is concentrated on the east side/Gedaref side of the park although trespassing herders are also found in the Blue Nile State part. The root

cause of nomads and semi-nomads trespassing the park boundary is the drastic reduction of grazing areas and animal routes outside the park due to extension of primarily planned and unplanned mechanized farming. This compels the nomads to resort to the park for fodder and water. The project preparation team has had several meetings with the Gedaref state administration and among other issues discussed ongoing efforts to develop a plan for rehabilitation of cattle routes (including resting places and water points) and the re-establishment of pastures through appropriate land use planning. The former Dinder National Park Project had greatly facilitated this, also in the other states. In view of the complexity of the situation (conflicting interests, uncertain landownership and political commitment), it appears that fast track activities to address the problem of trespassing herds should be limited to support Gedaref state to complete and implement its plan. The Project could provide required advisory expertise, capacity development among involved staff, and support to further studies/reasearch. Planning and implementation should be done in close cooperation with the beneficiaries and their organsiation and should be coordinated with the ongoing IFAD project in Butana that partly works with the same beneficiaries.

Another avenue could be to assist in 1) the revision and improvement and 2) the implementation of the Dinder National Park Management Plan as the plan intends to provide services to herders (water and alternative pastures) in the proposed transitional zones of the park. To improve and institutionalize the dialogue between the local stakeholders and the park administration, it would be very crucial to establish the proposed "Council of Park Stakeholders" which will include the DNP administration, village development committees, Unions of planned and unplanned mechanized farmers, traditional farmers, pastoralists, traditional community organsiations and leaders, and representatives of the involved states.

In order to be successful in protecting the parks resources from encroachment by pastoralists it is clearly necessary to implement a push-pull strategy in which law enforcement inside the park is accompanied by measures to make areas outside the park more attractive to pastoralists in order that the balance of costs and benefits shifts to a preference for grazing outside the park.

The environmental impacts of pastoralists in the park are far reaching and severely compromise the ability of the park to meet its biodiversity objectives. These impacts include direct and indirect impacts on the biodiversity resources. Cattle compete for grazing with wild ungulates in the park directly and also act to change the vegetation composition into a sward which is less palatable and nutritious for wild animals. Cattle can introduce diseases such as anthrax, rabies and bovine TB to the park which can cause severe mortality ot the wildlife. In addition the presence of herders in the park increases the risk of unplanned fire both from accidental sources as camp fires as well as from honey collecting and the deliberate setting of fires to improve grazing for cattle by removing the moribund component of the previous seasons' growth and to stimulate early resprouting to feed the cattle.

Cattle herders in the park are likely to engage in poaching wild animals to meet their need for meat rather than use their own livestock.

As mentioned under the Atbara section, in the long term increased levels of literacy and basic education would greatly facilitate change of behaviour and preferences. Therefore it is important to improve access and quality of education facilities (semi-nomads) and mobile schools (nomads).

6.3.5 Transport infrastructure

The present transport infrastructure is entirely inadequate. In effect most of the area becomes cut off for a period of three to four months during the rainy season. In order to be effective the project will need to develop an all weather transport infrastructure along three major axes and within the park itself. These are given in order of priority below

1) The contruction of an all weather road connecting the Rahad villages with Gedaref including a bridge or low level bridge across the Rahad river into the DNP.
2) The construction of all weather roads within the DNP in order to allow parks management to control the park and visitors to access the park during all seasons.
3) The construction of an all weather road from Dinder Town to Galegu in the DNP.
4) The construction of an all weather road from Er Roseires to Magano village.

The construction of these roads will be costly but will supply other benefits including improving the ability to establish security in the region and for this reason it is expected that the development of these roads would be the major central government contribution to the project.

In addition since the success of all other interventions is strongly dependent on the communications network, no other funding from the project should be made available until the commitment to at least phase 1 and Phase 2 of the roads development given above are made. And that the time schedule for the development is within the first two years of the project schedule.

6.3.6 Alternative energy

For Dinder area energy used in the area is mainly fuel wood. Other alternative energy are used in the area, such as diesel/for water pumps, improved stoves and solar energy which are used in public institutions, telecommunication and efficiently used at the Park camp ,

The LPG has been introduced in the area by the DNP Management Project (through a revolving fund) through the village committees. Some national NGOs also distributed LPG cylinders. LPG has been accepted by the villagers after a number of awareness programs which conducted by the DNP project.
The current construction of the roads will encourage usage of LPG. The problem LPG has faced in the area is the high start up cost, which is expensive due to the price of the gas stoves. Nevertheless, at present there is locally made stoves which have

improved its efficiency in different parts of Sudan. Through the Fast Track Watershed Project, these small efforts could be support and a small industry could be established for gas cookers, which will help in both the introduction of LPG in a large scale and could play a role in income generation activities for both men and women.

The introduction of solar energy as house hold source is not yet accepted by the community due to some believes and culture factors. Instead solar energy could be used for public institutions such as schools, communication, water pumps especially within the PARK as other diesel pumps will disturb the animals. Communal house hold lighting is another example of possible use.

6.3.7 Supporting Institutions, Capacity Building and Institutional Strengthening

6.3.7.1 Capacity building of parks staff

The DNP faces a number of serious issues in relation to the capacity of its staff to carry out the task required.

At the senior officer level some of the staff have some qualifications appropriate to the management of the park such as degrees in wildlife management. However this is not true of all the officers who should be involved in making ecologically based decisions about the management of the park. Similarly officers tasked with maintaining the social interface of the park are not trained resource sociologists. Furthermore there is a high level of mobility amongst the senior officers within the police force so that officers who are successful in the park are likely to be transferred or promoted to higher levels in general or specialist policing. In order to overcome this problem there will need to be a structural change in the police force. There should be little problem in recruiting qualified people to manage the park since there are many university trained wildlife management graduates in the country. In general all posts concerned with management of the natural resources of the park should be filled by these graduates. Specialised in service training for these staff is best done by attendance at specialised short courses.

At the junior officer level there is little capacity to carry out the job which is expected of them and the people in post generally have limited experience of the requirements of wildlife management. This position has been common in many parks throughout Africa where the first emphasis for parks management has been protection. This is the case for many parks in Africa now considered flagship models of conservation such as Kruger Park in South Africa and the Serengeti Park in Tanzania. There is a need for these junior officers to be trained in and to carry out a number of roles in the park including such activities as wildlife protection, fire management and control, road maintenance, camp maintenance, wild animal capture and care, botanical surveying, tourism etc. These junior officers should become specialised and have teams of rangers dedicated to their speciality according to need. There is therefore a need for technical training and experience for this level of staff in order to complement the role

of the senior officers. The park will not survive long without them. These staff are probably best trained in situ by a combination of formal classes and counterpart training by experienced junior officers selected from the parks systems of other countries such as South Africa, Kenya and Tanzania.

7 Detailed Technical Assessment for Ingessana

7.1 Brief Description of Ingessana Project Site

7.1.1 Definition of project area

The project area is bounded by the border of Bau locality. Bau town, the center of the locality, is situated some 80 km to the southwest of El Damazin town which is the capital of the Blue Nile State.

7.1.2 Institutional Framework in Ingessana

At the State level there is the Wali (Governer) for Blue Nile State. Under him there are eight ministries. These are the Ministries of Agriculture, Health, Education, Finance, Youth and Sports, Physical Planning and Public Utilities, Welfare and Ministry of Local Governance.

The Blue Nile State is divided into four localities: El Damazin, El Roseires, El Kurmuk and Bau. The targeted area (Ingesssana area) lies within Bau locality which is the focus of this consultancy.

Ed Damer Locality – Institutional Set-up			
		Commissioner	
		Executive Director	
Education	Chief Finance	Chief Technical Inspector - Agriculture	Services
	.	*Rain fed Agri. Inspector*	*Health*
	Procurment	*Forestry Inspectors*	*Welfare*
		Horticulture/Irrigation Insp.	*Engineering*
		Animal Wealth Inspector	
		Inspector of Pasture and Fodder	

The forestry staff of Bau Locality consists of 5 forest inspectors (BSc degree holders) and 25 assistant inspectors and forest guards (secondary and primary school education).

7.1.3 Key Characteristics

The district lies within the Savannah Zone with annual precipitation ranges between 600 and 800mm with a long-term mean of 710 mm per annum in Ed Damazin town. Bau locality depends on rain as its major water source and 70% of Bau Locality experience water scarcity in summer.

Ingessana Hills rise 800 to 1000 feet above sea level. The area, otherwise, is monotonously flat at an altitude of about 465 m. a. s. l. The prominent seasonal tributaries (Wadi/ Khor) that emerge from the Ingassana massif in a radial pattern are Wadis Timsah, Maganza, Ferri, and El Dom. Among these, Wadi Maganza virtually drains all northeastern parts of the Ingessana Hills. Its seasonal waters end up into the western banks of Roseries Dam reservoir at a point located some 20 km south of El Damazin town. Another first order seasonal stream, Wadi Uffut, partially drains the southeastern hill slopes into Roseries Dam reservoir; some 12km to the southeast of Wadi Maganza confluence with the Blue Nile.

Bau locality is endowed with rich forest resources with more than 55 tree species. It is one of the major producers of Gum Arabic.

7.2 Rationale Selection and screening of focal areas

7.2.1 Selection criteria and ranking

Based on information gathered, Bau locality can also be divided into three agro-ecological zones: (1) Ingessana Hills, (2) the foothills of Ingessana Hills, and (3) the low-lying farmlands outside Ingessana Hills, which are described below.

a) Low-lying farmlands are occupied by large scale mechanised and semi-mechanised farms. There are also few scattered small scale traditional farmers. All the farms are rain-fed. The soils are mainly black cotton soil (vertisols) and forest vegetation is extremely scanty with few patches of *Acacia senegal*, *A. seyal*, *A. polyacantha*, *A. mellifera*, *A. nilotica*, *Anogeissus leiocarpus, Balanites aegyptiaca*, *Combretium hartimanimum*, *Hyphane thepaca* and *Tamarindus indica*. This is one of the areas where transient nomads temporarily settle during the rainy season when they travel between Kurmuk and White Nile in search of pasture and water. Most of the trees have been cut down for expansion of mechanised agriculture. The remaining trees are being cut down for charcoal making by the small scale traditional farmers who inhabit this area. Charcoal making contributes significantly to their household income.

b) Ingessana Hills used to be densely covered by forest until very recently. The major forest flora includes *Adansonia digitata*, *Anogeissus leiocarpus*, *Boscia salicifolia*, *Boswellia papyrifera*, *Combretium spp* and *Stercula setigera.* The Hills are also endowed with rich deposit of minerals as described above. However, most of the hills have lost their forest cover as a result of intensive charcoal making and illicit cutting for other purposes. Most of the population on the Hills are miners or employed by mining industries. Thus, mining is also causing a lot of damages to the forest and the environment.

c) The foothills of Ingessana Hills are areas where majority of small scale traditional farmers are settled. They practice rain-fed hoe-agriculture. Since the forest cover on adjacent Hills are degraded, runoff from these Hills is causing significant soil erosion on these foothills. As a result, agricultural crop productivity has declined. Thus, farmers reply on forest resources found both on the foothills and adjacent Hills for their livelihood. Most of the farmers are involved in Boswellia incense tapping, charcoal making and harvesting and selling of fruits of *Adansonia digitata* and *Tamarindus indica*. The transient nomadic community also temporary settle here during the rainy season.

Since the three zones are distinct and all have there specific environmental concerns and root causes, it is recommended that only one pilot integrated watershed management project is implemented in a representative village in each zone. It is also recommended that the pilot village for the watershed management project on Ingessana Hills shall be one of the villages where intensive artisanal gold mining is taking place.

Concerning the transient nomads, as described above, they temporarily settle in both low-lying farmlands and foothills of Ingessana, thus, causing land and water use conflicts with local farmers. But not all villages are affected by this. According to a recent study on nomadic pastoralism carried out by the Ministry of Agriculture, nomads have five traditionally established routes which traverse through a number of villages in low-lying farmlands and foothills of Ingessana. They temporarily settle in these villages during the rainy season. It is therefore recommended that the two representative villages for the pilot projects in low-lying farmlands and foothills of Ingessana shall be the ones that lie on these traditional routes and where nomads are known to settle consistently every year so that the issue of land and water use conflicts between nomads and farmers are addressed by the watershed management fast-track project properly.

The specific selection criteria for the Ingessana area are proposed to be:

- Extent of linkage between watershed degradation and prevailing livelihood practices.
- Extent of vulnerability/ resource dependency
- Importance/Influence

- Extent of willingness of the target groups to participate (i.e. those with present unsustainable livelihood practices should be committed to the called upon process of change).
- Extent of institutional capacity to support and implement projects at State and Locality levels.
- Extent of previous exposure to development support
- Extent of development potential for alternative livelihoods
- Extent and probability of external risks

During the detailed assessment a number of potential interventions areas were evaluated and incorporated in a screening matrix using the same set of selection criteria.

Each criterion has been assigned a value between -2- to +2. In case any criteria receive -2, the area will be deselected. The result of the screening is presented below.

7.2.2 Key Livelihood, environmental concerns and root causes

7.2.2.1 Deforestation and soil erosion

Deforestation on the Ingessana hills causes considerable erosion which contributes to the downstream siltation problem in the Roseries dam. Intense rainfall during rainy season results in pulses of floods and the high flow and speed extensively in the khors network, which results in erosion. However, the Bau locality is dominated by flat clayey soils and is therefore not prone to erosion.
Current mining practices have severe impacts on the forest resources of Ingessana Hills which in turn resulted in soil erosion and increase of sediment flow in the Blue Nile and Rosaries dam. Both the chromite and gold mines are a major source of livelihood for a large number of community members in Ingessana Hills. The activities of both the chromite and gold mines are, however, causing significant environmental damages and water pollution from mercury etc. In one of the chromite mine areas that was visited during the present mission, many trees have been felled and a large area of land has been dug out in order to gain access to the underground and there is also a large quantity of mine waste that has been deposited on site, all of which have caused visible damage to the environment in general and the forestry and water resources in particular. Artisanal gold mining activity also involves felling of trees and digging and excavating pits sometimes as deep as 15 m. These activities have also caused visible damage to the environment and forestry resources.

There are about 15 underground chromite mines on Ingessana Hills and there is more room for expansion. So far, the government of Sudan has identified 20 gold mining sites on Ingessana Hills and there may be more in the future. The government is also planning to grant concessions to private gold mining companies to invest in the area. This is a welcome development for the communities of Ingessana Hills as these

will generate more employment opportunities and income. However, according to the Law of mining in Sudan, miners have no obligation to rehabilitate the site after their operations have finished. The Law only recommends forest restoration on abandoned sites. In the absence of any obligations, the future prospect of forestry, soil and water resources in an ever expanding mining environment is grim.

Charcoal making also constitutes a critical issue and challenge to the government of Sudan. One of the major sources of income to large number of local people in Bau Locality is charcoal, fully absorbed by the nearby market of El Damazeen. As a result, the forests of Bau locality have been over-exploited and disappearing. In the Blue Nile State including Bau Locality, the growing stock in 2003 was estimated to be less than 9 m^3 ha^{-1} (Salih and ElSeed, 2003) which is equivalent to less than 1 m^3 ha^{-1} of mean annual increment, assuming a rotation of 10 years for charcoal. Since Bau locality is predominantly savanna with low density of trees, especially *Acacia seyal* which is the most preferred tree for charcoal making, the annual allowable cut cannot be more than 1 m^3 ha^{-1}.The current rate of charcoal making in Bau locality is, on average, 10 sacs (450 kg) per family per year. Assuming a charcoal conversion efficiency of earth kilns of 20%, a family needs to harvest about 2250 kg of wood to produce 10 sacs of charcoal per year. Using the standard conversion factor of 1 ton (1000 kg) to 1.39 m^3 at 15% moisture content (air dried wood), a family needs to cut about 3.3 m^3 of wood per year, which is three times the annual allowable cut. Unless strict law enforcement is applied, the forests of Bau locality can disappear in a few years.

The main root causes are lack of alternative incomes that can substitute the relatively high incomes from mining and charcoal, lack of alternative energy sources and lack of regulation and enforcement.

7.2.2.2 Biodiversity, agriculture and rangeland productivity

The locality is distinguished as being the zone of both animal and rain-fed husbandry. However, the carrying capacity of the land is in decline. During the period 1984 and 2003, areas of forests and rangelands have been reduced to one-third of their areas in 1984 in Bau locality to give way to croplands, weather commercial or subsistence (Mohammed Khair, 2003). Croplands now surround the Ingessana Hills. Remaining tree cover is mostly on the Ingessana Hills and on few stretches west of Bau locality. The main threat to the wild plants and animals is its habitat loss through land degradation, expansion of the rain-fed agriculture, nomadic grazing which competes with the wildlife for forage and water and introduces diseases that kill wildlife, and misuse of firearms. Civil war was also considered as one of the big threats to the wildlife in the Sudan. Perennial plants are disappearing and leguminous plants are less than 5% of the plant community, thus decreasing the quality of the rangelands (Abu Sas, 2007).

The expansion of mechanized rain-fed agricultural farms is the most important factor for the deterioration of the natural resource base, adversely affecting grazing and traditional farming lands.

Yields of various crops are declining with time currently far below their genetic potential. Losses in biodiversity and land degradation are continuing unabated (Ayoub, 1999).

Obviously one of the root causes are that the area has been war stricken for many years e.g. there is little infrastructure in place and land ownership and land use licenses are still not clear in many areas. Some other important root that the project must consider are causes are the lack of long-term and integrated planning and the difficulty to efficiently undertake extension services and law enforcement. As in the other areas pro-poor investment is modest.

7.2.2.3 Water availability

The annual precipitation ranges between 600 and 800mm with a long-term mean of 710 mm per annum in Ed Damazin town. Varying from season to season, this region receives dependable rainfall which extends over the period May to September.
Still, one of the limitations for local population is the lack of all year round access to water.

Where there is access to water in constructed haffirs and dams, the quality of water is often poor due to lack of fencing and purification. Both people and cattle are using the same water sources. However, there are also a few good examples in the area of water source protection.

Lack of water infrastructure to capture the water during the rainy season is definitely the most critical root problem in the Bau locality. The recent war has prevented infrastructure development. The second problem is the poor design/construction of some of water infrastructure seen. There are, however, many topographically well suited locations for dams and structures along the foothills of the Ingessana Hills.

7.2.3 Problems and objectives tree

In summary, the environmental concerns are deforestation, soil degradation and the increased pressure on remaining productive areas, and the related social concerns are lack of drinking water and the increasing number of conflicts over natural resources.

For the purpose of the Fast Track Watershed Project in the Bau Locality, the Consultant proposes to translate these various but interlinked causes into two key problem areas; 1) the lack of alternative incomes to substitute livelihood practices that are profitable but highly environmentally destructive; 2) the difficulty of enforcement 3) the failure of the government to manage the conflicts between the traditional farmers, The pastoralists and the mechanised farmers 4) the lack of integrated, sustainable and pro-poor watershed development planning as well as policy formulation necessary to promote alternative and sustainable practices.

This implies that in order to reverse the situation, the fast track watershed project is proposed to be directed by the aforementioned overall project objectives and the following specific objective:

"To reduce the pressure on the natural resources –currently providing the valuable environmental services - and to reduce people's vulnerability by offering alternative, more reliable and environmentally sound livelihoods to the people".

7.3 Assessments of Land and Water Management Interventions

The objective of this task is to assess the technical, economic, financial, social and environmental feasibility of the proposed measures and interventions aimed at improving the livelihoods of the local target groups as well as the use and management of natural resources in each area and resulting in local and regional benefits.

The proposed measures to be assessed by the assignment have been divided in several intervention areas as listed below:

1. Water resources development, harvesting and storage
2. Environmental and Biodiversity
3. Agriculture and Rangeland
4. Reforestration/Afforestration
5. Development of alternative incomes, revolving funds and marketing services

Guided by the IWRM/Watershed Management Concept, the Consultant have undertaken assessment of feasibility and acceptability of the proposed measures and how intervention options need to be tailored to the project area, taking into account local bio-physical conditions, previous experiences, and community priorities and needs voiced during consultations. Based on the ToR and detailed assessments of feasibility the Fast Track project is proposed to focus on the following intervention areas.

7.3.1 Water Resource development

As mentioned above, one of the limitations for local population and cattle is the effort to have year round access to water. Also mentioned above the Bau Locality can be dived in three area a) the low-lying farmlands, b) foothills of Ingessana Hills and c) Ingessana Hills.

7.3.1.1 Low-lying farmlands

For the low-lying farmland area, water development is proposed to be included as an integral part of the potential project component proposed by the Pastoralists and

Nomads Union in Blue Nile State for rehabilitation and improvement of the migration routes and further described under section 9.3.5.2 “Grazing regulations and regulation of pastoralist/animal routes”. The plan proposes to increase the width of the routes to 2 km, to plant trees along the routes, to construct haffirs, water points and dams along the routes to avoid congestion in a few areas, and to build campsites. The plan also includes an element of cost sharing by the users.

7.3.1.2 Foothills of Ingessana Hills

For the foothills of Ingessana Hills, water harvesting schemes e.g. construction of a number of small dams and Haffirs on Khors as far as possible adjacent to villages and small towns could greatly improve water for people and agriculture, including livestock. These dams and haffirs could be constructed as community assets, with a possible shift in implementation modality from public works to community assets and haffir building and/or operation license to private sector entities.

In addition to the above identified development opportunities, it is proposed to support construction of the shallow ground water wells in the vicinity of khors and wadis. This should be combined with construction of weirs across wadis. Areas close to khors and wadis are sometimes used as a shallow ground water source in the dry season, but the potential to develop this much further is believed to be very good. Some geoelectric investigations indicate awareness of the potential, but no significant development of this opportunity has been identified. It is therefore proposed to support development in this area under the Fast track project. This is proposed to be undertaken through institutional support and demonstrations on the ground.

Several potential sites for above interventions have been identified. Yet, it is recommended that suitable dam locations are identified and properly studied during project implementation, mainly for two reasons i) allow flexibility and ii) ensure institutional capacity building. The first reason is linked to the fact that there are many parallel plans to rehabilitate and construct new haffirs and hence it is not advisable to fix specific sites. The second reason is connected to the Consultant’s observation of poorly design/constructed dams/haffirs which indicates that the Locality could benefit from institutional strengthening of the whole planning, design, implementation (construction and supervision) process. Formulation of project guidelines for hydraulic structures (including SIA and EIA framework) is recommended to be produced together with training and technical assistance. Improved protection of drinking water and improved purification would also be an integral part of such a project. Taken the above in consideration it is recommended to include a project component to improve siting, design, construction and construction supervision of dams and hafirs (Hafirs: 20 000–60 000 m^3 and cost: 30 M SD < 0,2 M USD), and to include abstraction facilities in order to separate human and livestock water usage. This component should be combined with the following interventions:

1. Design, construction and supervision of weirs in wadis to create prolonged surface and subsurface water storage, including abstraction facilities.

2. Capacity building of operators and users of water facilities in order to minimize water spillage and usage.

3. Capacity building of designers, contractors and supervisors in order to improve quality of water facilities

4. Capacity building of institutions , which are responsible for advice to farmers on water utilities

It could also be interesting, to test enhancement of infiltration in shallow aquifers close to rock outcrops in the foothill area, where sandy sediments are abundant and to test of improved subsurface storage and abstraction facilities.

In the field of water management capacity building is required in almost all fields, e.g.

- siting and location
- innovative techniques for collection, storage and extraction of surface and ground water
- design according to the above
- construction
- construction supervision
- operation and maintenance

Thus, support would be required to all levels of administration responsible for water management, federal, state and locality as well as supervision at village level. This support could be accomplished by contract to local Universities and Consultants, versatile in the described technologies.

7.3.2 Erosion monitoring

The foothills of the Ingessana hills is exposed to considerable soil erosion, evident in the formation of ravines, contributing to the sediment transport in khors and wadis and eventually to the sedimentation of the Roseries reservoir.

Erosion is best monitored from the air. It is recommended that erosion monitoring in this particular area is carried out based on either aerial photographs or satellite imagery. Which of the two methods should be chosen depends on cost, quality and availability. These details will be discussed with the Remote Sensing Authority in Khartoum.

Interpretation for both options will need to be supplemented by a limited ground truthing exercise.

7.3.3 Mining

The current gold panning activites and the UNIDO-financed support to the development of the gold panning and mining practices have been visited during the inception and detailed assessment period. The following are observations and finding from discussions with the primary stakeholders and the UNIDO experts and the Consultant's observations.

- Most people involved in gold extraction are local Ingessana, but during the rainy season others come to seek their fortune as gold panners.
- Forests have been cut in the area for charcoal making and reinforcement timber in goldpits
- Water is abundant in the area, and several pits meant for gold extraction have been developed as water wells, suitable for human consumption and panning.
- The UNIDO project has provided technical advice on how to maximize gold output, minimize mercury usage through efficient amalgamation processes and inexpensive retorts.
- The UNIDO experts claim that the main obstacle for a full success of that project is reluctance by the gold panners to invest in improved implements for extraction and refining of gold, thus a micro-credit programme might be tailor-made for the needs of this stakeholder group

Outputs of micro-credit support to the UNIDO project would include as follows
- Improved health conditions for workers and workers' families, since the whole family is usually involved in the gold extraction activities using mercury,
- reduced release of mercury to the environment, due to increased efficiency in the amalgamation by usage of inexpensive retorts and increased gold output.
- Increased social cohesion and conditions within the Ingessana, who are expected to be the primary beneficiaries for the UNIDO project, and a reduced risk of land 'occupation' by others including large scale external companies.
- Reduced soil erosion, due to improved gold extraction practices and less felling of trees, since the retorts need less energy per gram extracted gold, etc.

The detrimental environmental, health, economic and social effects of expanding artisanal river-bed or alluvial gold panning in Ingessana is a key area of concern. The negative effects observed primarily in the Ingessana Hills and downstream, also in the Blue Nile can be to become worse as this is a growing business.

In addition to threats to health and domestic use of water, worsening quality of the river, if not reversed, is likely to have far-reaching consequences for plans to expand commercial agriculture in this area.

Some of the major water-related and environmental problems associated more generally with alluvial gold panning – much of which is informal or illegal and hence uncontrolled – and becoming rapidly significant in the Ingessana Hills, include the following:

- Damage to riverbeds and banks through digging up of river channels, tunnelling operations and surface trenching, causing siltation of rivers and dams which in turn causes deterioration of water quality, choking up of water pumps and irrigation systems, reduction of wetlands and grazing areas for domestic and wild animals, destruction of aquatic habitats, and an overall reduction in biodiversity.

- The direct release of mercury and other poisonous chemicals such as cyanide into the river system affecting both human and animal health.

- The emergence of unplanned mining settlements sited close to water courses, with poor sanitation facilities leading to water pollution from human waste.

- The uncontrolled chopping down of trees close to rivers for use in both mining operations and housing causing deforestation which contributes further to erosion and siltation.

A number of social problems also arise with the rapid and unpredictable growth of gold panning, including land-use conflicts between migrant gold panners and local resident communities, the use of child labour, poor health and sanitation conditions, the migration of men in particular for long periods thus placing mining in competition for labour with food production, with increased risks of the spread of HIV/AIDS.

On the other hand, it is important to recognise that if undertaken in an appropriately controlled and responsible way, alluvial gold panning (as well as other small- and larger-scale mining) can make an important contribution to economic and social development. This has been recognised by the UNIDO and countries. In Zimbabwe, for example, a Statutory Instrument has been created that promotes formalisation, and hence monitoring, of gold planning activities through the Rural District Councils. In Mozambique, in a recent speech, the Minister of Mines said that small scale mining activities should be encouraged, but stressed that this should only be done in the context of creating – and training – miners associations so as to reduce negative environmental impacts.

What is clear is that addressing the problems of gold panning, whilst optimising its positive potentials, needs a comprehensive and well coordinated approach that takes account of the many intersecting issues, be these environmental, technical, institutional, economic, social, political, and so on. It is increasingly accepted that the forced removal of panners is neither an appropriate nor an effective solution. The preferred approach is to establish dialogue with panners, assist them in forming cooperatives or committees, develop and promote appropriate technologies to minimise and mitigate both environmental and health hazards of mining practices, undertake education and awareness activities, and explore and develop alternative livelihood options (through the "honeypot" approach of providing viable and attractive alternatives). In addition, there is a growing need to ensure the revision and/or harmonisation of legislation and to develop clear policy and institutional frameworks and capacities for managing this burgeoning activity. Under more formalised and controlled conditions, links could be made with appropriate micro-financing institutions to support small-scale investments both in improved mining practices and alternative livelihoods.

Fortunately, there are valuable experiences and positive initiatives in Ingessana upon which to draw and expand. Work has begun (under the Global Mercury Project) on identifying and implement win-win solutions whereby gold panning can be made both more efficient and environmental friendly. Several studies have been undertaken and new technologies are being developed under the UNIDO-funded programme, to minimise negative environmental and health effects, and a pilot projects has been initiated in Gugub.

Still there is the absence of a strategic approach, the lack of coordination, and the need for clarification of roles and responsibilities in relation to management of gold panning.

With regard to the mining activities which most probably are there to stay, it is recommended that regulative management tool is combined with informative and economic management tools.
Firstly it is proposed that the project, through the institutional support component, support as far as possible the State Government's legislative regimes that obligate miners to minimise the damage they cause during mining operations and to rehabilitate the site after their operations have finished. These could be introduced through contractual arrangements, which are linked to the informative and economic management tools.

To this end, it is proposed that the miners will be supported to constitute a Miners Management Committee responsible for forestry and rehabilitation of abandoned mining sites and other pilot activities. The Committee and the Government Committee/Working Group (represented by e.g. FNC, Ministry of Mines, State Ministry of Health, and Bau Locality) will then enter into an agreement in which the Committee agrees to take responsibility for ensuring that their mining operations

cause minimum damage to the environment in exchange for which they collect non-timber forest products and receive a share of the revenue from the sale of timber products as well as benefit from improved mining technologies.

Bau Locality, FNC, State Ministry of Health and Federal Ministry of Mines play important roles with respect to controlling and monitoring water quality these aspects. However, a range of other key technical and social development institutions are critical to the effective management and monitoring of gold panning activities.

Representatives from the following institutions will be important partners in the Project Working Group on Gold Panning Management and Mitigation, and in ensuring competent and consistent monitoring of both water quality and other aspects of this project:

Representatives for the ministries of Mineral Resources, Environment, Agriculture, Public Works, Health, Tourism, and social affairs; relevant NGOs, large-scale mining companies, researchers and consultants. In addition, relevant microfinance institutions may be approached to consider financing various activities related to improved gold panning practices (healthier, environmentally sustainable and more efficient), or to viable alternative livelihoods.

7.3.4 Reforestation/Agro forestry

The Forestry Expert has so far visited 12 villages and interviewed 18 officials and experts and 56 local community members in Bau locality during the course of the two missions (February and April). As a result, the Expert strongly believes that adequate knowledge of the area has been acquired to be able to confidently proceed to the next phase of the detailed project planning.

As aforementioned discussed charcoal making also constitutes a critical issue and challenge to the government of Sudan. It is, therefore, imperative that charcoal making must be replaced by more sustainable income activities. Until such time, charcoal making must be by permit only and this should be issued to resident farmers only who must organise themselves into charcoal producer groups. FNC must issue licence to these groups only with a production quota based on annual allowable cut. FNC must also delineate the forest area for each group and the group must enter a Joint Forest Management agreement with FNC. The charcoal producer group must take the responsibility of managing the forest designated to it by protesting against fire and illicit cutting and planting. Non-residents as well as residents without permits who use any part of the Bau locality forest resources to make fast cash income by illegal charcoal making must be barred immediately. This must be enforced throughout the Blue Nile State by FNC in collaboration with the State and Locality law enforcement agencies.

It is recommended that the watershed management fast-track project should contribute to solving some of the problems of charcoal making through: (1) development of alternative income generating activities to replace charcoal making, and (2) introduction of alternative source of energy and energy efficient cooking stoves to reduce the dependency on charcoal on a pilot basis.

From the above description, it is apparent that the three zones are quite distinct from each other in terms of vegetation, soils and livelihood characteristics.

The following forestry and agroforestry interventions are recommended for each zone.

7.3.4.1 Low-lying farmlands

i) It is recommended that contractual agreement is drawn with all mechanised farmers in the selected pilot village to plant trees around individual farm boundaries, homesteads and other farm buildings and along farm access roads and ravines with indigenous tree species to achieve the 10% forest cover required on each mechanised farm. The tree species recommended for such plantation include *Acacia senegal*, *A. seyal*, *A. polyacantha*, *A. mellifera*, *A. nilotica*, *Anogeissus leiocarpus, Balanites aegyptiaca*, *Combretium hartimanimum*, *Hyphane thepaca* and *Tamarindus indica*.

Mechanised farms occupy a significant proportion of low-lying farmlands in Bau locality. In order to achieve the required 10% tree cover on farms in Bau locality, the involvement of large scale mechanised farms is decisive. Further discussion with the large scale farmers will be undertaken during the coming farming season (June and July) to illicit their perceptions and draw up methods and modalities for their involvement in tree planting activities on their farms.

ii) It is recommended that all small scale traditional farmers in the selected pilot village are supported to form a Community Forestry Group. The group will establish a community forest using indigenous tree species of high economic value such as *Acacia senegal* for gum, *Balanites aegyptiaca* for fruit and *Tamarindus indica* for fruit to create a forest resource that they can use as an alternative source of income to charcoal making. The group will also be supported to establish strong direct links to high-value and export markets for non-timber products of indigenous tree species, including gum arabic, *Balanites* fruit and *Tamarindus* fruit to cut down the current long market chain and enhance their incomes.

7.3.4.2 Foothills of Ingessana Hills

It is recommended that the forest reserve in the foothills and adjacent Hills in the selected pilot village is managed by the village community through Joint Forest Management with FNC. The village will be supported to constitute a Village Forest Management Committee. The Committee and the FNC with then enter into an agreement in which the Committee agrees to take responsibility for safeguarding the forest through protection from fire, grazing, and illegal harvesting in exchange for

which they collect non-timber forest products and receive a share of the revenue from the sale of timber products. The Committee will also be responsible for enclosing and carying out enrichment planting in the degraded patches within the forest using indigenous tree species of high economic value such as *Adansonia digitata*, *Tamarindus indica*, and *Boswellia paperyfera* to restore and make the forest more productive so that it can support the livelihood of the village community. The village community members will be given training in modern method of tapping so that *Boswellia* incense production becomes a major source of income. The Committee will also be supported to establish a strong direct links to high-value and export markets for non-timber tree products of indigenous tree species such *Adansonia* fruit, *Tamarindus* fruit, and *Boswellia* incense to cut down the current long market chain in order to enhance their incomes and reduce their dependency on charcoal making.

7.3.4.3 Ingessana Hills

It is recommended that the forest reserve in the selected pilot village of miners is managed by the miners through Joint Forest Management with FNC. The miners will be supported to constitute a Miners Forest (and rehabilitation) Management Committee. The Committee and the FNC will then enter into an agreement in which the Committee agrees to take responsibility for ensuring that their mining operations cause minimum damage to the forest and safeguarding the forest through protection from fire, grazing, and illegal harvesting in exchange for which they collect non-timber forest products and receive a share of the revenue from the sale of timber products. The Committee will also be responsible for rehabilitating abandoned mining sites as well as any degraded patches within the forest by planting indigenous tree species of high economic value such as *Adansonia*, *Tamarindus*, and *Boswellia* so that the forest becomes an additional source of income to them. The Committee will also be supported to establish strong direct links to high-value and export markets for non-timber tree products of indigenous tree species, including *Adansonia* fruit, *Tamarindus* fruit, and *Boswellia* incense to cut down the current long market chain and enhance their incomes.

7.3.4.4 General recommendation for all zones

It is recommended that alternative energy sources for cooking such as LPG and improved energy saving cooking stoves which could decrease the pressure on woody biomass and forest reserves are introduced in all the three pilot villages in the three zones.

7.3.5 Crop diversification and intensification

Apart from area at the foothills of Ingessana Hills, the soils of Baw Locality are predominantly heavy cracking black clays (Vertisols). Although they show considerable variation in different environmental conditions generally, vertisols have high plasticity and stickiness. Owing to considerable contraction on drying, large and deep cracks are formed during dry season. Thus cracking on drying and water logging when wet are the major characteristics of black clay soils along with low

nitrogen, phosphorus and organic matter. They however, contain abundant iron and fairly high quantities of lime, magnesia and alumina.

The Ingessana foot-hill soils on the other hand, are much lighter, well drained and inherently fertile but they are exposed to serious water erosion. The slopes of the hills are completely deforested and overgrazed and cannot retain any rainfall on the slopes. The runoff released from the slopes reaches the degraded fields at the base and erodes the remaining soils. The process perpetuates unhindered and the farmers continue to cultivate these soils in spite of their shallowness and declining fertility. In the larger flat plains of Baw Locality, some degree of sheet wash occurs but there is no clearly developed surface drainage system which suggests significant soil movement outside the area.

The land within the Hills (the horse shoe) and the foot-hills are occupied by small scale farmers while the area further outside Ingessana Hills largely is under large to medium semi-mechanized farms. Both the traditional farms and most of the mechanized farms report declining soil fertility and portions these farms go out of production every year.

Traditionally, small scale farmers combined crop cultivation and livestock rearing with minimum negative pressure on the natural environment. Over time however, population growth and expansion of semi-mechanized farms have disrupted this traditional shifting cultivation resulting in shortening or lack of fallow periods and thereby decline in crop yields. The farmers reported that this constant expansion of semi-mechanized farms has put too much pressure on the land through removal of vegetation normally used as grazing resources.

In the Baw Locality sorghum occupies most of the traditional and mechanized farms indicating a predominantly monoculture cropping system. Minor crops like sesame, sunflower, beans, maize etc. are of much lesser importance in terms of area coverage and play insignificant role in crop rotation.

Farm activities are generally performed by family labour. Land preparation is carried out by hoe and weeding is also done using traditional implements. Occasionally, a families may organize " Nifir" for land preparation provided the family can afford to provide food and drink to the participating individuals. When this is the case, larger area can be cultivated. Weeding and other farm activities are performed only by family members.

The average yield from "virgin" land is reported to be between 7 and 10 bags/feddan whereas production from "old" land can be as low as 2 to 4 bags/feddan. According the farmers, fertility decline is measured by the prevalence of weeds relative to the crops.

Farmers classify their farmlands as being "virgin" or "old"- relating to fertility or productivity of the soil. Poor or "old" land is identified by the prevalence of weeds. The heavier the weeds the poorer/older the land. When weeds start to overtake the fields, the farmers abandon the area for about 4 to 5 years, during which time fertility is

regained. In replacement, farmers open up new areas or land which was left fallow during previous years.

Medium and large scale farmers, who are from outside the villages and engaged in other activities can be considered as hobby or part-time farmers. Like the nomads who move into the fields after the crops are harvested, these farmers move in at the onset of the rains, plant their fields, harvest the crops and leave the area. They are not engaged in any land improvement efforts at any time.

At the onset of the rains, the farmers prepare their fields and plant the crop year after year. Once the crop is harvested, the livestock from the villages as well as the nomadic herds take over the fields removing all crop residues. Normally, soil organic matter existing on the soil surface as raw plant residues helps protect the soil from the effect of rainfall, wind and sun as well as providing essential plant nutrients. Therefore, accumulated organic matter is considered a storehouse of plant nutrients. Removal or burning of these residues, as is the case in Ingessana area, exposes the soil to negative climatic impacts, and deprives the soil organisms of their primary energy source.

In order to address yield improvement for the traditional and semi-mechanized farms, it will be necessary to look into the limitations of the production medium, i.e. the soils. In black clay soils (vertisols), the major constraints to production can be ranked follows: soil water management, tillage, cropping systems, and nutrient management.

Generally speaking, black clay soils (vertisols) are fertile. Their inherent limitations are largely a function of the moisture status of the soil and the narrow range of moisture conditions within which mechanical operations can be conducted. Therefore management of soil water is both the most difficult and the most important aspect of Vertisol management, particularly in the semi-arid areas.

Normally, soil water management for agricultural crops deals with optimization of water infiltration into the soil and then its retention in that portion of the soil where it subsequently can be extracted by crop roots. Effective infiltration depends on conditions being favourable for adequate water flow into the soil horizon. Water transport characteristics of a soil strongly influence water infiltration, evaporation and deep percolation rates.

The dark black clay soils of Ingessana area however, lack most of these merits, the major problem being decline in biological and physical attributes of the soil. This is manifested in the total absence of soil structure, absence of voids in the soil associated with loss of structure leading to resistance to root growth, reduced retention of soil moisture in plant available form and reduced infiltration capacity and permeability, all of which lead to reduction in yields. According to the communities in Ingessana area, the key agricultural problem related to soil degradation is declining soil fertility. They attribute this yield reduction to the soil getting “old”.

As observed in the field, the soils manifest abundant wide and deep cracks in the dry season. At the onset of the rains, large quantities of water enter the cracks before the

soils swell and the cracks close up and the soil profile may be well charged to the depth of cracking. Once the cracks are closed the soils become impermeable and infiltration falls to very low rates. The water may simply form puddles on the soil surface, much of it to be lost by evaporation or drains out of the field depending upon the prevailing slope of the land.

In as much as it is important getting adequate water into the soil for use by the crops, there is also the need to provide adequate surface drainage to avoid plant water-logging once the cracks have closed and infiltration rates become very slow. A traditional and relatively easy method which has been successfully applied in many countries in Africa is the cambered bed, built by ploughing up and down so that the soil is turned inwards to the centre. Other simple micro-relief patterns designed to improve surface drainage such as beds and mounds made with hoes and other implements, and a range of ridges, narrow beds and broadbeds, often made by animal-drawn implements, and all separated by a furrow whose essential role is to provide surface drainage and dispose of it safely. ILCA has developed a low-cost, oxen drawn broadbed and furrow maker which has been adopted by over quarter of a million small scale farmers in Ethiopia. The yield increase has been very significant.

As indicated earlier, vertisols are low in nitrogen, phosphorus and organic matter. However, under rainfed production in semi-arid areas, nutrients appear to be less important than soil water management. Studies have shown that yields are more often raised by improved surface drainage or increased available water than by the use of fertilisers.

Cropping systems are also a major aspect of Vertisol management, and different strategies have to be adopted according to the amount and distribution of the rain. For example, intercropping and relay cropping may increase yields several-fold, depending a good understanding of the soil moisture regime and a better use of available moisture.

7.3.5.1 Possible Interventions

1. The soil water management technologies discussed above are known in the Sudan and can make significant production increase if adopted by the farmers in Baw Locality. Putting the physical structures on the ground does not put any financial constraints on the farmers and can be done with family labour. Furthermore, the whole field does not have to be treated in a single year but could be built progressively few lines at a time. Another advantage is that once put in place, the structures remain in place and require only some maintenance as required. The detailed design can be worked out depending upon the amount of rainfall, slope of the land and other details. The most important consideration is to convince the farmers on the benefits of the intervention. It is therefore suggested that demonstration sites be established at each village during the first phase of the project. Once the physical structures are put in place other

agronomic conservation measures like strip cropping, mixed intercropping, crop rotation etc can be introduced[5].

2. The soils of the Ingessana foot-hills are seriously degraded and require immediate intervention. However, the slopes of the mountains which are yield most of the water remain bare and degraded. Therefore, these slopes require prior intervention before any meaningful conservation measures can be put in the farms in the foot-hills.

3. Ingessana farmers keep significant number livestock, particularly cows and oxen primarily for social values. At the same time, the heavy task of farming is carried out by members of the family with hoes, which is not very effective. The size of field planted depends upon the labour available in the family. It is therefore, proposed that the project consider introducing the use of oxen for ploughing. Prototype equipments and accessories can be initially introduced. Farmers can plough more land and manage the land better.

7.3.6 Grazing regulations and regulation of pastoralist/animal routes

Livestock rearing is the mainstay of many farming communities and employs a sizable workforce. It is also a source of social security for the masses in the Locality. Poor genetic makeup, limited feed and water resources and lack of effective animal health cover are the main constraints for livestock development. Livestock is reared in extensive nomadic grazing, thriving on the rangelands.

A considerable amount of land is under bush and grass. Such areas are available for grazing; still competition is there between animal and crops. As lands close to villages are exhausted, new and more distant areas are opened for cropping and grazing. Long-standing civil war, adverse weather, low inputs, and weak agricultural prices kept much of the population remain at or below the poverty line for years. The latest estimation indicates 50% (2004 est.) of the population are below the poverty line.

Ingessana tribe is not a nomadic tribe. They graze their cattle within their settlements where they also practice some crop production growing mostly sorghum, sesame, peanuts, and some vegetables. Their herds are of low quality, poor beef and milk.

The natural habitat of Bau locality is mainly composed of tall grass plus Acacia woodland. Perennial plants are almost absent due to, perhaps, overgrazing, deforestation, range fires and frequent droughts. The locality is distinguished as being the zone of both animal and rain-fed husbandry. However, the carrying capacity of the

[5] Under the prevailing production system where the same fields have dual owners and dual objectives, i.e. animal grazing and crop production, and each trying to maximize the benefit, it would be difficult to undertake any meaningful intervention on a large scale. However, there must be possibility to show the farming community how much could be realized.

land is in decline because of the above mentioned reasons. During the period 1984 and 2003, areas of forests and rangelands have been reduced to one-third of their areas in 1984 in Bau Locality to give way to croplands, weather commercial or subsistence (Mohammed khair, 2003). Croplands now surround the Ingessana Hills, about one million feddans (one-fifth traditional subsistence farms and the rest mechanized agriculture). West of the Ingessana Hills is mostly rain-fed agriculture, north of them is mostly animal husbandry and few cropping areas, east of the Hills is mostly horticultural crops because of the availability of alluvial soils and khors waters, and south of the Hills is mostly land of tall grass and some woodland. The remaining tree cover is mostly on the Ingessana Hills and foothills and on few stretches west of Bau locality. When rangelands are degraded, livestock mostly graze on crops residues. About 1.5 million heads of cattle, 3 million sheep and 266 thousand heads of goats from the Blue Nile State graze in Bau Locality at one time of the year. In addition, many nomads with their cattle from the White Nile and Sennar States cross Bau Locality in their seasonal migration between the too dry winters in the north and the too muddy and biting flies in summer in the south. Four migration routes cross-cut Bau Locality, three routes are west of Ingessana Hills and one east of it. Cattle on these migration routes may encroach on croplands causing conflicts between herders and farmers.

According to the chairman of the Pastoralists and Nomads Union in Blue Nile State, these migration routes have existed for a long time and the users have a legal right to them. Previously, they had a width of 1 km but during the war people started cultivation on the routes and when they nomads came back they found the land occupied. The routes now are only about 50 m wide. So in reality, the nomads do not encroach the fields but farmers, primarily large scale farmers, encroach the migration routes.

In 2006, the Director of Pastures and Fodders prepared a draft law for the Protection and development of Pastures and Fodder Resources in the Blue Nile State. This draft law has been submitted to the State Minister for Agriculture, Animal Wealth and Irrigation for his appropriate action. No action was taken till February 2007. Perennial plants are disappearing and leguminous plants are less than 5% of the plant community, thus decreasing the quality of the rangelands (Abu Sas, 2007).

7.3.6.1Efforts to Improve Rangelands and Resettle Nomads[6]

1) In 1955 Harrison saw that only nomads can use much of the range area. This still remains true, and his recommendations for improving nomadism remain valid. Among his recommendations was the development of dense pattern of shallow wells that would be cheap, would open unused areas, and would yield small enough quantities of water that large herds would not be drawn to them (Harrison, 1955).
2) Development of fire lines, mechanically or chemically blazed.
3) Rotational grazing would be successfully managed if the range was allocated and registered to tribal owners. Until the individuals and groups knew that the benefits of new or improved ranges would be theirs, all efforts to develop rotational grazing would fail.
4) In 1958, FAO introduced fencing of 250,000 acres as the first trial for range improvement in the Sudan. Without community support, the fences were soon and permanently breached.
5) In 1968, FAO tried a nomad-settlement ranch which was not again successful. The families to whom grazing rights were assigned overstocked the paddocks tenfold, and the livestock of envious neighboring tribes were finally admitted.
6) The USAID had two failure undertakings. One was the Abyei Project in southern Kordofan where the beneficiaries wanted only mechanized cultivation and would not accept the alternatives offered, principally animal traction or pesticides and no-till cultivation. The other project was the Blue Nile Integrated Rural Development Project in south of Damazin. The project provided extension and credit to 2,500 farmers, of whom 1,000 also received tractor services. In 1983 and after spending millions of US$, the project faced acute repayment problems, and that the range-management division, charged with organizing and modernizing pastoral activity, had done little except to conduct a vaccination programme. *We were told that, ironically, this project was later on sponsored by Sheikh Osama Bin Laden and was doing well until the Sheikh was expelled from the Sudan. The remnants of the project were still there, we were told.*
7) In managing rangelands, little attention was given to land-use planning.
8) Responding to the need for water without effective land use planning, will contribute to the continued degradation of the surrounding land.
9) On the other hand, it can be said that there is no point in recommending land-use planning in an environment without secure land titles, nor any point in exploring new crop rotations and range management systems when those methods can not be applied in the absence of secure land tenure.
10) The Sudan government attempted three types of settlements of nomads. These were: planned settlement on irrigated agriculture, settlement as spontaneous development of irrigated schemes, and settlement on rain lands.

[6] The points below are from: i) Bret Wallach (1989). Improving Traditional Grassland Agriculture in Sudan, *Geographical Review*, 79:2, 143-160.ii)El Sammani, Mohamed Osman, and Ali Abdel Aziz Salih (2006). Nomads' Settlement in Sudan *experiences, lessons and future prospects*, United Nations Development Programme, Khartoum. Iii)Elnour Elsiddig (2001). Community Based Natural Resources Management in Sudan, Faculty of Forestry, University of Khartoum, Sudan. Iii) Harrison, M. N. (1955). Report on a Grazing Survey of the Sudan, with Recommendations for Development and Improvement.

11) As an example of the planned settlement on irrigated agriculture are the 20,000 families of cattle, sheep and camel nomads from the Butana and River Atbara area who were settled in the New Halfa Agricultural Scheme irrigated by Khashm El Girba dam. They were given tenancy in the Scheme, and also allowed to have a small number of animals inside the Scheme and large numbers outside the Scheme. But nomads were more interested in their animals than in their tenancies. With the continued decline in their crop revenues due to shortage of irrigation water (by 1977 half of Khashm El Girba Dam storage capacity was lost), nomads began to rebuild their livestock as security against drought risks. In general, they were unhappy because the Scheme management wanted cotton not cattle. Other nomads, mainly Beja were settled in Suki Scheme in 1972, Beja were also settled in Rahad Scheme in 1980s. Some of those who were settled in Suki fled the Scheme because of bad land preparation and the attack by malaria.
12) In general, planned settlement in irrigated schemes were considered relatively successful.
13) Examples of settlement as spontaneous development of irrigated schemes are the case of the famous Gezira Scheme, and Tokar and Gash Deltas Schemes. The well doing tenants were those who stuck to their land and attached to their animals, leading to the revival of the previously advocated concept of integration of animal in the crop rotation. Nomadism ceased to exist in the Gezira. Their livestock continued to exist with changes in herd composition and management. The two Deltas were not meant for the settlement of nomads, but for the production of cash crops by flush irrigation. The nomads would stay on the fringes of the schemes growing their dura, provided that they keep their animals off the tenancies during the time of crop existence in the field. This type of settlement were also considered relatively successful.
14) Examples of settlement on rain land are many. Concern about the settlement of the Beja was growing, being faced by frequent droughts and severe land degradation and the risk of famine in the Red Sea area. Other nomads' settlement projects in rain lands were implemented by the Department of Rural Development of the Government of Sudan and the United Nations agencies in western Sudan in Kordofan and Darfur. Some of the shortcomings of these resettlements were changing the habitat from dry to wet environment without assistance for adaptation to new conditions. Some failures were attributed to poor planning for application of a pastoral solution, inadequate follow-up and lack of supervision.
15) The lessons learned from these cases are:
    a) Top-down planning, designing, and implementation;
    b) Nomads were not considered partners in the development of the livestock economy, while the animal was considered as a commodity. The whole issue was not considered within a socio-economic and environmental related system.
    c) Different tribes had different nomadic traditions, which required special treatment and management.
    d) Lack of provision of the right type of services that suit nomadic conditions.

7.3.6.2 Potential Project Component

The Pastoralists and Nomads Union in Blue Nile State has submitted a plan for rehabilitation and improvement of the migration routes to State Minister of Agriculture, Animal Wealth and Irrigation and was introduced to us by the Director of Agriculture of Bau Locality. The plan proposes to increase the width of the routes to 2 km, to plant trees along the routes, to construct haffirs, water points and dams along the routes to avoid congestion in a few areas, and to build campsites. The plan also includes an element of cost sharing by the users and the Union has already gained experience with this in other areas. It is suggested, that the Watershed Project assists in reviewing and improving the plan and to support implementation of parts of it, e.g. a specific route that passes villages where other Watershed Project interventions are proposed.

As mentioned under the Atbara section, in the long term increased levels of literacy and basic education would greatly facilitate change of behaviour and preferences. Therefore it is important to improve access and quality of education facilities (semi-nomads) and mobile schools (nomads).

7.3.6.3 Livestock market

The livestock sector in Blue Nile is large and socially and economically important. Livestock is important for millions of rural sedentary and nomadic households in North Sudan: They provide meat and milk. They represent a main source of cash income for producers in traditional rainfed areas where crops typically yield little above subsistence needs. Levels of rural poverty in these areas are in the range of 65 to 90 percent.

Off take rate estimates are around 5 million cattle, 10 million sheep and 12 million goats. Though the domestic market is the main outlet, livestock accounts for a substantial proportion of exports from North Sudan[7]. Sheep constitute 80 percent of livestock export; up to 1.5 million head of sheep are exported annually, principally to Saudi Arabia. Increasing oil revenues have resulted in further appreciation of the Sudanese Pound making livestock exports less competitive. At the same time, incomes in the urban areas are increasing rapidly, resulting in greater domestic demand for livestock.

[7] Livestock is the main agricultural commodity exported from Sudan, before cotton, sesame and gum arabic. For the period 1995-2004, total agricultural exports from Sudan ranged from US$271m (1995) to US$457m (2004). For the same period, livestock exports accounted for between US$20m) and US$182m, with livestock as a percentage of total exports ranging from 1.25 to 28.5%.

In market places, there is limited price differentiation for stock of different ages or quality; sales are all by confidential private treaty (also known as “secret auctions”) conducted by middlemen. Due to distances from markets and general distrust, producers do not sell their animals directly at markets but instead to small traders who come to their village or resting area. Second, a major cost is transport which also reduces profits. However in recent times the price differentials between markets have reduced due to improved road conditions. Third, despite the central government’s measures to eliminate internal taxation, the states and localities continue to levy some taxes and fees as they depend on these revenues. However little of these taxes are invested by the states on the livestock sector due to competing demands and the amount of revenue actually generated by states and localities.

Ingessana is among the poorest regions in Sudan, where tensions and conflicts over land are recurrent. The social structure is very heterogeneous, and the customary institutions weakened by decades of civil wars. Allocation of land for semi-mechanized farming is believed to be the main origin of the conflicts resulting in blocking traditional seasonal migration routes. These states are crossed by cattle from Southern Sudan en route to terminal livestock markets in Khartoum State.

8 Micro-finance Component

8.1 Lessons Learned from project areas

A rapid appraisal was carried to draw lessons from the experience of past project interventions in order to, inter-alia, improve the preparation of this project. Many disadvantaged rural women and other poor still have no or very little access to credit due to their inability to provide co-operative guarantees or personal guarantors acceptable to banks. Increased credit access remains a key to a poverty alleviation strategy in the rural areas. Mobilisation of rural savings has not been so far an important aspect of the ongoing portfolio. Group collateral as a substitute for personal guarantees has not been tried out in former projects. The lesson is that a more pro-poor rural financial services policy is needed to ensure that hurdles are removed and that these services reach the poorest.

Lessons learned in implementing projects with rural finance component indicate that, access to services compatible with requirements of the poor is important, a diverse range of institutions is required to enhance outreach: institutional viability is important to provide permanent access: institutional strengthening needs are significant and social intermediation support for the poor is important to enable them to benefit from access to microfinance services.

8.1.1 Successful practices

Successful practices emphasize that financial intermediaries should (a) appropriately price products and services; (b) adopt innovative structures and practices that encourage proximity to communities and enable handling of large customers; (c) implement inexpensive administrative and operating procedures; and (d) incentives to staff to encourage good performance. Institutional autonomy, good governance, and professional management are prerequisites. Outreach to the poor is greater with effective targeting, greater commitment to attain a viable scale of operation, and appropriate pricing policies.

8.1.2 Providing Access to Women

Substantial efforts are required for delivering financial services along with technical training for enterprise development to women, thus enhancing their social and economic status.

8.1.3 Role of Government

The government's interventions to strengthen the rural finance sector, should complement the market and decrease over time, while private participation in the provision of financial services should increase once the basic policy framework and key institutions are in place. International experience shows that to develop the rural finance sector, priority should be given to viability of operations. Start-up initiatives require investment support as access to money markets will only materialize over the medium to long-term. Targeting the poor requires complementary services such as infrastructure, skills development, which can be offered in a participatory manner and coordinated with the delivery of financial services.

8.1.4 Lead institution

A Lead institution is needed to play the role of anchor and catalyst to generate momentum for growth, and encourage investments and institutional diversity.

8.2 Rural Finance in the Project Areas

The rural financial sector in the project areas is characterized by few formal financial institutions and informal system as no NGO in the project is engaged in the provision of financial services to the rural poor. Thus, most poor households in the project areas have no access to either formal or semi formal institutions. The rural finance market is essentially served by informal arrangements by landlords, input suppliers, agricultural traders and moneylenders.

Informal sources currently provide for most of the financial needs of the poor usually, rich farmers extend loans to poorer landowners and tenants in exchange for part of their output. At times, moneylenders, shopkeepers, traders, middlemen also provide credit. The effective annual rates of interest in the informal sector are much higher than formal sources of finance. It is therefore preferable that the poor have access to

credit from formal or semi-formal sectors at affordable rates. This will allow the rural poor to retain a greater share of profits from their efforts.

Bank financing to the micro enterprise sector in the project area has been taking place on a very limited scale with experiences to date being largely negative. By and large bank's lengthy administrative procedures, standard loan amounts and terms as well as collateral requirements remain a major bottleneck to access. Currently, banks simply see lending to micro enterprises as inherently too risky with misperceptions of the market reinforced by badly performing government lending schemes. As a result, the existing collateral requirements continue to be a major barrier for poor and low income persons.

The formal financial sector in the project areas is dominated by ABS. It is the single largest provider of agricultural credit in the project areas. It provides credit to farmers with land titles as collateral or personal guarantees as a collateral substitute. It does not have effective financial products for women and the landless. It is characterized by low lending rates, poor recoveries, is not sustainable and in many cases the credit does not reach the poor farmer, landless and women.

ABS has the mandate of supporting agricultural development and is the main source of institutional credit for the sector. Operating procedures, loan terms and conditions and collateral requirements of ABS are yet incompatible with the requirements of banking with the poor.

Although ABS has a relatively wide network in the project areas, the operating procedures are incompatible with the requirements of the small/marginal farmers. The existing rural financial system is practically inaccessible to many disadvantaged rural women, the landless and other poor due to their inability to provide cooperative guarantees or personal guarantors acceptable to ABS.

Field trips confirmed that perceptions, common to the inhabitants of rural Sudan, are applicable to the targeted area. They may be summarized as follows:

(a) Most farmers regard obtaining a loan form the ABS to be highly complicated (administrative procedures) and frequently inaccessible (collateral requirement);

(b) Agricultural cooperatives are regarded as an institutional extension of the ABS and, hence, are regarded in the same manner;

(c) Informal financing mechanisms (al-bay' bil-ajal, shark-lending) are viewed as abusive and are resorted to only because of the lack of other alternatives; and

(d) The vast majority believe that a serious gap in the realm of financing exists which is significantly responsible for the economic stagnation prevalent in rural areas.

8.2.1 Constraints

Affordable microfinance services are not available to the majority of the poor: thus they are unable to participate in the local economy. Therefore, in the absence of complementary or alternative arrangements, the microfinance market will remain grossly underserved, and its poverty reduction potential largely unrealized. In order to realize the poverty reduction potential of Microfinance, the following constraints and issues needs to be addressed.

8.2.1.1 Social

Inadequate access of the poor to services

Inadequate access to productive resources and social services has resulted in low indicators of well being and lack of employment opportunities. This situation is compounded in rural areas where access is even more difficult due to inadequate or complete lack of basic infrastructure. Low skill level and absence of support for human resource development for the poor prevents them from diversifying their household income. Government interventions have not yielded the desired impact due to inadequate emphasis on community based participatory approaches.

Outreach to women

The gender orientation of formal sector institutions including ABS and their products and delivery mechanisms are insufficient to enhance outreach to women.

Absence of risk mitigation measures

The disadvantages of the poor households include lack of access to financial services, unfair terms of participation in the local economy, and vulnerability to economic and physical downturns. Poor households forego potentially viable technologies, production choices, and income opportunities due to risk aversion. Mechanisms to mitigate such risks are not available. In addition, the poor have no means to secure the safety of their savings.

8.2.1.2 Financial and Other Constraints of Micro and Small Enterprises

Microentrepreneurs, as low income households and start up entrepreneurs, are unable to meet the collateral requirements of financial institutions which include for e.g., fixed assets, guarantors, government salary. It is not uncommon for banks to require collateral up to three times of the value of the loan amount and alternative collateral such as the purchases of investments made with the loan itself are not accepted. As a result financial penetration rates remain low and cash based transactions continue to dominate the market. In general, banks are unaccustomed to working with poor clients, and as such are unfamiliar with the nature and cycle of their businesses, which they see as inherently more risky and costly than traditional individual lending.

Geographic distance from bank branches, excessive paperwork and administrative requirements, compounded by the arbitrary application of lending procedures and outright nepotism and corruption prevalent among government bank employees work to create significant costs that poorer borrowers are unable to bear.

Conventional banking products often do not meet the financing needs of most microenterprises, with loan sizes and repayment terms that do not match the business cycles of their enterprise. The micro enterprises are generally considered as non bankable. The banks are increasingly cautious in granting credits and are conservatively collateral oriented. Their loan portfolio comprises mainly short-term trade facilities or longer term loan to larger enterprises.

The micro enterprises service small and contained markets due to their rather primitive institutional capacity, they lack sufficient information on market developments, changing consumption patterns and new products in order to ensure a demand driven production. Their limited sales outreach additionally hinders them from expanding their outreach to diversify their market channels.

8.3 Microfinance-Specific Policy Framework

A conducive policy environment is required to encourage innovations and to allow a diverse set of institutions to provide a range of services, particularly savings, in a supervised and regulated environment. The required policy attributes include: (a) promotion of institutions that can target the poor with adequate gender emphasis; (b) acceptance of individuals as well as groups of individuals for Microfinance transactions; (c) mechanisms to ensure that social intermediation precedes and accompanies microfinance services; (d) significant investments in social intermediation; (e) pro-poor financial innovations such as measures to mitigate risks faced by the poor; (f) autonomy in pricing and client selection; and (g) measures to integrate microfinance in the financial system.

8.3.1 Institutional Limitations

The Banks perceive microfinance as high risk and consequently avoid entry into microfinance. The organizational structure and institutional orientation of Banks as a collateral based lending institution is not consistent with the participatory community based micro lending for farm and off farm activities. At present, the rural finance market is essentially served by informal mechanisms. Banks operating in the rural areas have a very limited range of products and lack of capacity to diversify their products.

8.4 Proposed Project Rationale and Components

Currently served by informal arrangements, the rural finance sector in the project areas is unable to expand. Rural finance services are provided on a very limited scale. Other than informal arrangements, institutions to bridge demand and supply gap for microfinance services do not exist. The aggregate outreach from institutional sources is almost negligible. The existing rural financial system is practically

inaccessible to the small farmers, the landless and women, because of collateral requirement and burdensome procedures and costs. However, there is significant scope for rural finance, given the extent of the demand by small farmers, the landless and women in the three project areas.

Overall the institutions in the project area have not been successful in reaching the rural poor. While the ABS performs an important function from the stand point of rural financing, a significant segment of the target population has no access to financial services. Indeed, the provision of such services is directly linked to the project's aim of addressing, and thus contributing to the reduction of rural poverty. Landless farmers and women constitute a particularly vulnerable segment of the population whose economic empowerment is significantly stifled by their lack of access to financing mechanisms which are consistent with their specific needs and available resources ABS is a state-owned institution, the operating procedures and policies of which are in accordance with government practices. Other formal institutions in the project areas are characterized by low lending rates and poor recoveries and are not sustainable. ABS is extending financing to micro and small enterprises in the project areas. However, its loan products, operating procedures and collateral requirements need to be modified to meet the needs of the target group.

8.4.1 Approach

The development goal is to reduce poverty and improve livelihoods of rural households. To achieve this goal, the overall objective of the rural financial services is to enable active rural poor to increasingly access a wider range of sustainable financial services and products that respond to their needs.

Rural financial services is build on seven basic principles:

(e) Concentration on microfinance and micro and small enterprise development;

(f) Deepening and expansion of viable financial services in the project area;

(g) Demand responsive to the priorities of the communities;

(h) Promoting synergies between rural finance/market development and enterprises;

(i) Expanding and strengthening the role of ABS through capacity building. Building ABS's capacity to enhance performance and outreach of a diverse range of rural financial services;

(j) Establishing mechanisms that would promote successful experiences and best practices in rural finance; and

(k) Building inclusive financial systems whereby the financial services needed by the poor, and the institutions that provide and support them are integrated into the formal financial sector.

8.4.2 Project Interventions

The Project's objective is to contribute to reduction of poverty and unemployment and to improve livelihoods of the target population in the project areas. Improvements in the socio economic status of the poor, especially women, will be achieved by increasing investment incomes, and employment. For this support will be provided to expand outreach and strengthen institutions.

Rural Financial Services aims at providing sustainable access to financial services for project target population (poorest households, women, unemployed youth) to enable them to start/develop an income generating activity that will improve their social and economic well-being thus lifting them out of poverty. In that respect, the project seeks to (a) provide support for ABS institutional and financial strengthening; and (b) develop microfinance in rural areas by utilizing the network of Local Development Committees formed under the project as facilitators to expand the outreach of ABS.

8.4.3 Support to Agricultural Bank of Sudan (ABS)

The provision of support to ABS is threefold and aims at increasing profitability, efficiency and sustainability :

(l) **Institutional strengthening** through (i) implementation of best practices at the three project areas branches including savings and deposits mobilization, loan appraisal, collection and recovery improvements, outreach and diversification of activities eligible for financing and staff incentive scheme; (ii) implementation of best practices at national level including conversion of branches into profit centers and MIS upgrading;

(m) **Capacity building** through provision of technical assistance and training to ABS project areas branches and Head Office staff to assist ABS in implementation of the above-mentioned best practices.

(n) **Financial strengthening** through a credit line to the three project areas branches to be used for on-lending to target population and testing new delivery mechanisms, new types of clientele such as members of Local Development Committees and the financing of rural development activities.

A credit line would be extended to the ABS for its branches in the three areas to be used for on-lending to target population and testing new delivery mechanisms. The credit line would finance the requirements of borrowers through two windows, namely, micro credit loans and small and medium enterprises sector loans. The micro credit loans would be utilized for farm and off-farm income generating activities to support

the investment requirements of borrowers. Typical activities financed would include farm crops, goat rearing, milch cattle, poultry, cottage enterprises, small trading, rural transport, and mobile phones. The loans would be utilized for income generating activities and micro enterprise development. Borrowers would be the project's target group. These borrowers are expected to cross the poverty threshold with successive cycles of micro credit.

The small enterprise loans would create jobs through the support of the small enterprise sector in the project areas. This window would finance the requirements of private entrepreneurs in the project areas. Typical activities financed would include agro processing and related enterprises.

The ABS will use the network of Local Development Committees (LDCs) as an outreach mechanism to reach communities. In addition, the project will assist in the creation of Business Development Centers in the project areas that will assist target population in starting/developing their income generating activities or their micro-enterprises.

8.4.4 Activities Proposed

In order to institutionally and financially strengthen ABS and to provide an easy and sustainable access to universal banking products and services for the rural poor, the project will finance the following activities:

Technical assistance, training and institutional strengthening required for the implementation of best practices and draft of new procedures and policies. Costs would include: (a) recruitment of international experts (b) recruitment of local university graduates to assist international consultants (c) recruitment of local training institutions to train Saving Bank; focal point at ABS Head Office responsible for the supervision and follow-up to facilitate implementation of new delivery mechanisms and savings and deposits mobilization policy; and (d) purchase of sets of computer equipments (one for each branch and one allocated to the focal point at Head Office).

Credit line. The credit line will be used by ABS branches to finance on farm and off-farm activities so as to effectively and efficiently reach the most vulnerable segment of the target population (rural poor, women, young unemployed, micro-entrepreneurs with no collateral) and promote rural development.

Besides institutional and financial strengthening of ABS, alternative ways of reaching the project target population and meeting their needs and requirements in terms of financial services will be explored by the project. ABS would utilize the network of LDCs established under the project as facilitators to reach the target population and promote rural development.

To create a favourable environment for the development of income generating activities in the project areas, the project will also promote the **creation and implementation of three Business Development Centers** in the project areas for their projects. The project would finance training in business and project evaluation, marketing and market studies, accounting, business management, legal environment.

8.4.5 Financial and Institutional Strengthening of ABS

Best practices to be implemented at ABS. Capacity building of ABS for providing universal banking products and services to the target group that meet their demand and needs. This wider range of products and services provided by a more efficient and sustainable ABS would enable a larger segment of the population to have access to financial resources to start and develop their income generating activities thus improving their livelihoods (especially poor households, women and unemployed youth).

Best practices will be implemented at level of the ABS branches that are located in the project areas. Best practices to be introduced at local level would include:

(o) **Review of credit operations**. The objective is to fine-tune the current products offered by ABS with the demand and need of its target population (especially with regards to maturity and collateral requirements);

(p) **Portfolio management, collection and recovery policy**. The objective is to promote adequate loan appraisal and follow up of loan beneficiaries and to drastically reduce the level of portfolio at risk and of bad debts in the three branches and to maintain a sustainable on-time repayment rate thus increasing their profitability;

(q) **Increase in branches outreach**. The objective is to diversify loan products offered by ABS either by widening the range of activities eligible to a loan or by using the network of LDCs that can be used as facilitators to serve more efficiently and at lower cost, the rural poor households in remote areas or by introducing innovative delivery mechanisms;

(r) **Staff motivation through incentive scheme**. The objective is to promote responsibility and accountability of staff members with a view to increase their efficiency, thus reducing transaction costs and maintaining the current level of operating expenses; and

(s) **Savings and deposits mobilization policy**. The objective is to increase at low cost the financial resources of ABS branches, to use part of these resources for on-lending purposes to project target population and to offer a wider range of banking products and services to rural population meeting their needs and requirements.

The implementation of these best practices at the level of the branches will be carried out gradually during the first three years of the project as some changes will only be introduced once impact from other policy changes is significant and effectively measured.

The following two best practices would be implemented at Head Office level. Information and data required for their implementation can only derive from analysis and review carried out at Head Office that concern the entire ABS. These best practices include:

(t) **Turning branches in the project area into profit centers**. The objective is to obtain a clear and fair view of each branch activity, capacity to generate profit or at least to cover costs and risks and to promote responsibility and accountability within the staff through decentralized decision power to enhance performance of each branch. The objective is also to adjust the level of operating expenses and of financial resources to the current and expected level of activity; and

(u) **Upgrading current Management Information System**. The objective is to develop an adequate MIS providing accurate data for each activity in a timely manner that enables staff and branch manager, Head Office staff and ABS management as well as Directors to take well-documented necessary day-to-day or strategic decisions and actions.

Credit line. The project would finance a credit line to be used by the ABS branches in the project areas for on-lending purposes to the rural population with a focus on project target group.

ABS branches will use the project credit line in accordance with reviewed and updated procedures and methodologies. In order to institutionally and financially strengthen ABS and to provide an easy and sustainable access to universal banking products and services for the rural poor, activities at the level of ABS would include:

Technical assistance, training and institutional strengthening required for the implementation of best practices and draft of new procedures and policies.

A credit line to finance the incremental demand for loans from the target population as a result of the introduction of changes in ABS lending activity and procedures and of the implementation of best practices This credit line would be used by ABS branches/profit centres to finance members of LDCs for on farm and off farm activities so as to effectively and efficiently reach the most vulnerable segment of the target population (rural poor, women, unemployed youth, micro-entrepreneurs with no collateral) and promote rural development.

The ABS would enter into a financial relationship with LDCs whereby ABS uses LDCs as facilitators to reach their members, thus increasing their global outreach in rural areas towards the poor population.

To create a favourable environment for the development of income generating activities in the project areas, the project will also promote the creation and implementation of Business Development Centres that would provide non-financial services to micro-entrepreneurs, members of LDCs in the project area for their projects.

Implementation of best practices at ABS and provision of a wider range of banking products and services to the project target population that meet their demand and needs. This wider range of products and services provided would enable a larger segment of the population to have access to financial resources to start and develop

their income generating activities thus improving their livelihoods (especially poor households, women and unemployed youth).

8.5 Risks and Safeguards

The rural financial services design is based on lessons learned from successful practices, and has strong ownership by the Government and stakeholders. The following are identified risks:

(v) **No growth in income of the poor**. Income of the poor may not increase due to constrained market opportunities and poor quality of production. The market driven approach and technical assistance would reduce this risk.

(w) **Marginalization of poor and women**. Access of rural finance to women may remain low. Collection and analysis of gender segregated data will enable continuous monitoring and evaluation of the impact of the project on women and ensure adjustments as required. In addition, effective targeting, of poor communities, participatory processes, small loan size, and pricing at market rates will make the project loans less attractive to non poor.

(x) **High Delinquency**. Effective safeguard against delinquency would include significant investment in capacity building of ABS and adoption of internationally accepted best practices.

9 Local, regional and transboundary benefits

To be added.

10 Next steps

10.1 Preparation of the Summary Intervention Report and the undertaking of multi-stakeholder workshop

Three team members would return to discuss the draft plan with local stakeholders and beneficiaries spending about two days in each district.

The final interim report will comprise of a Summary Intervention Report (Project Design and description of project components) including draft LFA and M & E

framework. The four subject matter reports (namely the institutional-, technical, social- and environmental interim subject reports) will create the base for the summary Intervention report.
In designing project interventions the consultant will also take into account (i) linkages and synergies with other IDEN interventions and (ii) how to best link with ongoing or planned government programs for example in the health and education sector, that the project needs to interact with for long-term sustainability.
The workshop will be used to present the most feasible solutions, addressing its advantages and disadvantages, with the aim of gaining a consensus for the finalisation of the detailed project preparation.

The resulting proposed project components and activities will be designed to address the interlinked root causes of current levels of watershed degradation in the project area.

10.2 Development of the Project Implementation Plan

Expected Output as stated in ToR: A Project Implementation Plan (PIP) outlining project components and activities with cost estimate by component and by activity, where possible. The document will logically outline how these components address and link the results from the assessments described above. It was originally expected that the project would consist of an amalgam of community driven projects at micro-level, which would need to be grouped and coordinated at a higher level. Such a component is proposed to be included in the project as one of three key framework project components. This implies that this consultancy recommends not only at micro-level.
There will also be crosscutting interventions (roads, rural infrastructure, etc.) which embrace the whole target area and maybe extend beyond it. The Consultant must show how these different operating levels are to be managed and integrated. The PIP should also indicate a sub-project investment cycle for typical sample areas. From the various studies, the Consultant would compile the costs of the proposed project into software such as COSTAB or other similar.
Proposals for bridging activities should also be made, and fully budgeted, and presented together with the PIP. To this end the Consultant will undertake the activities stated in the Tor and repeated below.

Based on the outputs under above tasks, the consultant team will propose a detailed and comprehensive package of project interventions to address the area specific project objectives.
First year/phase activities should be described in detail, and should take account of the possibility of a funding gap between the design and implementation phases. The first-year detailed design should indicate those activities that could be started (or continued) to 'bridge' any period between design and implementation; such activities would need to draw on national and/or community resources rather than external funding.

10.3 Economic and Financial Analyses

The Consultant will undertake economic and financial assessments of project proposed activities, including the impact of project activities on beneficiary livelihoods as stated in the ToR. However, no major focus will be put on evaluation of potential financing from GEF and carbon sequestration funds. Instead focus will be put on the following tasks.

1. Assess project costs and benefits by activity and carry out economic and financial assessments of project activities, including support to alternative livelihood activities (this will include the development of crop/farm budgets and estimation of direct and indirect benefits; intangible benefits and costs should be described if not estimated quantitatively).
2. Undertake a sensitivity analysis to determine robustness of project investments from an economic and financial viewpoint.
3. Assess the fiscal impact of the project on the government.

10.4 Monitoring and Evaluation

Prepare a document in which would be included: (i) project indicators and log-frame; (ii) identified needs for developing an appropriate M&E system for the project; and (iii) a monitoring and evaluation plan with details of how, by whom and when measurements would be prepared; and (iv) baseline conditions against which progress can be measured.

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