

USAID
INTEGRATED STRATEGIC PLAN
IN THE SUDAN
2003 - 2005

ENVIRONMENTAL THREATS AND OPPORTUNITIES ASSESSMENT

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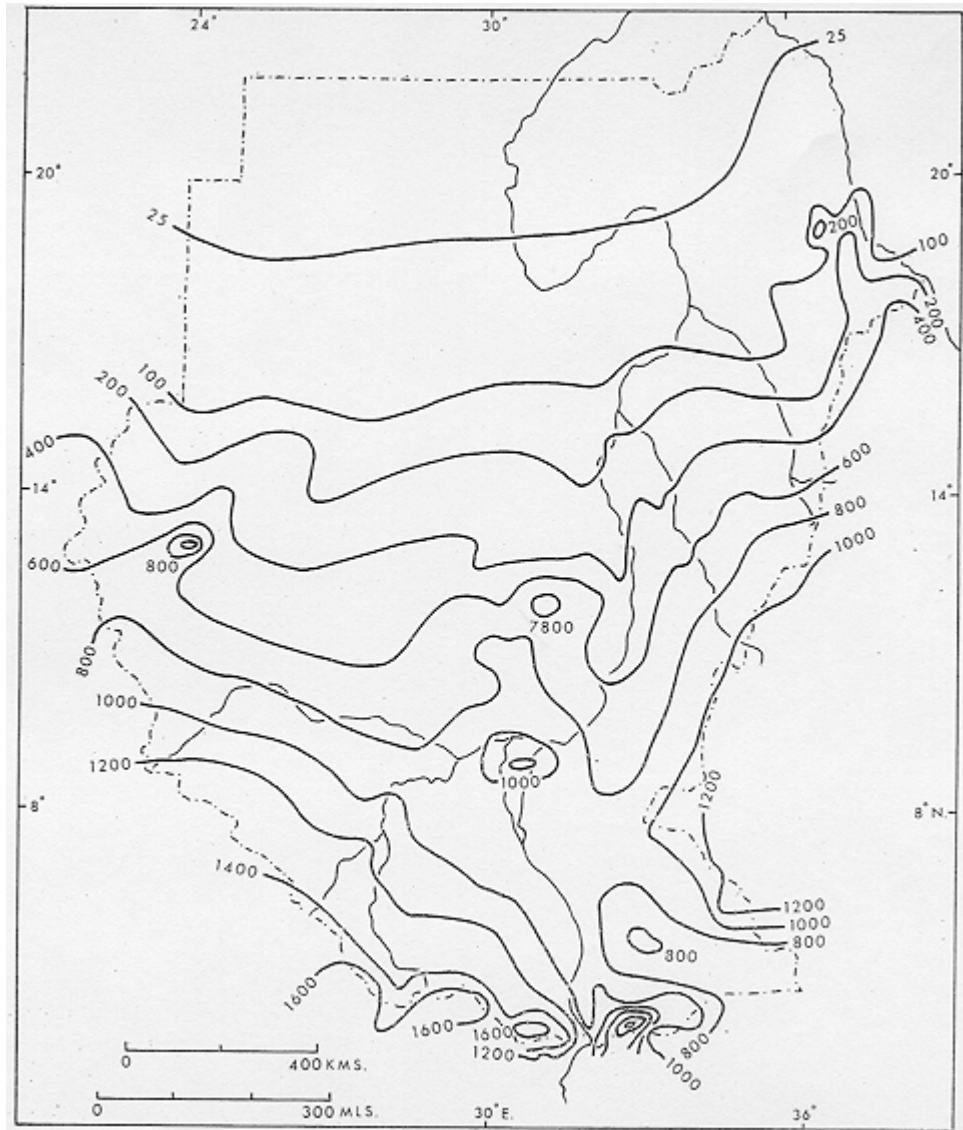
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ACRONYMS

CANS	Civil Authority of Southern Sudan
CBNRM	Community Based Natural Resources Management
CRS	Catholic Relief Services
DA	Development Assistance
ETOA	Environmental Threats and Opportunities Assessment
FAA	Foreign Assistance Act
FNC	Forests National Corporation
GEF	Global Environment Facility
GOS	Government of Sudan
ICIPE	International Centre of Insect Physiology and Ecology
IDP	Internally Displaced Persons
IGAD	Inter-Governmental Authority on Development
ISP	Integrated Strategic Plan
IUCN	International Union for the Conservation of Nature(World Conservation Union)
NBI	Nile Basin Initiative
PEA	Programmatic Environmental Assessment
PERSUAP	Pesticide Environmental Review and Safer Use Action Plan
OLS	Operation Lifeline Sudan
SO	Strategic Objective
SPLM	Southern People's Liberation Movement
STAR	Sudan Transitional Assistance for Rehabilitation Program
UN	United Nations
UNDP	United Nations Development Programme
USAID	United States Agency for International Development
USG	United States Government
WHO	World Health Organization

MAP OF THE SUDAN
Mean Annual Rainfall



ACKNOWLEDGEMENTS

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EXECUTIVE SUMMARY

Background

Despite its vast land area—the largest in Sub-Saharan Africa—and relatively low overall population density, sustainable development in the Sudan remains a significant challenge from both an environmental and socio-economic perspective. For four decades, the North and the South have been locked in an armed struggle that basically revolves around the nexus of political dominance and resource allocation. In the North, the problems of a fragile, arid environment have been exacerbated by unwise land-use choices leading to widespread indications of the intertwined dilemmas of abiding poverty and desertification. The South is better off from an ecological perspective—a more productive and robust resource base, albeit not one without its vulnerabilities. The resilience of the natural resource base in the face of human pressure will be put to a significant test as millions of IDP's and refugees return to the rural countryside to reestablish their livelihoods.

For some time now, the US Government has been supporting the IGAD sponsored Peace process. With the prospect of Peace on the horizon, the new USAID Integrated Strategic Plan (2003-2005) for the Sudan will focus on encouraging and sustaining a transition from humanitarian relief to one of recovery and development. As the ISP notes, “There are many challenges ahead”, not the least of which are wise choices about the nature of the program which will help to ensure the greatest impact on the welfare and well-being of the people of the Sudan and the sustainability of its activities and investments. How these activities affect resource use will be telling. These matters of resource use are the building blocks of the social compact in Southern Sudan and an inability to address them in the past has often led to conflict, not only with the North but among Southerners themselves.

USAID's Integrated Strategic Plan (2003-2005) for the Sudan

USAID's previous ISP's for the Sudan have contributed significantly to ensuring improved conditions for peace and security and to meeting the pressing food security needs of the people of the South and also of the displaced persons residing in camps around Khartoum in the North. The possibility of a peace agreement will allow as many as 4 million people to return to their homelands, doubtless with rising needs and expectation related to their welfare and way of life. The goal statement of the new ISP reflects these new circumstances: “Foundation established for a just and durable peace with broad participation of the Sudanese people”.

The strategic objectives planned for this ISP take full account of the “fragility of any peace agreements” and directs the USAID assistance program to address the fundamental challenges to maintaining the peace in the next three years (USAID 2003). Programs in three focus areas—food security, governance and health and education—will contribute to meeting this goal. A special objective will continue “expanded support to the Sudan Peace Process” (ibid).

The Need for an Environmental Threats and Opportunities Assessment

ADS 201.5.10g provides USAID's guidance concerning how USAID missions need to incorporate environmental requirements into their ISPs. This guidance is derived from provisions of the Foreign Assistance Act (FAA).

Environmental Sustainability: USAID recognizes that concern for the environment and wise management of the natural resources base are absolute requirements of any successful development program. Section 117 of the FAA "*Environment and Natural Resources*," dictates that efforts be made to maintain (and restore) natural resources upon which economic growth depends, and to consider the impact of USAID's activities on the environment. The legal requirements of the FAA are reflected in USAID's *ADS Chapter 204 "Environmental Procedures*," which guides users on the application of *22 CFR Part 216*. Regulation 216 codifies the Agency's procedures "to ensure that environmental factors and values are integrated into the A.I.D. decision making process." Accordingly, USAID conducts assessments to ensure that its environmental priorities are incorporated into results planning, achieving, and monitoring. 22 CFR Reg 216.9 allows for (a) bi- or multilateral environmental studies regarding the proposed action(s) or (b) concise reviews of the environmental issues involved including summary environmental analyses or other appropriate documents, in lieu of environmental assessments otherwise required by USAID environmental procedures. This assessment follows option (b).

Tropical Forestry and Biological Diversity: Sections 118 "*Tropical Forests*" and 119 "*Endangered Species*" of the FAA codify the more specific U.S interests in forests and biological diversity. These two provisions require that all country plans include: 1) an analysis of the actions necessary in that country to conserve biological diversity and tropical forests; and 2) the extent to which current or proposed USAID actions meet those needs. Section 118/119 analyses are specific legal requirements of all USAID operating unit strategic plans. It should be noted that 22 CFR 216.5 requires USAID to conduct their assistance programs in a manner that is sensitive to the protection of endangered or threatened species and their critical habitats.

As part of its ongoing preparation of an Integrated Strategic Plan for Assistance Programs in Sudan, 2003-2005, USAID/REDSO/NPC and the USAID Sudan Task Force have contracted the services of an environmental review team to prepare an Environmental Threats and Opportunities Assessment (ETOA). The purpose of this assessment is dual.

On the one hand, it is intended to assist the USAID Sudan Task Force to identify environmental threats that could affect the sustainability of its program as well as environment and natural resources management opportunities that could enhance its overall impact from both a socio-economic development and/or an ecological perspective. These considerations are intended to proactively inform the decision-making process related to program design and implementation. On the other hand, this assessment constitutes a first level of compliance with USAID's legal framework for environmental review of the USAID program in the Sudan as an operating unit in the process of preparing

a new Integrated Strategic Plan discussed above.

Given the current special circumstances of the Sudan wherein the territory in the South is largely administered by opposition movements while the North is largely administered by the GOS in Khartoum, the Environmental Threats and Opportunities Assessment was carried out separately and differently in the two areas. The findings and recommendations below reflect this two-pronged approach to the ETOA although the greatest import has been given to the activities of the ISP in Southern Sudan where the bulk of the resources will be invested.

General Findings and Recommendations

It should be noted that the bulk of the USG funding for this program comes from categories of USG/USAID assistance funds that enjoy exemptions and/or categorical exclusions within the framework of USAID's environmental procedures. In large measure, the humanitarian relief and transition and development activities under the ISP, however funded, are expected to help in transforming "Sudan through a peace that is viable and visible in peoples' lives" (USAID 2003). Accordingly, the plan must go ahead as effectively and efficiently as possible with primacy given to the precepts of humanitarian assistance, maintaining the peace agreement and sustaining the food security situation for the people of the Sudan.

Accordingly, this ETOA has also been carried out fully cognizant of the all important criterion of expediency in emergency/relief and transition to peace setting that will characterize the near-term in the Sudan. Overshadowing the transition to development activities and a concern for environmental sustainability will be the enormous and important challenges of the humanitarian situation that must be faced in the near-term, for example, with the return of possibly millions of IDP's and refugees to their former homelands. Satisfying their basic human needs must have primacy in the quest for peace. The intent of this ETOA is, therefore, primarily focused on identifying ways to increase the effectiveness of planned activities over the short to medium-term and enhancing the sustainability of these investments that will be so critical to peace and justice.

The sections which follow review the SpO/SO's and their planned activities as appropriate and where pertinent makes suggestions and recommendations as to their environmental implications. The section concludes with a review of the special circumstances related to tropical forestry and biodiversity conservation thereby fulfilling the stipulations of Sections 118 and 119 amendments to the FAA. The findings and recommendations of this ETOA are as follows:

Continuing to Build a Capacity for Environmental Management: Any and all efforts to plan and guide the future development of the Sudan will be handicapped by the present lack of reliable data and information on the state of the environment and by the need for enhanced human resources and institutional capabilities to guide its management. USAID is encouraged to increase its on-going support for strategic analysis and capacity building

in the environment sector. Beyond the present efforts of the SACB working groups and the planned training centers, it is recommended that USAID consider additional technical assistance and support to these efforts in the form of technology transfer advisors and/or a technical assistance contractor in the field of natural resources planning and policy development. Such assistance should be directed at creating a capability and institutional home in the form of an environmental and natural resources planning unit, ideally housed in the Secretariat for Wildlife and Environment of the Commission for Economy, Production and Physical Infrastructure of the Executive Branch of the SPLM. Such a unit could also eventually take on the responsibilities for the integrated planning and environmental review of all government plans and programs in Southern Sudan which will be required to ensure their ultimate effectiveness and sustainability.

Special Objective 4. Expanded Support to the Sudan Peace Process

Under **Program Focus Areas 1**: Expanded support to Sudanese peace building and maintenance capacities--the Mission may wish to consider the following suggestion:

- Adding language specifically aimed at developing methodologies for natural resources based conflict resolution as part of its support to “grass roots people-to-people peace processes”. There is a growing body of knowledge, experience and understanding about natural resources conflicts that has emerged as the logical nexus with governance programs and which could directly contribute to efforts to maintain the peace agreements in the Sudan.

Under **Program Focus Area 2**: “Timely Support to Peace Dividends and Confidence Building Measures”, both the “Quick Impact Program” and the “Confidence Building Measures” would benefit from:

- An interim understanding of and efforts to address the land tenure issues. The current lack of guarantees for small holder tenure over their farm lands, whether from the customary perspective of village elites making these decisions or as a result of government imposition of land ownership, can retard the investments in the development of more productive farming systems, food security, poverty alleviation opportunities and/or lead to local level conflicts.
- Similarly, any efforts to re-establish people on lands more marginal in productivity than those they had in the past, for whatever reason, will likely increase adverse environmental impacts associated with the land clearing for agriculture that unavoidably will be part of the return of large number of IDP’s and refugees. There is a need for a recognition that agriculture in Southern Sudan, as it is everywhere else in the world, represents a primary opportunity for sound natural resources management-- managing the basic resources of soil and water. An improved understanding of participatory approaches to community based natural resources management as a new paradigm in considering agriculture sector development options is a real opportunity. Using such an approach puts the critical

issues of land tenure and land capability/land-use on the table for consideration and could lead to greater sustainability of the land-use development mosaic.

Strategic Objective 5. More Effective and Participatory Governance

Under this SO, “USAID is expected to provide support for local governance strengthening...including expanded support for certain SPLM “national” level institutional development focusing on technical sector strategy, planning and policy development. Here again, the potential for proactively addressing the natural resources conflict resolution methodologies and activities fit well with the governance results being sought under this SO and its activities aimed at increased participation of civil society in peace and governance processes.

It is important as well, as the result of this ETOA, to recall the fact that: “Policy or strategy precedents set now may prove difficult to reverse and are likely to have more profound adverse environmental impacts than site specific interventions.” The view that agriculture and/or natural resources exploitation should be managed and taxed by the State needs to be tempered by the realization that wise use and resource conservation is best achieved by ensuring that local people perceive and benefit from the tangible incentives they bring.

Strategic Objective 7. Improved Equitable Access to Quality Health Care and Water and Sanitation.

Under the activities addressing improved access to quality water and sanitation, there is a need to ensure that hand-dug shallow wells and protected water catchments “haffirs” are accompanied with awareness raising and training programs to avoid the environmental health problems from using unsafe water.

Strategic Objective 8. Improved Food Security in Targeted Markets and Communities

Under the activities aimed at increased availability of food in targeted markets and communities, there will be opportunities to lessen the pressure on wildlife resources by ensuring that adequate relief supplies reach people moving into areas adjacent to known areas of wildlife concentration. Provision of protein rich food sources, perhaps small ruminants, rabbits and chickens—will help to alleviate the need for hunting.

Under the activities for increased access to food in targeted markets and communities, a range of activities need to be conditioned as follows:

- Road rehabilitation activities must be sufficiently robust to cope with the challenges of the wet areas and wetlands they must inevitably cross in Southern Sudan. In addition to the cumulative adverse environmental impacts that they generate, proper engineering and construction in these critical places will amply add to their durability. Furthermore, it is unlikely that “food-for-work” options for

road rehabilitation in these areas can be sufficient to build a reasonably durable and sustainable road. However, road monitoring and maintenance operations based on village level food-for-work could be a food security and/or income generation option well suited for the continuing durability of well constructed roads.

- Under these activities, there is a discussion of the option of encouraging “change in crop choice and cultivation techniques”. It is recommended that these efforts also promote on-farm soil and water conservation technologies to enhance and/or maintain crop land fertility and improve soil conditions (higher organic matter content) so as to be more resilient in the face of erratic rainfall regimes.
- The sense of the support planned for agricultural training centers which presumably include those related to wildlife and forestry, emphasize the importance of entrepreneurship and business skills. While such skills may be vital to the agriculture sector and could even have positive implications for the forestry sector, it is unclear how they might be applied to wildlife training. In the short-term, the SPLM needs to try and get hunting under control and develop a better understanding of wildlife resources in order to be able to sustainably manage offtake and exploitation.
- Trunk road rehabilitation activities need to incorporate the recommendations above regarding sound, environmentally conscious design and construction, solutions to traversing wetland areas, and routine maintenance to ensure the sustainability of these critical and extremely costly investments.

Threats and Opportunities in Tropical Forests

This report notes the unavoidable reality that there will be large-scale deforestation as a result of returning residents clearing land for agriculture and tree-cutting associated with rebuilding household and compound buildings and assets. USAID has already begun support for strategic analysis and capacity building in the forestry sector in Southern Sudan and a continuation and expansion of these efforts will be the best short-term investment to ensure that forests and woodlands occupy their rightful and appropriate place in the emerging land-use mosaic.

The following approaches and activities can also help to mitigate the consequences of these adverse impacts on the tropical forest resource base:

- Avoid any actions, decisions or policies that force small farmers onto marginal lands where the consequences of deforestation in the form of erosion, desertification and localized climate impacts will be more severe.
- Work with the Southern Sudan Forestry Department to develop their skills in the area of community forestry with the intention of incrementally developing a forestry extension capability that can aid the country’s farmers and smallholders to

pursue the logical options of on-farm agroforestry, small-scale tree planting and natural forest and woodlands management as part of a productive land-use mosaic geared to inherent capabilities of the land on which they depend.

- Launch a program to bring the now rampant uncontrolled burning of forests, woodlands and grasslands under control through awareness raising, working with county authorities, and promoting the low cost and effective option of early burning.
- Promote a program to license charcoal production in the major charcoal production areas and require compensatory reforestation and/or natural forest protection as part of the permitting system.
- Bring in the expertise to develop an economically and developmentally sound strategy for utilizing the established plantation forest resource base...especially the very valuable Teak resources, both on reserve forest and community areas. Encourage the SPLM to cancel the present extraction contracts until and unless this strategy is in place.
- Encourage reforestation programs and seedling nurseries to supply planting stock ideally at the community and farm levels to plant valuable fast growing species like Teak. Such programs could be assisted with incentives provided through food-for-work, especially on community and farm lands. In addition to forest species, such a program could promote and facilitate fruit tree orchards, especially in the better watered areas of Southern Sudan.
- Work to develop a strategy as well for the wise stewardship, conservation and sustainable management of the natural forests and woodlands, particularly in the high forest areas in the more southerly areas of Southern Sudan which might logically and usefully be integrated with the considerations for management of wildlife and biodiversity

Threats and Opportunities for Biodiversity Conservation

There is presently no easy way of knowing the status of wildlife and biodiversity conservation in the Sudan although it is very clear that present hunting pressures are out of control and unsustainable. USAID has already begun support for strategic analysis and capacity building in the wildlife sector and a continuation and expansion of these efforts will be the best short-term investment to ensure better stewardship of the country's once globally significant wildlife populations in Southern Sudan.

The following approaches and activities can also help to mitigate the consequences of the present pressures and adverse impacts on the country's wildlife and biodiversity assets:

- The SPLM should take an affirmative policy stance on the need for the protection

of wildlife resources even before survey and census data are fully compiled. This could include unequivocal and very public pronouncements of absolute prohibitions against the hunting of elephant, rhino and chimpanzee. There is also a need to bring commercial hunting under control; at a minimum, there should also be restrictions on which kinds of game meat can be sold in public.

- The Southern Sudan Wildlife Department senior leadership would benefit from training and/or study tours to neighboring countries to familiarize themselves with the new methodologies of community oriented wildlife and protected area management.
- Given the present situation, a cooperative agreement with one of the major, U.S. based international conservation organizations to work with the Southern Sudan Wildlife Department and the Southern Sudan Wildlife Conservation Organization is recommended as the most effective means to build skills and capacity and help develop a strategy for the conservation and development of biodiversity in the country. Such a cooperative agreement would constitute a significant response by USAID to the mandate of Section 119 of the FAA in the Sudan.
- The ready availability of firearms is the leading cause of biodiversity losses. USAID and the SPLM may wish to consider using a special incentives program to promote the decommissioning of firearms as SPLA soldiers and others are being demobilized.
- The present plans to build and operate a Wildlife Training Center at the Boma National Park should be complemented with some resources to ensure that proper control and protection of the Park and its biodiversity assets are possible.

PART I- INTRODUCTION TO THE ETOA

Purpose of the Assessment

Environmental review is an important and mandatory part of the USAID programming process. Accordingly, and as part of its ongoing preparation of an Integrated Strategic Plan for Assistance Programs in Sudan, 2003-2005, USAID/REDSO/NPC and the USAID Sudan Task Force have contracted the services of an environmental review team to prepare an Environmental Threats and Opportunities Assessment (ETOA). The purpose of this assessment is dual.

On the one hand, it is intended to assist the USAID Sudan Task Force to identify environmental threats that could affect the sustainability of its program as well as environment and natural resources management opportunities that could enhance its overall impact from both a socio-economic development and/or an ecological perspective. These considerations are intended to proactively inform the decision-making process related to program design and implementation.

On the other hand, this assessment constitutes a first level of compliance with USAID's legal framework for environmental review of USAID's program as an operating unit in the process of preparing a new Integrated Strategic Plan. The legal requirements under the Foreign Assistance Act (FAA) are spelled out in USAID's ADS Chapter 204 "Environmental Procedures" which discusses procedure and policy for the application of 22 CFR 216—USAID's codified set of environmental review rules that specify Agency procedures "to ensure that environmental factors and values are integrated into the decision-making process." In addition, this assessment will address the requirements under Section 118- Tropical Forests and Section 119- Endangered Species. These two amendments to the FAA constitute a mandate for country plans to analyze the actions required to conserve biological diversity and tropical forests and the degree to which current and proposed USAID programs meet those needs.¹

Scope and Methodology for the Assessment

Given the current special circumstances of the Sudan wherein the territory in the South is largely administered by opposition movements while the North is largely administered by the GOS in Khartoum, the Environmental Threats and Opportunities Assessment was carried out separately and differently in the two areas: (a Southern Entity and a Northern Entity—Government of Sudan).

In the South, a field team including a Senior Natural Resources Team Leader, working with three locally hired Southern Sudanese natural resources specialists, was deployed for

¹ For a more fulsome explanation of the legal basis and procedural requirements for environmental review applicable to USAID country programs, particularly as concerns East and Southern Africa, refer to the publication: Moore and Knausenberger 2000: *USAID/REDSO/ESA Strategy Environmental Threats and Opportunities Assessment with Special Focus on Biological Diversity and Tropical Forestry*.

a period of approximately three weeks. Their work included: review of the existing literature, including the reports emanating from USAID supported natural resources working groups funded under the current ISP; field visits to a series of sites of possible programming relevance (rural community areas, areas of known wildlife concentrations, potential road rehabilitation activity sites, forest areas and the margins of wetlands); and extensive consultations with rural people, local government authorities in the natural resources sector and staff of partner organizations.

In the North, security and political considerations precluded a field based assessment and accordingly, the work there was covered by a Senior Natural Resources and Environmental Management Specialist visiting Khartoum on related (but non-USAID-funded) activities and through a desk study of the available literature (**Annex A** contains the full Scope of Work for the Assessment Team). The latter specialist has compiled a separate and self-contained report that has been drawn upon by the Team Leader in the preparation of this report and which may be found as **Annex D**.

The complete list of references consulted in the course of this assessment may be found in **Annex B** and the list of persons contacted in Southern Sudan is included as **Annex C**. It should be noted that the Team Leader and two of the three local hire specialists benefited from their participation in a Stakeholders' Workshop convened by USAID to discuss its plans for the 2003-2005 Integrated Strategic Plan, held in Rumbek, Southern Sudan from 11 to 13 February 2003.

Background to the Sudan and USAID's ISP

Civil war between the North and the South, driven by a struggle for political equity, economic development and the sharing of natural resources, has gone on for more than four decades in the Sudan since its independence from Britain in 1956. The toll in human suffering, lack of development progress, damage to vital infrastructure and accompanying natural resources degradation, is staggering, affecting both North and South although it is disproportionately much more severe in Southern Sudan. Of late, progress in Peace Negotiations under the auspices of the Inter-Governmental Authority on Development (IGAD) and with strong support from the U.S. Government have allowed for a partial cease-fire and hopes for a more enduring peace. The after-effects and the challenges to relief and development will take years to address. The table which follows provides some basic facts and statistics currently available of relevance to understanding the current situation in the Sudan.

As much as 36% of Southern Sudan's estimated twelve million people have been displaced, some to the so-called "Peace Camps" in the north and another 400,000 have fled the country to refugee camps or to fend for themselves in neighboring East African States (Itto et al, 2000). Estimates point to almost 2 million people who have died from war related causes (O'Toole & D'Silva 1999). The IDP's, despite massive efforts at humanitarian relief, make do, attempting to eke out a subsistence survival and dependent on the erratic rainfall where they find opportunities to farm, with little access to modern

inputs for fully productive agriculture. Because of persistent insecurity, they are also frequently and inherently dependent on the fragile natural resource base which forms an important part of their coping strategies through the collection of indigenous wild foods. Continuing disruptions and displacements and the typically erratic rainfall patterns leave them evermore vulnerable to food security shortfalls and even famines resulting from severe droughts.

Table No. 1- Basic Facts and Statistics

Socio-Economic Data	Natural Resources/Environment Data
<p>Total Population- 31.7 million Population Growth Rate (annual %)- 1.9 % Urban Population (% of total)- 37 % Poverty Rate (% of total population)- Life Expectancy (years)- 56.2 years Infant Mortality Rate (per 1,000 live births)- 81.2 Illiteracy Rate, adult males (% of males 15+)- 29.7 GDP (current \$)- 12.6 billion GDP Growth (annual %)- 6.0 % Breakdown of GDP: Agriculture- 46.4 % Industry, Manufacturing & Mining- 15 % Electricity & Water- 1.7 % Construction- 4.7 % Governmental Services- 5.8% Other Services- 26.4 % Present Value of Debt (current US \$)- 14.8 billion Inflation (annual %)- 6.0 % Unemployment Rate (annual %)- 16.6 %</p>	<p>Total Surface Area (hectares)- 250,000,000. Total Land Area (hectares)- 237,600,000. Total Forest Area (hectares)- 42,367,000. Total Pasture Area (hectares)- 110,000,000. Total Land Other- Arid/Desert (hectares)- 72,258,000. Percent of Area Affected by Desertification- 51 % Total Gazetted Protected Area (hectares)- 8,600,000. Percent Total Area Protected (%)- 3.45 % Population Density- 12.6/sq. km. Annual Deforestation Rate (% of change)- 1.4 % Freshwater Resources per Capita (cubic meters)- 4,952 Improved Water Source (% of pop. with access)- 75 % Improved Sanitation Facilities, Urban (% of urban population with access)- 87 % Energy Use per Capita (kg of oil equivalents)- 501.8 Electricity Use per Capita (kwh)- 45.8 Woodfuels-% of Total Energy Consump. (%)- 87.6%</p>

Source: Various, including World Band website and Ejigu 2003. It should be carefully noted, however, that the reliability of the data presented in this table cannot be fully ascertained under the present circumstances and therefore its use is intended as indicative only. It is also probable that this data was derived solely from the North.

Although significant progress has been made in meeting the humanitarian challenges in Southern Sudan (see the discussion below on USAID support for the Sudan), much remains to be done both from a relief and development perspective against a backdrop of significant constraints. Continuing insecurity from localized outbreaks of hostilities affects both relief and development program activities. Infrastructure, particularly an inadequate

and damaged road network both as a result of war and the lack of investment and maintenance makes access to many parts of the Southern Entity difficult and costly. Overladen trucks carrying relief supplies churn the roads into a quagmire during the rainy season and they become impassable. Low levels of citizen involvement in governance and program decision-making combined with a growing syndrome of dependency on relief is undermining the need for greater participation in relief and development programming. Limited local capacity, both in human resources and Southern Sudanese organizations who can manage programs is another major constraint.

The more populous North and its Government which has controlled the wealth and governing structures of the country is only marginally better off from a socio-economic development perspective. The war has brought deficit spending to meet military expenditures, social dislocation, the deterioration of basic infrastructure and lack of access to aid and foreign investment (World Bank website, Sept. 2001). Poverty, unemployment, rampant inflation and a downturn in almost all economic indicators has, until recently, characterized the economy of the North although the general economic picture is improving since the initiation of oil production and export sales. An inability to service external debt prompted several of the multilateral organizations to cease operations and lending there.

In the last few years, the overall economic situation has been improving and the agriculture sector seems to be making a comeback, albeit one highly dependent on the continuation of normal rainfall patterns. The North together with foreign governments and outsiders has invested heavily in opening the oil fields and a pipeline to the Red Sea and is beginning to reap the proceeds of the sale of oil although it remains a highly contentious issue at the peace negotiations.

USAID Support for the Sudan

The USG has contributed to the development of the Sudan for many years.² In the 1980's, this support included economic support, development assistance and food aid, the latter especially during the drought emergencies of 1984-1985. In 1990, development assistance was suspended "following the overthrow of the democratically elected government by a coup d'etat" (USAID 2000). Humanitarian and relief assistance, however, has continued unabated through the rest of the decade as a result of the conflict, droughts and flooding.

² Records of USAID assistance to the Sudan in the fields of energy, forestry and natural resources can be found in a series of publications produced by the Africa Bureau from 1982 to 1986, titled: *Energy, Forestry and Natural Resources Activities in the Africa Region*. The 1986 version of these reports gives information on the following projects: Western Sudan Agricultural Research, Renewable Energy Project, Energy Planning and Management, Eastern Refugee Reforestation, Commodity Import Program (all bilateral projects); Environmental Training and Resource Management (Africa Regional Project); Human Settlements Natural Resources System Analysis, Environmental and Natural Resources Expanded Information Base, Energy Technical Service and Support, Small Decentralized Hydropower, Conventional Energy Technical Assistance, Energy Policy Development and Conservation, Training in Conventional Energy (Centrally funded projects); and Restocking of the Gum Belt, Development of Tea Production in Southern Sudan, and Development Program Assistance (PL-480 funded projects).

The famine of 1988 in Bahr el Ghazal and continuing refugee and relief needs as a result of the ongoing civil war prompted USAID to contribute significant amounts of relief assistance to Southern Sudan, in particular under the aegis of the U.N.-led, multi-donor assisted Operation Lifeline Sudan (OLS). The USG has provided more than US\$1 billion in assistance to the Sudan since 1989 for relief and rehabilitation in the form of food aid, primary health care, water and sanitation, seeds and tools for farmers, veterinary services and transport for emergency aid.³

Early success with rehabilitation activities (road reconstruction, agricultural rehabilitation, local grain purchase for relief programs, localized economic rehabilitation, transport, and trade) in opposition-held areas of the South prompted USAID to launch its first Integrated Strategic Plan (1997-1999). That program saw a modest return to rehabilitation cum development assistance under the ongoing Sudan Transitional Assistance for Rehabilitation (STAR) Program, organized as grants to civil society and CBO's "with resources to undertake rehabilitation projects that increase self-reliance while increasing their ability to advocate with civil authorities" (USAID 2000).

As the security situation improved in Southern Sudan as a result of SPLM successes in controlling additional territory, USAID has increased its emphasis on making the transition from relief to development given the inherently more productive soils and climates of the South and the options for trade with neighboring East African States. Indeed, the goal of the second ISP (2000-2002) was: "A less vulnerable, more self-reliant population better prepared for a transition to peace" (ibid). Under that ISP, now coming to a close, three strategic objectives are being pursued: 1)- An enhanced environment for conflict resolution; 2)- Enhanced food security through greater reliance on local resources; and 3)- Enhanced primary health care through greater reliance on local capacities.

The Integrated Strategic Plan (2003-2005) under preparation builds on both the achievements of the past and on the emerging optimism that a settlement to the civil war may be possible. The IGAD sponsored peace negotiations in Kenya have led to an agreement for a six year interim period of a "national unity government" in which the autonomy of a "southern entity" is fully recognized and begins to operate as a government of the South (USAID 2003). A new goal statement is foreseen, as follows:

**“Foundation established for a just and durable peace
with broad participation of the Sudanese People”.**

Programs will be designed for three focus areas under the new ISP: food security, governance and basic social services. As the Concept Paper for this new ISP notes, there are: "Risks to the environment from rapid growth and returning populations. While Southern Sudan is naturally bountiful, exploitation of natural resources has been minimal with the exception of petroleum production. Northern Sudan is largely arid and desert. A

³ For a comprehensive review of USG assistance to Equatoria in Southern Sudan in the 1990's, see: O'Toole & D'Silva 1999: *Evolution of a Transition Strategy and Lessons Learned: USAID Funded Activities in the West Bank of Southern Sudan, 1993 to 1999*.

large upswing in investments in both areas would have a major impact on the environment and must be properly managed”(ibid). It is in the light of these risks that the present environmental threats and opportunities assessment (ETOA) has been carried out.

PART II- SECTOR-WISE ENVIRONMENTAL ASSETS, THREATS AND OPPORTUNITIES

The Sudan is a large country--the largest in Sub-Saharan Africa--with a total area of approximately 250 million hectares, extending north to south for more than 2000 kilometers from about 22 to 4 degrees north latitude and 1800 kilometers west to east from 23 to 38 degrees east longitude (see map at the beginning of this report). Southern Sudan constitutes about one-third of the total land area, extending south along a line roughly equivalent to 10 degrees north latitude, with the exception of the extension of Upper Nile State which extends north to about 12 degrees north latitude.

With a total population of roughly 31 million inhabitants, most of whom (62%) are found in the North, the average population density is only about 12 people to the square kilometer.⁴ While this fact suggests a rather reasonable ratio of people to land, the extremely arid conditions of the north, including extensive areas of desert has concentrated people in the North along the course of the Nile River.

The South has a considerably more productive natural resources base as a result of more abundant rainfall patterns (albeit occasionally erratic and sparse) and more productive soils. Indeed, it has been this juxta-positioning of people and resources that has played a significant causal role in the current conflict between the North and the South. However, the chronic displacement of hundreds of thousands of people often with their livestock within Southern Sudan has undermined traditional community husbandry practices for natural resources and transformed much of the land temporarily into open access resources with usage rights for all but the responsibility of none.

The following sections examine the sector-wise understanding of the natural resource assets and the circumstances of the interactions of people and the environment which lead to environmental threats and opportunities. Owing to the long years of civil war and the paucity of recent analyses of the environmental conditions of the country, fully reliable data and information is often lacking. The assessment, nevertheless, has tried to identify and use the best available data sources, pointing out the inconsistencies and contradictions where necessary. Clearly, however, a challenge for the future is to update and improve the socio-economic and geographic/geophysical data base as a basis for planning and sustainable development.⁵

AGRICULTURAL RESOURCES AND LAND-USE

Despite its large land area (230 million hectares) and the fact that agriculture has for many years been the driving force of the economy of the country (35-40 % of GDP), farming

⁴ Population density in the Sudan is about 1/4 of what it is in neighboring states like Kenya and Tanzania (40 to 45 people/km²), where land capabilities and land-use are similar.

⁵ At least once matter of primary data collection should be pursued as a matter of course and quickly--the installation and operation of additional meteorological stations spread across Southern Sudan, reporting to a central office which even in the short-term will prove useful in better understanding the food security and agricultural production situation.

and/or livestock husbandry remain a risky business from both socio-economic and environmental perspectives. This is due to the inherently low rainfall (see **Figure No. 1- Historical Rainfall Patterns of the Sudan**), erratic rainfall, over-use and the lack of access to or use of modern agricultural inputs.

The Agriculture/Land-Use Situation in the North

In the North, the motor force of the agricultural export sector can be found on the approximately 1.8 million hectares of large irrigation schemes (the Gezira, Rahad and New Halfa) dependent on the Nile waters, flood irrigation schemes on the Atbara River (the Gash and Tokar schemes) both areas producing cotton as the main crop. There is also a more diversified, pump-based irrigation along the Nile River. Just to the south of Khartoum one finds the origins of the early establishment of mechanized rainfed farming, now expanded much more widely, particularly on the central sand plains, producing mainly sorghum. Sorghum was once an important export crop to the countries of the Middle East, sometimes in exchange for needed petroleum products.

Traditional rainfed farming, characterized by shifting cultivation and subsistence farming, once covered almost 12 million hectares in the 400 - 800 mm rainfall zone of the savannah belt of the central and western portions of the North between 10 and 14 degrees north latitude. Millet and sorghum as well as cash crops such as groundnuts and sesame were grown in this farming system. Livestock husbandry is also another important component of the agriculture sector in the North, practiced mainly as a traditional system including nomadism and transhumance. Large numbers of animals including cattle, camels, goats and sheep are exported to countries like Saudi Arabia.

The following **Table No. 1** on land-use, taken from the *Sudan Country Study on Biodiversity*, can only be considered illustrative of the conditions in the North because of a number of issues and inconsistencies related to the data it presents.⁶

All four of the farming systems in the North (irrigation, mechanized rainfed farming, traditional rainfed farming and livestock husbandry) have led to significant adverse environmental consequences that threaten their sustainable productivity.

- **Antiquated flood irrigation systems**, even in the very large schemes have led to wasteful use of scarce water resources, instances of soil salinization, the spread of water-borne diseases and irrational use of agricultural chemicals, particularly pesticides applied to monoculture areas of cotton. The attempt to build the Jonglei Canal bypassing the Sudd Swamps where much water was lost to evaporation and evapo-transpiration, was seen as by the North as a means for increasing the flows

⁶ On the one hand, it seems highly unlikely that the Government of Sudan is able to measure actual land-use, and considerably less likely to be able to project it on a five year basis, so one must question the source of the data. Similarly, the data given do not add up to the total area of the country, nor to the area of the North (two column totals of 104 million hectares represent only approximately 40% of the total area of the country against an estimated total area for the North of 150 million hectares), and finally the increase in total projected area (an extra 10 thousand hectares under traditional rainfed agriculture) in 2010 goes unexplained.

of the White Nile and making more water available for irrigation purposes in both Northern Sudan and in downstream areas of Egypt.

Figure No. 1– Historical Rainfall Patterns of the Sudan

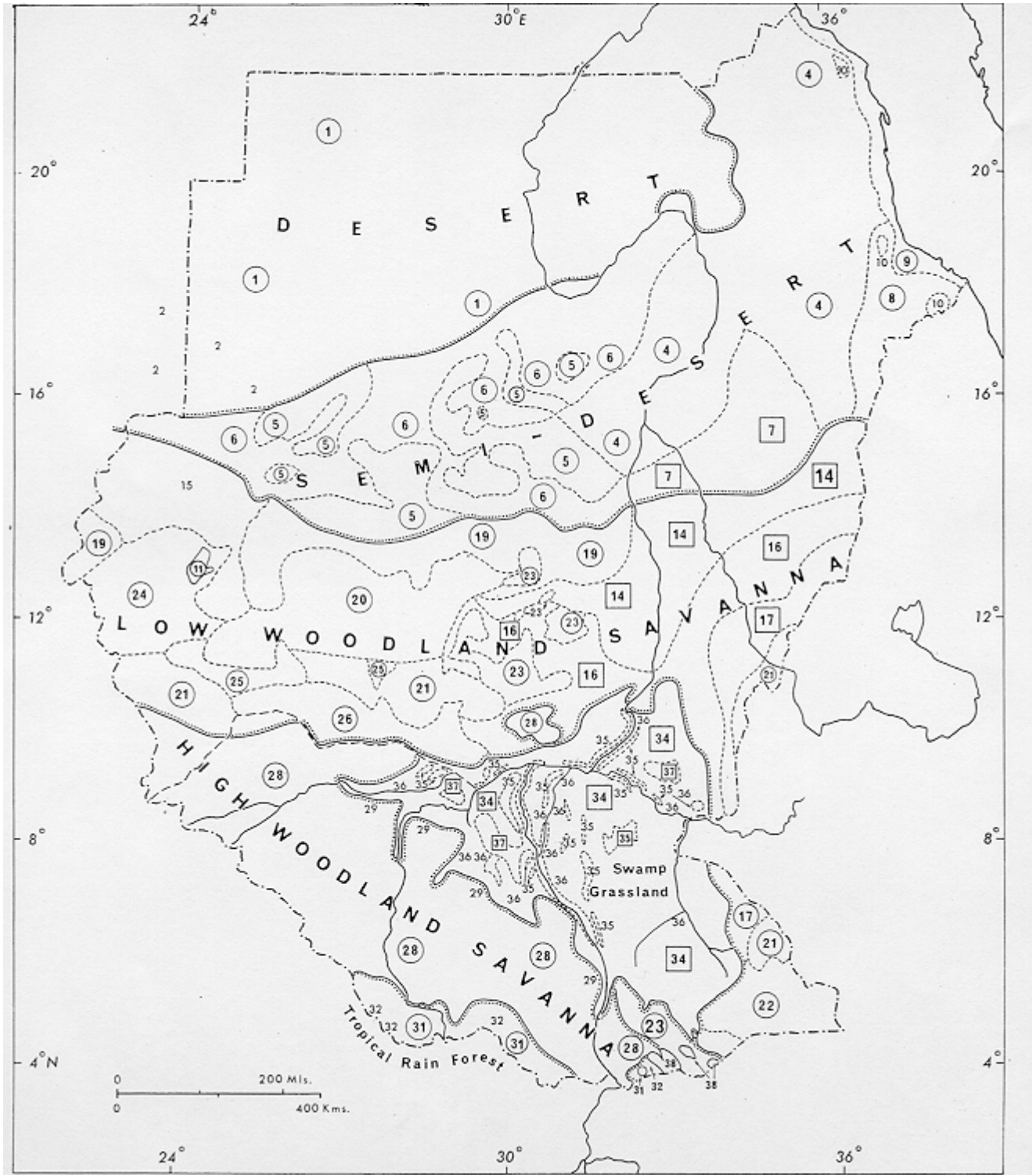


Table No. 1- Land Use in the Sudan

Land Use Category	Projected Area (1000 ha)		
	2000	2005	2010
Forest Land >20% Crown Cover	3,069.5	2,939.0	2,808.5
Forest Land 10-20% Crown Cover	4,486.5	4,283.0	4,079.5
Scattered Trees/Shrub Rangeland	42,751.3	40,810.5	38,869.5
Grass Rangeland	20,110.0	20,110.0	20,110.0
Wasteland	15,882.0	16,065.5	16,249.0
Irrigated Agriculture	1,860.0	1,860.0	1,860.0
Mechanized Rain Fed Agriculture	7,599.5	8,949.0	10,298.0
Traditional Rain Fed Agriculture	8,561.5	9,303.0	19,944.5
Totals	104,320.3	104,320.0	114,219.0

Source: HCENR/IUCN 2001–Sudan Country Study on Biodiversity

- **Mechanized rainfed farming** has proven to be another environmentally degrading system. Carried out mainly as non-farmer financed, agribusiness enterprises producing sorghum and sesame, large areas within the low rainfall belt were cleared of vegetation and put under the plow. In an effort to keep costs down by avoiding weeding, large blocks (typically 1000 feddans⁷) were disced extensively only after the onset of the early rains when weed and other plant seeds sprouted. Low or erratic rainfall after the crop seeds were sown often meant that an entire annual crop could be lost and the only recourse was to plow it under and try again in the following year. Years of early discing have all but eliminated the seeds of any plants on these large areas and once abandoned, re-vegetation is slow or absent. There have been examples where after three or more years left in so-called fallow, almost no vegetation other than a few hardy *Acacia mellifera* seedlings have repopulated the area and begun the process of soil rehabilitation, leading critics to term this farming system as “mechanized desertification”.
- **Traditional rainfed farming**, sometimes including the agroforestry system of “gum gardens” (orchard like configurations of the Gum Arabic tree, *Acacia senegal*) have suffered as a result of increasing human and animal populations. Increased pressure on the land have led to an unavoidable reduction in fallow periods leading to reduced yields, soil fertility losses, soil degradation and erosion and desertification.
- Like traditional farming, **livestock husbandry** has suffered as a result of increasing

⁷ A feddan is approximately the equivalent of an acre, with a total area of 4,200 square meters.

populations, of both people and livestock and the spread of agricultural lands, leading to a breakdown in traditional extensive grazing management controls. Reliable data on the status of livestock numbers is not presently available.⁸ The result has been rampant over-grazing, soil erosion and degradation, range deterioration and rising conflict between transhumant herders and sedentary farmers. Localized deforestation and soil compaction, leading to erosion and soil degradation is also common around water points where livestock concentrate in the arid north.

Other matters of interest related to agriculture in the north of Sudan

Although the data are far from conclusive, owing to a lack of good records, inadequate numbers of meteorological stations and a relatively short historical record, there is some cause for concern that global warming may affect the arid/semi-arid north of Sudan. Some evidence points to a gradual and slight shifting south of the rainfall isohyets, something seen elsewhere in Sahelian Africa, further exacerbating the issues associated with the sustainability of rainfed agriculture.

There are a number of crop species well known worldwide that some believe have their origins in the Sudan, including pearl millet (*Pennisetum glaucum*), sorghum (*Sorghum bicolor*), a type of melon (*Cucumis melo*), watermelon (*Citrullus lanatus*) and okra (*Abelmoschus esculentus*) (MOET 2000). Continuing inroads into the sustainability of the agricultural landscape and the natural areas surrounding it could threaten the genetic diversity of these important crop species.

Many of the difficulties with agriculture in the North of the Sudan, and their attendant adverse impacts on the environment, are the result of mistaken choices by government in managing and guiding the agriculture sector and its development. For many years now, the demand for food and export crops has been met by horizontal expansion of the agricultural frontier, often agro-industrial expansion onto very marginal lands with subsidies and incentives received from government. It is no longer so easy to find new lands on which to expand mechanized agriculture. Where attempted in the north, it is only likely to worsen the existing conflicts with and impact on the livestock sector or threaten protected areas. There was concern at one time about the expansion of mechanized farming onto the lands adjacent to and even including the only national park in the north--Dinder National Park in Sennar.

The Agriculture/Land-Use Situation in the South

In the South, the situation of agriculture and land-use patterns are quite different from those of the North and considerably more promising, despite years of disruption of the rural economy as a result of the civil war. For example, a larger percentage of the total area of the South can be considered arable, and in Western Equatoria, rainfall conditions

⁸ The *Sudan Country Study on Biodiversity* (HCENR 2001) comments (p. 66) that "the last livestock census was conducted in 1975-77".

even favor the production of two crops in a given year. This is not to say, however, that farming systems or agricultural technology are more advanced in Southern Sudan; perhaps it is exactly the contrary.

With a few modest exceptions, some dating back to colonial times, the agricultural sector in Southern Sudan received little support from government and has remained largely traditional and subsistence oriented. Very little has been done to upgrade or modernize the farming practices of the majority of the farmers in the South. They have little access to inputs or credit beyond seeds and tools now being supplied as part of humanitarian relief programs managed by the international NGO community. Farmers traditionally cultivate the soil by hand and practice shifting cultivation for a period of three to five years before leaving the land in fallow and moving onto another patch in the vicinity of their village.

On the northern margins of the South, most communities practice pastoralism, keeping large herds of cattle as well as goats and sheep. The former are moved seasonally to find fodder resources and water. Like their more sedentary farmer brethren, they too have been affected by the civil war, displaced into more inaccessible areas where Tsetse fly may be more common and Ngana transmitted by Tsetse will decimate herds. Their herds, easier to see from the air than groups of fighters, have been occasionally bombed by the north.

Outbreaks of traditional cattle raiding in the pastoral areas, once a common occurrence and rooted in culture, waned during the height of the war but have recently sprung up again owing to the availability of firearms among the population. Many former fighters and others now keep firearms, mainly AK-47's, ostensibly as defensive weapons with which to protect their livestock assets. A continuing lack of security has dampened the willingness to restock and in many areas of the South, fodder resources stand untouched except by the persistent fires, another environmental management issue, which spread uncontrolled across the landscape in the late dry season.

The civil war has also had a devastating effect on the support and market systems for agriculture in Southern Sudan. The poor condition of the infrastructure, the lack of trade and transportation and the dearth of access to agricultural inputs leaves farmers with little recourse except to subsistence agriculture. This has exacerbated the lack of attention paid to the small-scale farming sector by the Government of Sudan before the war. Furthermore, the former regional ministry of agriculture, once fully staffed, has seen its human resources shattered and the present Secretariat of Agriculture of the SPLM is in dire need of support for institutional strengthening and human resources capacity building (Itto et al 2000). Crop failures due to drought in 1997 and 1998 in Bahr El Ghazal combined with insurgency led to large-scale famine and the need for massive inputs of food aid and humanitarian relief. Sudan, once projected to become the "bread basket of the Arab World" is now barely able to feed itself (Itto et al 2000).

Despite these dire circumstances, it is now well understood that the better growing conditions and rainfall regimes offer significant opportunities for viable and productive land-use systems that could engage, employ and generate income for significant

percentages of the populations of the South. A wide variety of rainfed crops are already in production—maize, sorghum, sesame, groundnuts, cassava, oil palm, coffee, pineapples, mangos and many other vegetables and fruits, and a good deal of this production is now, within the more secure areas of Western Equatoria, finding its way into the local trade and with neighboring Uganda. A small portion of surplus cereals produced in the South have also been purchased locally by the aid agencies as relief supplies for food insecure populations elsewhere in the Southern Entity (Itto et al 2000).

While these opportunities bode well for the near to medium-term, it is also widely acknowledged that significant constraints will have to be overcome to bring agriculture up to its full potential in Southern Sudan. These constraints include: the return of displaced communities to their former lands; a legacy of land policy and land tenure practices that do not yet allow for private ownership of land and thus curtail wise use, conservation and investment in improved farming practices; farm labor shortages as a result of the loss of productive family members; health and nutrition concerns that undermine the productivity of farm labor; the general lack of professional and technical staff needed to manage the sector and pursue agricultural research; outdated farming practices and technologies and the lack of agricultural inputs and credit; the need for continuing investment to improve communications and transport infrastructure to link farms and markets; and up-to-date sectoral information on which to plan and guide the development of the sector.

It should be noted that in the short-term, many of these constraints may lead to a proliferation of agricultural practices and conditions inimical to the wise use, improved management and conservation of the natural resources base critical to the sustainable development and productivity of the agriculture sector in Southern Sudan.

Environmental Threats and Opportunities Related to Agriculture/Land-Use

Agricultural and Land-Use Threats: There will be an obvious and unavoidable spike in natural resources use as IDP's and refugees return to their former homelands and attempt to re-establish their livelihoods. Some points to bear in mind:

- People will be clearing land in order to return to farming. This will involve considerable tree cutting, brush clearing and burning. Farming oriented groups in Southern Sudan are still mostly using a slash and burn or shifting cultivation approach to farming, involving 3-5-7 years, depending on the quality of the site, of farming followed by long periods of fallow (reportedly up to 30 years). There is probably no way to avoid this land conversion, especially at the outset. Under certain circumstances, however, resettlement as a result of the Peace Accords could lead to positive environmental impacts in terms of agricultural resources and land-use, for example, as people move back to more suitable areas they abandoned because of insecurity, such as along the roads or in the Nuba Mountains where people move their farm plots out of the more fragile hills and on to former plains areas.

- The magnitude of the adverse impacts on the environment could, however, be mitigated by avoiding schemes which will displace local people from their traditional farming areas (typically the most fertile parts of the landscape) by claiming these areas for agro-industrial development (among the sector development options Sudanese colleagues seem to be considering), or by attempting to direct, guide or control the return of these people. Any efforts to re-establish people on lands more marginal in productivity than those they had in the past, for whatever reason, will likely increase adverse environmental impacts, at a minimum on the short-term. Similarly, it would be prudent to include guidance and training on soil fertility enhancement/management and on-farm soil and water conservation technologies and practices in the planned support for enhanced agricultural extension services related to crop choice and cultivation techniques foreseen under the ISP.
- As most farming is done manually, support which adds mechanization and/or draft animal power to the farming system will increase the area being cleared and burned. Such situation will require more careful environmental review to gauge their potential for adverse impacts. This includes both the direct impacts on the ground of such agro-industry as well as the indirect consequences of moving former farmers of the area in question onto other lands which might be less suited for agriculture.

Policy, Planning and Strategy: Any consideration of agriculture and land-use issues at this stage in the development of the Southern Sudan and the evolution of the Peace Process and USAID support of it, must also begin with an understanding of sector policy, planning and strategy. It may be the policy, planning and strategy processes that could have the most profound impact on the environment. Policy or strategy precedents set now may prove difficult to reverse and are likely to have more profound adverse environmental impacts than site specific interventions. Clearly, the time is right to reinforce all efforts in support of the development and application of environmental management capabilities within Southern Sudan. Among the things noted as potentially leading to adverse environmental impacts were the following:

- Basic policy directions—one gets a disquieting sense that the Southern Entity authorities in the natural resources sector would like to go back to the “*status quo ante*” typified by a “command and control” approach as their central theme of sector policy. They want to do so for a number of logical reasons: they will need to tax natural resources use to generate funds for government; they feel an obligation to provide employment for former fighters; they have a sense that these resources are abundant; and because it is the way it was when the war broke out and many have not been exposed to more progressive approaches to government management of the natural resources sector. Clearly, however, and this is a fundamental and very important issue: great care will be needed to avoid exacerbating environmental issues associated with agriculture and rural

development by avoiding actions, policies and decisions that erode peoples' actual or perceived land and resource tenure rights.

Doubts about land and resource tenure rights by local people as a result of governmental planning or control mechanisms, however well intentioned, can have an impact on both wise use and conservation of natural resources. They lead to an unwillingness to accept production trade-offs for conservation purposes because of the uncertainty that it will lead to benefits for local users. They can also stifle interest in investments for the purposes of improvements and/or management. This reinforces a dependency on natural resources along with a subsistence mind set and persistent vulnerability to food insecurity due to the vagaries of weather—a declining spiral of production, productivity and well-being. In short, natural resources extraction must be viewed as central to the issues of local governance, revenue flows and as an important part of the roots of conflict.

- Reaching for improved strategic analysis and capacity building. The present efforts under the SACB are a good start and adding important information for the consideration of how to proceed in those sectors in the future. At present, the outcome of the resource surveys undertaken by the forestry and wildlife working groups can only be considered qualitative in nature because of the limitations of time and resources available for the exercises in question. Perhaps more importantly, however, is the need to build on this basic information and begin to identify and tackle the issues and opportunities of the sectors. This should ideally be done in a more integrated fashion given their close inter-linkages, something that was recently discussed in a workshop held among the working groups in Nairobi in early February 2003. Cross-sectoral integration is something that sounds logical but typically is hard to achieve, especially when various sector institutions are in the process of building their individual capabilities and seeking resources for doing so. One way to achieve this integration at the outset is by supporting the development of cross-sectoral capabilities for environmental review as part and parcel of increased environment and natural resources planning capabilities (see discussion below).
- USAID as a development agency has particular and comparative advantages in the area of environment and natural resources sector strategy, planning and policy setting. Given its present activities and intended future commitments (agriculture, forestry, wildlife training centers under Southern Sudan Agricultural Revitalization Program), it would also be useful to support continuing institutional strengthening, capacity building and development in the area of environmental/natural resources planning and strategy. Concerted support to such a unit within the Southern Sudan Government, for example, as part of either the Secretariat for Agriculture and Animal Resources or the Secretariat for Wildlife and Environment (and ideally including both of these natural resources oriented agencies) of the Commission on Economy, Production and Physical Infrastructure seems most appropriate, something akin to the plans for a Center for Statistics and

Evaluation. At least one full time, well rounded, field-oriented natural resources planning technical advisor is suggested. Likewise, there are ample training opportunities available in neighboring countries (e.g., Uganda and Kenya) related to community forestry, community-based natural resources management, and natural resources based conflict resolution.⁹

- Basic statements of policy and strategy are needed, almost before action programs can get underway, and certainly before the Southern Entity draws up new laws. The new forestry (2) and wildlife (1) laws prepared by the Law Society are still merely editorial updates of the older existing laws. Apparently, no specialists presently working within the sector (none from the closely related working groups under SACB) in Southern Sudan were involved in these drafting efforts and it shows. The wildlife law is almost a verbatim redrafting of the 1975 Wildlife Conservation and National Parks Act. As such it is outdated both substantively (e.g., it would allow hunting of elephants) and with respect to policy. The present level of effort and timing for the sector-wise strategy development under SACB is inadequate—for example, the planned activities to be carried out over a two month period, leading up to a national workshop on wildlife policy and strategy.
- Similarly, the matters of policy and strategy beg the question for a cross-cutting opportunity to address natural resources tenure under the governance related focus area of the ISP. Building local capabilities to broker basic natural resources use and conservation decisions and avoiding conflict are a prima facie case of governance opportunities. The approach could usefully be used in the agriculture/land-use, wildlife, forestry and water resources sectors in Southern Sudan. These matters of resource use are the building blocks of the social compact in Southern Sudan and an inability to address them in the past has often led to conflict, not only with the North but among Southerners themselves. There are ample cases where support for good governance in natural resources, at various social levels, would be warranted and welcome.

FOREST AND WOODLAND RESOURCES

Few countries in the world stand to gain more from the wise stewardship of their forest and vegetative cover or to lose more from its destruction than the Sudan. For decades now, policy and practices in the country have led to massive deforestation as a result of the abiding dependency on woodfuels, large-scale clearing for mechanized agriculture and widespread annual burning. Vegetative cover types for the Sudan are normally categorized into five types, as per **Table No. 2** of the vegetation zones of the Sudan, also presented as **Figure No. 3** (after Lebon 1965).

⁹ For example, it has been learned that USAID/Kenya is working through PACT and the Forest Action Network based in Kenya on the preparation of an Anglophone Africa Training Manual for natural resources based conflict resolution. During a visit to the Forest Action Network in Nairobi, one of the working group members was signed up as a participant in the Forest Action Network and furnished with a copy of an FAO produced training guide (two volumes) for natural resource conflict resolution.

Table No. 2- Vegetation Zones of Sudan

Type of Vegetation	Approximate Location	Annual Rainfall
Desert	North of 17 degrees north latitude but excluding the Red Sea Hills	Less than 2 inches of rainfall (50 mm.)
Semi-Desert Acacia Scrub and Short Grasslands of North-Central Sudan	14-17 degrees north latitude and including the Red Sea Hills	2-8 inches of rainfall (50-200 mm.)
Low Woodland Savanna of Central Sudan	10-14 degrees north latitude and including Toposa area in Southeast Equatoria	8-30 inches of rainfall (200-750 mm.)
Deciduous High Woodland Savanna and Swamp Grasslands of Southern Sudan	5-10 degrees north latitude but excluding the Toposa area	30-50 inches of rainfall (750-1,250 mm.)
Modified Tropical Rain Forests of the Southern Borderlands	3.5- 5 degrees north latitude excluding the Toposa area.	More than 50 inches of rainfall (1,250 mm.)

Source: Lebon 1965. *Land Use in Sudan*.

The following table (**No. 3**) drawn from the authoritative FAO publication *State of the World's Forests* provides a synopsis of the country-wide forest cover situation and of forestry as a viable land-use option in the Sudan.

Table No. 3- The Forest Resource Situation in the Sudan

Total Land Area	237,600,000. hectares
Total Forest Area	61,627,000. hectares
Percentage of Land Area	25.9%
Forest Area Per Capita	2.1 hectares
Total Forest Plantations	641,000. hectares
Average Wood Volume in Forests	9 cubic meters/hectare
Average Biomass in Forests	12 tons/hectare
Total Forest Area- 1990	71,216,000. hectares
Total Forest Area- 2000	61,627,000. hectares
Forest Cover Change 1990 - 2000	- 959,000. hectares
Annual Rate of Change	- 1.4%
Forest in Protected Areas	10%

Source: FAO 2001. *State of the World's Forests*.

The *Sudan Country Study on Biodiversity* (HCENR 2001) provides some surprisingly detailed, albeit largely narrative analysis, not without some contradictions and gaps, of the forest condition in the “Southern Sudan States”. The Study points out that approximately 68% of the country’s forest biomass resources are found in the South and in the past, they accounted for approximately 85% of the total sawn timber produced. A number of the species found in the better watered portions of the South attain impressive sizes and produce high quality hardwood timber (e.g., African Mahogany– *Khaya senegalensis* and Iroko, sometimes called African Teak or Mvule– *Chlorophora excelsa*). Another– *Isoberlina doka*, was commonly cut for railroad ties because of its strength and durability. In fact, there are so many valuable and workable timber species in these forests of the South, that it is surprising that a more sophisticated timber industry did not develop there; perhaps there is still a good chance.

In addition to timber, the forests of Southern Sudan provide a cornucopia of non-wood forest products used by local people. The best known of these is “Lulu” or the Shea Nut Butter Tree– *Vitellaria paradoxa* (see cover photo) which local women process to produce an oil useful for a variety of household needs, occurring in a wide belt and at relatively high densities through the center of the natural forests of Southern Sudan.¹⁰ Further to the north, in Bahr el Ghazal and Jonglei, another very prominent tree based wild food crop comes from the *Balanites aegyptiaca* whose fruit is consumed and seed used as a staple to substitute for cereals during hard times. Indigenous wild foods have traditionally been an important component of coping strategies during times of food insecurity.

Biong Deng says that “During the famine of 1998 in Bahr el Ghazal, wild foods contributed more than any other food sources, including relief food, in saving the lives of a large number of famine victims because of its easy availability and affordability” (L. Biong Deng in Grosskinsky and Gullick 2000). Any number of other tree and shrub species found in the natural forests and woodlands are active parts of the household diet and family pharmacopeia and their real values may rival that of the wood and wood products normally harvested.

The following table (**No. 3**) provides a synopsis of forest types and some information on site characteristics and conditions, drawn for the most part from the recent *Sudan Country Study on Biodiversity*. **Figure No. 2** presents a map of vegetation types of the Sudan.

¹⁰ Lulu, now classified as *Vitellaria paradoxa*, was formerly known as *Butrospermum niloticum*. There is a new monograph available on the species although a copy could not be obtained as yet. See Hall, J.B. et al, 1996. *Vitellaria paradoxa*: A Monograph. Publication No. 8, School of Agriculture and Forest Sciences, University of Wales, Bangor, pp.- 105. Produced under DFID Forestry Research Project No. R4850.

Table No. 3- Forest Types of the South

Forest Type	Approximate Area	Characteristics
Low Rainfall Woodland Savanna	7000 km ²	“...both sides of the White Nile in the northern tip of Upper Nile Region...vegetation occurs on heavy, dark cracking clay soil...rainfall between 400 and 570 mm...species include: <i>Acacia mellifera</i> , <i>Cadaba glandulosa</i> , <i>C. rotundifolia</i> & <i>Boscia senegalensis</i> ”
Low Rainfall Woodland Savanna	17,000 km ² 7,000 km ² 13,000 km ²	“...alternating with grassland type...along the boundary with Blue Nile State, extending in a narrow belt to river Sobat...extending towards Jelhak and the White Nile...around Riangmon, Unity State...extending from Mongala to Ikotos...species typically include: <i>Acacia mellifera</i> , up to 570mm rainfall to <i>Acacia seyal</i> - <i>Balanites aegyptiaca</i> up to 700mm...other species where flooding occurs include: <i>Acacia polyacantha</i> , <i>A. fistula</i> & <i>A. drepanolobium</i> ”
Anogeissus leiocarpus-Combretum hartmannianum woodland	2,000 km ² 9,000 km ²	“...along the eastern boundary of Upper Nile State, extending north to Kurmuk and beyond Roseris, and in an area west of the Boma Plateau southwards towards Akobo in Jonglei State...occurring on dark, cracking clays...always confined to sloping ground and seldom far from hills...dominant species are: <i>Anogeissus leiocarpus</i> & <i>Combretum hartmannianum</i> , with <i>Acacia seyal</i> and almost pure stands of <i>Pterocarpus lucins</i> , <i>Terminalia brownii</i> and along wadis, <i>Cordia africana</i> , <i>Celtis integrifolia</i> , and <i>Ozytenanthera abyssinica</i> (bamboo)”
Terminalia brownii-Sclerocarya-Anogeissus/Prosopis woodland	3,000 km ²	“...confined to northern parts of Bahr El Ghazal State to Bahr el Arab...on soils of stable sand...usually occurs under rainfall well over 600mm...dominant trees are: <i>Terminalia brownii</i> , <i>Sclerocarya bierea</i> , <i>Anogeissus leiocarpus</i> , <i>Prosopis africana</i> , & <i>Tamarindus indica</i> ...and in drier parts <i>Guiera senegalensis</i> , <i>Acacia senegal</i> & <i>Dalbergia melanoxydon</i> .”

Toposa Area	28,000 km ²	“...mainly grass grazing land on sand with some clay...dominated by thickets of <i>Acacia mellifera</i> ...and along watercourses occur <i>Tamarindus indica</i> , <i>Kigelia aethiopica</i> , & <i>Acacia sieberiana</i> .”
Anogeissus/Khaya/Isobertina Savanna Woodland	263,000 km ²	“...by far the largest vegetation type...stretches from the Imatong foothills across Equatoria to Bahr el Arab...characteristic of the ironstone laterite soils...under rainfall of 900-1,300mm...dominant species are: <i>Khaya senegalensis</i> , <i>Isobertina doka</i> , <i>Anogeissus leiocarpus</i> ...in drier areas associated with <i>Combretum spp.</i> and occasionally associated with <i>Parkia africana</i> , <i>Daniellia oliveri</i> & <i>Azelia africana</i> ... <i>Butrospermum niloticum</i> (also now known as <i>Vitellaria paradoxa</i> or locally as “Lulu” is also found as a dominant where other species are removed.
High Rainfall Woodland	24,000 km ² 5,000 km ²	“...derived rain forest stretches in a belt along the borders with Uganda, Congo and Central Africa towards Yei, Maridi and Tambura, and an area of the Boma Plateau...trees are over 30 m in height and 250 mm in diameter...characteristic species are: <i>Terminalia glaucescens</i> , <i>Albizzia zygia</i> , <i>Vitex doniana</i> , <i>Acacia polyacantha</i> & <i>Anogeissus leiocarpus</i> ...smaller trees include: <i>Combretum hinderanum</i> , <i>Grewia mollis</i> , <i>Annona Chrysophylla</i> , <i>Bridelia scleroneura</i> & <i>Dombeya quinqueseta</i> ...giving the formation a multi-storey character”.

<p>Bowl Forests</p>	<p>—</p>	<p>“...tropical rain forests...complete freedom from fire...located in depressions, gallery forests and at higher altitudes...typical species in the Azza Forest include: <i>Holoptelea grandis</i>, <i>Mildebraei dendron excelsum</i>, <i>Schrebera macrantha</i>, <i>Ficus palita</i>, <i>Chrysophyllum albidum</i>...in Lotti Forest, another example, species include: <i>Schrebera macrantha</i>, <i>Alstonia congensis</i>, <i>Khaya grandifolia</i>, <i>Entandophragma angolense</i>, <i>Chlorophora excelsa</i>, & <i>Cola cordifolia</i>. In the gallery forests such as the Aloma Plateau, the dominant is: <i>Syzgium guineense</i>, with <i>Diospyros mespiliformis</i>, <i>Khaya grandifolia</i>, <i>Cola cordifolia</i>, <i>Ceiba pentandra</i>, <i>Mitragyna stipulosa</i>, & <i>Canarium schweinfurthii</i>.”</p>
<p>Flood Region or Toich</p>	<p>35,000 km² 21,000 km²</p>	<p>“...covers eighty percent of the land area of Upper Nile especially in Jonglei and Unity States...and northern parts of Eastern Equatoria...occurring on high land composed of sandy loams...two palms commonly found are: <i>Hyphaene thebaica</i> & <i>Borassus aethiopum</i>...and broad-leafed species such as <i>Combretum spp.</i>, <i>Celtis integrifolia</i>, <i>Randia nilotica</i>, <i>Albizzia sericocephala</i>, <i>Bauhinia spp.</i>, <i>Balanites aegyptica</i>, <i>Diospyros mespiliformis</i>, <i>Acacia sieberiana</i> & <i>A. polyacantha</i>...and the immediate area subject to flooding is covered with <i>Acacia seyal</i> and <i>Balanites</i> type savanna.</p>

Imatong, Dongotona & Didinga Mountains	-----	“...a rising, undulating plain of mixed grass woodlands changing to a belt of bamboo (<i>Oxytenanthera abyssinica</i>) at 1,300m altitude...to <i>Acacia abyssinica</i> at 1,600 m...in the wetter parts, there is a tree belt of about 15 m. height of <i>Albizia zygia</i> , <i>Terminalia glaucescens</i> , <i>Vitex doniana</i> , <i>Lannea kerstingii</i> , <i>Ficus glumosa</i> & <i>Acacia sieberiana</i>montane zone forests start at about 1,500 m altitude and can be divided into three zones: lower montane characterized by <i>Podocarpus milanjanus</i> , mixed with <i>Olea hochstetteri</i> & <i>Syzygium gerradii</i> ; in the upper Montane, Podocarpus forms the climax forest but the bamboo <i>Arundinaria alpina</i> occurs over fairly large areas...above 3,000m the heath lands are dominated by <i>Erica arborea</i> & <i>Myrica salicifolia</i> .
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Source: HCENR 2001. *Sudan Country Study on Biodiversity*.

Forest Management Operations and Reforestation in Southern Sudan

The forestry potential of Southern Sudan has been recognized since the colonial times and certain efforts at protection, management and plantation were made to take advantage of the better growing conditions there. For example, three different kinds of forest reserves were gazetted: protection forests (typically, the “bowl” forests, along riverbanks and in the vicinity of the Roseires Dam); protection forests with utilization of net yield (typically on steep lands or in the hills); and sustained yield forests on which regeneration can be assured (many of which have been planted with Teak and other species) (Itto et al 2000). Unfortunately, good data on the area of these many reserve forests and on the activities undertaken on them is presently lacking as records were lost or destroyed during the civil war.¹¹ **Table No. 4** provides a summary of the data and information available on the establishment of reserve forests in the Sudan. Similarly, although a number of sawmills were operating in the South, these are no longer operational also as a result of the war and their production records also lost.

¹¹ Refer to the *Report by the Technical Committee on Natural Resources Management and Utilization* (Itto et al 2000), pp. 58-60 or the Boateng Report on *International Market Potential for Rare and Exotic Sudanese Processed Wood Products* (Boateng 1998), neither of which unfortunately have been able to resolve these data lapses.

Figure No. 2- Vegetation of Sudan

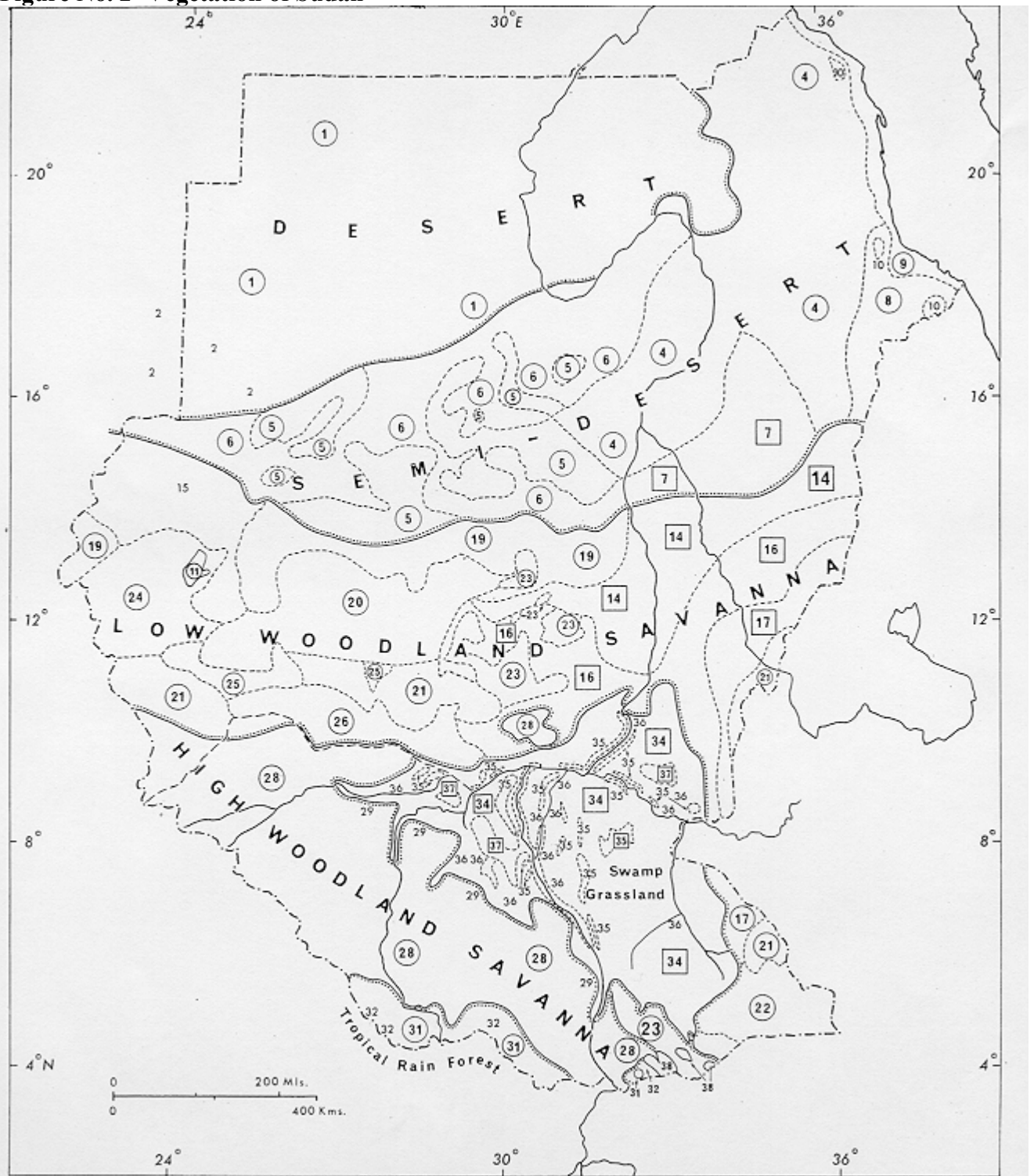


Table No. 4 - Gazetted Forest Reserves of the Sudan

Region	Reserves		Percentage of Total Area	
	Number	Area (1000 has)	North/South	Total Sudan
Northern	9	4.3	0.7%	0.3%
Eastern	64	208.9	32.1%	16.3%
Central	145	186.1	28.6%	14.6%
Kordofan	37	197.7	30.4%	15.5%
Darfur	20	47.3	7.3%	3.7%
Khartoum	7	6.2	0.9%	0.5%
Total Northern Sudan	282	650.4	100.0%	50.9%
Bahr El Ghazal	16	321.8	51.3%	25.2%
Upper Nile	23	65.5	10.4%	5.1%
Equatoria	29	240.5	38.3%	18.8%
Total Southern Sudan	68	627.7	100.0%	49.1%
Total Sudan	350	1,278.2	----	100.0%

Source: after Badi et al 1989. *The Forests of The Sudan*.

Of much more recent vintage, and as part of USAID support under the STAR Program for Strategic Analyses and Capacity Building, is a report on the *Kagelu Teak Plantation Survey and Inventory* (Tongun et al 2002). This document reports on the findings of the SACB Forestry Working Group carried out in the Teak (*Tectona grandis*) plantation block (see photo below) in Kagelu from February to March 2002. This interesting and important work has served to underscore the potential of the plantation Teak resource base found in many areas of Southern Sudan as a result of activities begun during colonial times and continued after Independence. These Teak plantations can be found both in reserve forest areas and on community and individual plots spread widely across Western Equatoria and extending into southern Bahr el Ghazal.

The Working Group produced a carefully surveyed map of the Teak plantations in the Kagelu Reserve Forest (thought to have once encompassed a larger area than that now planted with Teak) and identified the different compartments within the forest as a basis for future management. In addition, the group calculated the actual area planted to Teak (992 hectares) and the estimated standing volume (165,580 cubic meters) on the area. This work is a good start to the kind of efforts that will be required to harness the promising production potential of timber in the South for reconstruction, development,

employment and income generation.¹² The report also discusses the need and prescriptions for management which include opportunities for selective harvest of mature stands, thinning of untended pole stands, and routine measures of maintenance and protection essential to effective stewardship of these plantations.

As part of these efforts, some very innovative and promising work has been done in “destumping” degraded parcels of Teak to bring them back into production of useful round wood and timber products. On a test parcel of the Mamury Reserve Forest near Yei, about one hectare of highly degraded Teak plantation has been treated with the “destumping” technique—namely, cutting off with a chainsaw all but about 15 to 20 centimeters of the tree above ground level (see photo below). Each stump so treated then begins to coppice, producing numerous shoots that will form a series of poles and/or a new tree. Properly managed and protected, the coppice shoots can lead to useful pole products required in the local marketplace and eventually, be transformed into a stand of reasonably good form and timber production. The hypothesis of this pilot experiment is that the procedure will be cheaper and more effective than replanting the degraded Teak plantations common in the area. Costs of the treatment are offset by the production of some timber and considerable quantities of firewood. The eventual applicability of this technological intervention must be based on careful record keeping and cost structure analysis to determine if it is more cost effective than starting over from scratch.

Such operations will, if carried out in the future, generate substantial amounts of fuelwood (and possibly some other timber products) but the Southern Sudan Forest Department should resist the temptation to become a firewood supplier, for both marketing and efficiency reasons. A private contractor or local small contractors would probably be a more cost effective way of off-setting the costs of destumping. The Forest Department may also wish to test bowsaws for destumping in younger and smaller diameter plantations. These may prove just as effective especially for local farmers whose plantations tend to be younger and who are unlikely to be able to afford a chainsaw.

These widespread Teak (*Tectona grandis*) plantations in the southeast of the country, as mentioned above, constitute a potentially useful resource that could be harnessed to help finance the development and administration activities of the Southern Entity. Similarly, there are some community or private plantations of Teak in the area that could generate needed building materials and/or income for their owners. However compelling the financial needs, all concerned, whether SPLM or local people, would be better off if these stands were harvested more effectively, efficiently and sustainably.

The ongoing exploitation activities (the Logotech operation at Kagelu and smaller operations by the Forest Department there) are none of the above; the waste of a valuable natural resource arises out of under-funding and limited capable supervision, poor felling practices damaging the residual stand, high-grading of good plots, inappropriate saw

¹² Although the Kagelu Teak Plantation Survey and Inventory Report contains some inconsistencies and data presentation concerns, most of these are related to the complex task of statistical analysis in forest inventory, and could most probably be rectified with advice from an experienced professional forester.

milling technology and poor planning (delays to find fuel or spare parts).

Southern Sudanese foresters recognize these realities but will need more information to build a compelling case to be able to hold off the political pressure to harvest this resource as soon as possible. There is a need for a comparison of the alternatives of exporting the teak versus that of using it in the national marketplace (a more careful analysis of the cost/benefit realities of using the teak to earn foreign exchange through export versus its use as a building material, for example, in government/donor sponsored reconstruction of schools and clinics). Even though world prices for teak timber (\$1000-3000/m³) are considerably higher than the price being paid by the present contractor (\$100/m³), the key to considering any price changes revolves around an understanding of the costs of the operation (residual stumpage value calculations—a conventional and fairly straight-forward analytical forestry methodology).¹³

Environmental Threats and Opportunities Related to Forests and Woodlands

Demand for Wood Fuels, Timber and Deforestation in the South: Resettlement will also temporarily increase the rate and spread of deforestation, as a result of land clearing for agriculture, to provide wood supplies for rebuilding family homes and compounds, also for wood fuels for domestic energy needs.

It is estimated that building a simple Tukul can consume 50 small acacia (or similar) trees. The barns (“Luacs” in Dinka) or churches consume much larger numbers of trees. Another related practice that consumes significant quantities of trees is the construction of fencing (the “zariba”) used to contain or exclude livestock. The buildings mentioned above reportedly last 5 to 10 years depending on the quality of their construction, choice of species and termite pressure. In that period, many of the smaller trees could be regrown. A mitigation measure that could be suggested is to encourage the local people to do early burning and avoid grazing goats in the pole wood supply areas around their villages for a few years. This will allow the natural seedlings that will almost certainly appear to reach a size above which they are less susceptible to fire and grazing damage.

Fuelwood supply, scarcity and impact is very site specific and there is a need to avoid simplistic approaches to it as a commodity and a form of land-use. Several Southern Sudanese informants suggested the possibilities of plantation forestry to meet the fuelwood needs of emerging larger urban areas in the country. This probably will not work based on extensive financial and economic experience in many other countries and situations. Plantations require an investment which capitalized over the years required to produce fuelwood (7 years or maybe less) leads to a product that cannot compete in the marketplace with fuelwood collected freely in the bush that only bears the costs of cutting and transport.

¹³ Further information on the values of timber and the methods of calculating them may be found in the FAO Forestry Department publication: FAO Forestry Paper No. 43— *Forest Revenue Systems in Developing Countries*. Rome, Italy, 1983 and/or on the web site of the International Tropical Timber Organization (<http://www.itto.or.jp>).

There is a growing issue of charcoal production in Southern Sudan, both for local use and for sale along the roads to Uganda. Artesanal production of charcoal, using earth mounds, is notoriously inefficient and even more difficult to control. Much more study will be needed to identify a viable strategy that the Southern Sudan Forestry Department could implement to bring this situation under sound management. First and foremost is the recognition of the realities of supply and demand; unilateral efforts to ban charcoal production could have a negative effect, by stimulating the perception that supply will be curtailed, therefore driving up the prices because of continuous demand and thus stimulating more local people to become involved in the trade.

At least two mitigative measures can be recommended at this point: encouraging and facilitating replanting of fast growing species (for example, with *Cassia siamea*, a species found on the Kagelu Reserve Forest) or even timber species, such as Teak, as just compensation for the trees cut for charcoal; and encouraging those who are clearing land for agriculture to use the wood cut to produce charcoal for the marketplace. The most important point is the recognition that wood fuels have relatively stable demand and therefore, engaging in supplying it, especially under favorable growing conditions such as those found in the South, can be a viable on-farm income diversification option that adds value to efforts to conserve and manage local forest cover.

Similarly, the idea of introducing improved cook stoves that use fuelwood (as opposed to charcoal) will be unlikely to lead to significant energy cum wood savings. Fuelwood as a raw material has proven to be too variable as a combustible to allow for the design of a truly energy efficient “fuelwood stove” (on the other hand, charcoal is a much more uniform raw material for burning and several successful “bucket type” improved charcoal stoves have been developed, eg. the Kenyan Jiko).

There is, however, a need to avoid the over-simplification of equating “reforestation as the solution to deforestation”. Deforestation has never been curtailed by reforestation; it is a matter of identifying the causes behind deforestation and addressing them. Policy makers sometimes assume that one day they will deal with deforestation by calling in the foresters to reforest. By that time, it is too late and widespread environmental damage has occurred.

Furthermore, it is also important to be wary of the notion of the “miracle tree” for reforestation in Southern Sudan; it is an illusion. Of particular concern is the prospect of the “menace of mesquite”. Mesquite (*Prosopis spp.* other than the native African Mesquite, *Prosopis africana*) are common in northern Kenya and grow well in the area, for example, around Lokichoggio. The species provides good fodder, both leaves and pods, produces firewood and charcoal and some roundwood for home construction. Unfortunately, it is a highly invasive plant, especially in periodically wet or flooded areas and has been identified by the International Centre of Insect Physiology and Ecology (ICIPE) as one of its target concerns in work addressing the biological control of weeds in the Greater Horn of Africa. If it were to spread into the Sudd, it could possibly take over and lead to significant ecological losses. This has already happened in northern Sudan, in the Gash Delta of the Atbara River which has been almost completely taken

over by Mesquite.

Under the upcoming ISP, USAID plans to support the establishment of a forestry training center on the site of now destroyed Forestry Training Institute that was under development by GTZ at Kagelu, near Yei and which was destroyed during the war. The plantation forests around Kagelu, mainly of Teak, would provide a very useful practical training area for the participants at this new training center. USAID may wish to consider asking the SPLM to halt the ongoing exploitation activities taking place in this particular reserve forest so as to ensure that the full spectrum of management options can be offered as part of the training curriculum.

In addition, there is an important opportunity to provide the SPLM with technical advisory services in the area of forest management, utilization and conservation. A forestry advisor based in Kagelu or Yei could assist the Forest Department of Southern Sudan to identify the options for optimizing the utilization and transformation of the Teak plantation resource base and also of the extensive natural forest resources. S/he could also likely assist in the development of the training curriculum for the Kagelu Forestry Training Center based on an in-depth understanding of the challenges and opportunities facing the forestry/woodlands sector in Southern Sudan.

The Forest Resource Situation in the North

Although Northern Sudan shares some of the forest types found in the South, the majority of the forest resource base there is made up of open woodlands and savannahs of the Acacia type. The southeastern clay plains of Sennar, Gedarif and Blue Nile once had extensive forest areas and supplied large amounts of fuelwood, charcoal and poles for the areas further north and the cities. Unfortunately, given the relatively better rainfall conditions, many of these areas have now been cleared for mechanized farming.

Northern Sudan was also once the source of 85% of the world's supply of Gum Arabic, produced from the indigenous "Hashab" (*Acacia senegal*), once the second most important export crop after cotton. In some cases in Kordofan, demand was so high that an indigenous agroforestry practice of "Gum Gardens" emerged whereby local people planted the tree in widely spaced, orchard like configurations and practiced inter-cropping between the trees. The present status of the Gum Arabic resource and trade is unknown. In the mid-1980's, faced with persistent drought and low prices for their outputs as a result of the ineffectiveness of the monopoly control of the market by the parastatal Gum Arabic Trading Corporation and a 40% excise tax on its export, many small producers chose to cut down their trees and convert them into charcoal just before leaving the area.

The hills forests of the Red Sea Hills and Jebel Marra also have more significant tree cover but these, despite reservation and attempts at management, have long been under heavy cutting pressure. In addition, there are *Eucalyptus spp.* and Poplar (*Populus spp.*) stands in many of the cutoff areas of the irrigation schemes which take advantage of seepage and water supplies that are inadequate for the chosen crop species. In the Gash Delta of the Atbara River in Kassala State where mesquite (*Prosopis juliflora*) has

invaded these wetlands, there is a growing charcoal production system.

Northern Sudan also has some special forests characterized by unique ecological conditions, typically related to the presence of water and drainage-ways. Along the Nile and other rivers, there are some stands of more productive Sun Forests (*Acacia nilotica*) which grows to greater size but is much sought after for rustic building materials and even cut commercially for railway sleepers because of its strength and durability. Two palms were once relatively abundant. The Dom Palm (*Hyphaene thebairca*) occurs in well drained permeable soils along river banks or in depressions, in Upper Nile and along the Atbara River. The Doleib Palm (*Borassus aethiopum*) is found, sometimes in pure stands, along seasonal water courses on silty soils in the northern fringes of the Nuba Mountains and in neighboring Kordofan. *Tamarix nilotica* is a common species found along the Nile and other river courses, growing in areas where the rise and fall of the water has left relatively high salt concentrations. It was one of the principal species found in the Gash Delta before the invasion of the Mesquite. Along the 850 kilometers of the Red Sea Coast, there are groves of mangroves (mainly *Avicennia marina* and *Rhizophora spp.*). The mangrove forests have been much over-utilized by man for poles, firewood and as a grazing ground for camels.

The undeniable reality, however, is that Northern Sudan is a wood deficit area, in dire and constant need of fuelwood, charcoal and building materials whose supply has been dramatically affected by the expansion of agriculture and livestock. In 1990, the Government in Khartoum established the Forests National Corporation (FNC) to replace the Forests Administration to provide a more dynamic structure to meet the supply of goods and services of the forests of the country. In recognition of this reality, there have been growing efforts at community forestry since the early 1990's which included: re-stocking of the gum belt, participatory, community forestry efforts at agroforestry, including tree planting for windbreaks around villages in the north, and projects to promote community involvement in the conservation and management of officially reserve forests.¹⁴

Reliable data/information on the present status of community forestry or reserve forest management efforts under the FNC was unavailable for this assessment.

It is clear, however, that the Government in Khartoum will have to make serious progress in order to meet the wood and woodfuels needs of its people and to do so in a sustainable manner. Estimates made as part of the FAO Fuelwood Development for Energy Project suggests that, given the inherently slow growth rates of the forests and woodlands of the North (estimated at 1 cubic meter per hectare per year) and per capita demand for woodfuels (estimated at 0.5 - 1 cubic meter per year), 25 million hectares of these forests would have to be brought under management (Vink 1991). It is also possible that should

¹⁴ Pilot activities for community-oriented reserve forest management got underway in the late 1980's on the under-stocked Rawashda and Wad Kabo Reserve Forests in Southern Gedaref by the FAO with support from the Government of the Netherlands. See the Report: *Management of Natural Forest: the Rawashda Experience* by A. Vink, FAO Fuelwood Energy for Development Project (GCP/SUD/033/NET), Rome, 1991, pp.- 66.

a normalized trade relationship develop between the North and the South as a result of the Peace Initiative, that wood products and woodfuels could become an increasingly traded commodity. If wood fuels, particularly charcoal which is more economical to transport, could be produced under sustainable management regimes, it could become an ecologically and economically viable production option for the people and government of the South.

The new USAID ISP notes that assistance to the Government in Khartoum with activities to “reforest and restore degraded natural areas and reestablish resource management programs” is possible under the Horn of Africa Act. While there are doubtless vast areas in northern Sudan that might benefit from reforestation, care should be exercised in choosing the actual sites so as to avoid conflicts with pastoralists. Both USAID and the Government in Khartoum, however, should also understand that while wood fuels harvest has led to the wholesale degradation of extensive areas of forest in the north, it has been the policy framework promoting large-scale expansion of agriculture which probably had a more profound effect on the scale of deforestation. There are also significant opportunities for working with individual farmers and local communities in reforestation and agroforestry programs (e.g., windbreaks and gum gardens) and even co-management of natural forest areas that could improve farming conditions and productivity and reduce poverty.

WILDLIFE RESOURCES AND TERRESTRIAL BIODIVERSITY

There is probably no country in the world where the sustainability of once significant wildlife resources is under greater threat than Southern Sudan. Unfortunately, the present status of the country’s biodiversity assets is largely unknown and not easy to know as the fauna, unlike the flora, does not stay in place allowing itself to be inventoried with ease. There are no quick and dirty ways to investigate and/or estimate animal numbers on a scale commensurate with the size of a country such as the Sudan. Similarly, few if any reference documents of recent vintage exist or could be located as the profile of wildlife and biodiversity concerns is something that has begun to attract more attention and support as a development issue since the start of the civil war in the Sudan.¹⁵

Fortunately, USAID has been supporting work under the STAR program to ascertain the current status of protected areas, wildlife and biodiversity conservation. The following information on the protected areas of Southern Sudan were drawn from those sources. Conservation efforts were part of the colonial administration and a number of national parks, game reserves and controlled game areas (safari hunting areas) were created, and later expanded under the 1975 Wildlife Conservation and National Parks Act for the Southern Region (Itto et al 2000). The following table (**No. 5**) provides some data and information about the protected areas of Southern Sudan.

¹⁵ Two important reference reports were identified, and the latter consulted; they are: Blower, J. (actual date unknown but thought to have been written in late 1970's/early 1980's) *Wildlife Conservation and Management in Southern Sudan*, FAO Forestry Department, Rome; and Boitani, L. 1981. *The Southern National Park: A Master Plan*. Report under Technical Cooperation between the Sudan/Southern Region and the Republic of Italy. Prepared by the Instituto di Zoologia, Facolta de Scienze dell'Universita di Roma, Rome/Juba, December 1981.

More recently, the Wildlife Working Group under the aegis of the STAR Program has undertaken wildlife surveys (and companion surveys) in Nimule National Park (one survey carried out in wet season-2000) and Boma National Park (two surveys, one in the wet season-2001 and one in the dry season-2002).¹⁶ All three wildlife surveys have added valuable information to the knowledge base regarding the overall status of wildlife in these parks and, by correlation at least to some extent, in Southern Sudan.

Table No. 5- The Protected Areas of Southern Sudan (National Parks and Game Sanctuaries)

Name	Date Established	Area (Sq. Km.)	Location/ Province	Species
National Parks				
Southern	1939	23,000.	Equatoria & El Buhyrat	Elephant, White Rhino, Eland
Nimule	1954	410.	Equatoria	Elephant, Hippo, Water Buck
Radom	1983	12,950.	Southern Darfur	Elephant, Giraffe, Giant Eland
Boma	1978	22,800.	Upper Nile	Elephant, Giant Eland, Buffalo
Badingilo	1989	84,000.	Equatoria	Elephant, Black Rhino, Buffalo, Giraffe
Game Sanctuaries				
Shambe	1978	620.	Lakes	White Rhino, Nile Lechwe, Buffalo
Kidepo	1974	1400.	Equatoria	Elephant, Lesser Kudu, Cheetah
Chelkou	1975	5,500.	Bahr El Ghazal	Elephant, Buffalo, Giant Eland
Ashana	1939	900.	Bahr El Ghazal	Elephant, Giant Eland

¹⁶ Companion surveys in the Nimule area were undertaken as well by other SACB Working Groups, one as a Livestock Survey (Ater, Lado & Uchalla 2002) and the other on the Food Security Situation (Kwaje, Arop & Odu 2002). The survey work carried out in Boma in 2001 was presented in the form of an integrated report on: *The Impact of Conflict on the Boma National Park: The Status of Food Security, Wildlife and Livestock.*

Bire Kpatuos	1939	5.	Equatoria	Bongo, Yellow-Backed Duiker
Bangangai	1939	6,000.	Equatoria	Forest Elephant, Bongo, Forest Buffalo
Mbari-Zunga	1939	120.	Equatoria	Bongo, Bushbuck, Yellow-Backed Duiker
Numatina	1939	2,100.	Bahr El Ghazal	Elephant, Giant Eland, Roan Antelope
Zeraf	1939	9,700.	Upper Nile	Nile Lechwe, Sitatunga, Hippo
Fanyikang	1935	480.	Upper Nile	Nile Lechwe
Juba	NA	NA	Equatoria	NA
Mongalla	NA	NA	Equatoria	NA
Meshra	NA	4,500.	Equatoria	NA
Boro	NA	NA	Equatoria	NA

Source: Itto et al 2001. Report by the Technical Committee on Natural Resources Management and Utilization.

The **Nimule National Park Survey** set out to determine the current status of wildlife populations and the conditions affecting them, with particular attention to the status of three keystone species: elephant, hippopotamus and Ugandan Kob. Survey results for these three species (direct/indirect counts, respectively) were as follows: elephants: none observed as the animals reported had migrated out of the park but were seen in an adjacent area/156 specimens; hippo: 413 specimens/853 specimens; Uganda Kob: 1829 specimens/1706 specimens (Morjan et al 2000). The report concluded that although small and under intense human pressure from both local populations and a large number of IDP's, Nimule was still considered as a viable area for the national park. Poaching, however, remains active and accordingly, there is a pressing need to staff up and better equip the Southern Sudan Wildlife Authority personnel posted there.

The combined survey carried out in the **Boma National Park** was specifically designed to assess "the impact of the current conflict (1983 to present)" on the resources of the area. It sought to address a series of articulated objectives: "to assess the impact of the conflict on major wildlife populations; to appraise the status of food security and settlement patterns around the Park; to evaluate conflict prevention and management capacities of the communities and Civil Authority of Southern Sudan (CANS); and to develop a strategy with local communities for enhancing food security by improving agricultural production while simultaneously reducing negative impacts on wildlife and other natural resources" (Lual Deng et al 2001).

From a wildlife and biodiversity perspective, Boma National Park is particularly important because of its size (2.28 million hectares) and the fact that it was once the site of one of the largest wildlife migrations in the world, that of the White-Eared Kob. The articulated nature of the surveys (wildlife, food security and livestock) was predicated on early results of USAID efforts during the period 1994-1999 which “demonstrate that South Sudan can achieve a food surplus if an integrated approach to conflict resolution, prevention and management, community-based livestock development and wildlife conservation is undertaken” (ibid).

The findings of the Boma Surveys are doubtless a microcosm of the challenges facing wildlife conservation in South Sudan. They conclude that: “The food production systems of all the communities in and around the Park are becoming greatly reliant on natural resources (wild foods collection, hunting and fishing) while the traditional livelihood activities such a crop production and rearing of livestock are gradually and regrettably diminishing...that the communities are more vulnerable to food insecurity...hunting has greatly expanded during the conflict as a result of the proliferation of firearms...that the Suri and IDP’s have been restricted in accessing natural resources as they constitute now the battlefield of tribal conflicts” (ibid). As the above suggests, the survey also noted significant declines in once relatively abundant animal populations, including major reductions in the numbers of White-Eared Kob, Lesser Eland, and Roan Antelope (ibid).¹⁷

The 2002 Dry Season Wildlife Count Report concluded that the Boma “Park still has a high biodiversity despite the fall in numbers of wildlife” and that...“Although hunting is not allowed, wild animals provide an important source of livelihood for many of the communities in and around the Boma ecosystem”...that “Hunting for meat and skin to supply local and foreign markets has been in the rise targeting in addition to Kob, other endangered species such as Elephant, Leopard and Lesser Kudu”...and that Leopard, Lesser Kudu Skins and Ivory” are available in local markets (ibid). Furthermore, the proximity to the border with Ethiopia indicates that “there are an active Elephant and other animal species poaching groups that cross into Southern Sudan” (ibid). The report suggests that both civil authorities and some communities seem to have a potentially positive attitude towards wildlife conservation, as was demonstrated in a Wildlife Workshop held in Boma in December 2001 but that alternative livelihood strategies will have to be found to ensure that conservation imperatives can be met.

The wildlife and biodiversity assets of Southern Sudan are not only found in the protected areas nor are they only a matter of keystone mammalian species. Large numbers of animals move widely, even into adjacent countries and typically towards the wetland areas in the dry season. This will make the task of wildlife and biodiversity conservation more challenging and almost by definition, entail a good deal of work with communities and other sectors to manage pressures and conflicts arising out of human-wildlife interactions. Similarly, the spectacular bird life of the Sudan is thought to include 937 species, of which over 600 are resident and over 300 regular seasonal migrants. Among

¹⁷ In a number of species, there were inconsistencies in the data collected and their comparison with an earlier wildlife count in 1980.

the latter, Palearctic migrants are particularly important and 17 species of these are considered as being of global conservation concern (Robertson, P.2001). Fortunately, the bird life is little hunted or harassed although habitat loss, particularly in wetland situations, could have significant adverse impacts on this component of biodiversity.

Environmental Threats and Opportunities Related to Biodiversity

The widespread availability of firearms is doubtless contributing to large scale and completely unsustainable levels of hunting of game throughout the Southern Sudan. Evidence of game meat being consumed, both for subsistence and for sale, are commonplace. There is also an alarming availability of ivory. It is easily and apparently cheaply available in town marketplaces (seen for sale in Rumbek); many young people wear bracelets, armbands and rings of ivory. Some say it is the result of SPLA sanctioned killing of elephants to feed the fighters during the height of the war; others believe it is an on-going problem.

A recent high level directive from the Office of the Chairman of the SPLM has prohibited these practices in the future which is an example of good leadership. The Wildlife Working Group believes that the proactive effort at arms surrender as part of demobilization will have direct benefits for wildlife conservation. At the outset, unequivocal and very public pronouncements of absolute prohibitions are probably warranted against the hunting of elephant, rhino and chimpanzee if the Southern Sudan Wildlife authorities wish to demonstrate their conviction about biodiversity conservation and thus attract continuing support from the global community that they require and deserve.

Hunting is likely to be most acute in areas where returning IDP's and refugees are the most difficult to reach with food aid and relief supplies. Hunting for game meat will increase significantly as IDP's and refugees return to their homelands and need sustenance while waiting for the crops to grow. Where these areas coincide geographically with known areas of wildlife richness, special efforts should be made to ensure the timely and sufficient provision of relief. Commercial hunting is also on the rise and efforts will be required to bring it under control. It is often not really a matter of short-term food security. Typically, the commercial hunters respect no rules and decimate wildlife populations whenever they get a chance. At a minimum, there should also be restrictions on which kinds of game meat can be sold in public.

The Wildlife Department of Southern Sudan, according to its leadership and other ranking staff members, wishes to reconstitute itself as it once was, with territorial staff posted in all the payams where there are significant wildlife resources in order to take control of this situation. It is a simple and apparently logical response but is probably unworkable, for a number of reasons: high costs of employing and equipping these staff members; some likelihood that poorly paid or irregularly paid and poorly supervised (transport constraints for senior staff) game guards may turn to rent seeking behavior as a means of sustaining their families, or worse, become poachers themselves; such behavior will reinforce community perceptions that wildlife is an open access resource harvested

by others so there is little reason for conservation; and it will be virtually impossible to comprehensively control hunting with so many firearms available.

Quite obviously, a much more strategic and staggered approach to biodiversity conservation by the Wildlife Department will be needed in the near-term, identifying the priority actions that make the most sense and are likely to be most effective with the resources available from government and donor partners. Here again, as in so many other natural resources related policy areas in Southern Sudan, there is a real opportunity to make the right choices as the new Southern Entity takes on the mantle of responsibilities for the country. USAID is already assisting in that regard through the workings of the Wildlife Working Group under the SACB/STAR program. It can and probably should do more in this area in order to aid Southern Sudan to make the most effective development use of its as yet poorly understood but promising wildlife potential.

The present efforts at wildlife surveys under the SACB initiative in Boma and Nimule are an excellent start but have demonstrated the difficulties of effective wildlife population studies. These efforts would benefit, however, if their duration could be increased, the level of effort (LOE) expanded significantly and if the operational resources to get the job done could be improved. For example, thirty work days will be woefully insufficient for the survey in Southern National Park, one of the largest national parks in Sub-Saharan Africa (2.3 million hectares) which once (1981) harbored vast herds of animals: (15 thousand elephants, 160+ rhinos; Boitani, 1981). Aerial surveys would be considerably more effective if the issue of security for the airplanes and crews could be worked out. It is also likely that with the present fleet of aircraft operating in Southern Sudan and the availability of support services for aircraft operation already in place, the costs of implementing an aerial survey could never be cheaper.

A wildlife training center set up in Boma National Park is expected to be one of the activities under the new ISP. However, the nature of the training curriculum and the target audience for participant trainees are unclear. Several informants suggested that the training there, like the other USAID supported training centers, will focus on enterprise development and business opportunities related to wildlife. It is difficult to understand exactly how people will make money based on wildlife resources, especially since it will be many years before Southern Sudan can claim a portion of the declining global demand for ecotourism. If on the other hand, the mechanism is intended to be commercial hunting for game meat, game ranching or sport hunting, this will require improved data on wildlife population status and sustainable harvest levels in order to ensure that biodiversity conservation norms are being respected.

The “what” to do in the wildlife and biodiversity conservation sector is complex, and perhaps the best approach will be to consider the “how” to do it. Some years ago (1998), USAID took the very logical step of attempting to engage an international private voluntary organization—World Wildlife Fund—to take the lead in guiding the SACB activities related to wildlife. Although this initiative was never implemented, the time may be ripe for reconsidering it. Organizations like Conservation International and the World Wildlife Fund bring skills, experience, long-term commitment that is not always

donor dependent, and resources of their own, largely raised through private donations, to the challenge of responding to the global imperatives of biodiversity conservation. A USAID commitment to a cooperative agreement with such an organization would go a long way to fulfilling its obligations under the Section 119 amendment to the Foreign Assistance Act. The chosen cooperating sponsor under such an agreement could work with both the Southern Sudan Wildlife Department and the Southern Sudan Wildlife Conservation Organization to build skills and capacity and help develop a strategy for the conservation and development of biodiversity in the country. Because of their international stature, such an organization might also find it easier to bridge the gap between the North and the South.

Biodiversity Conservation in Northern Sudan

The challenge of wildlife management and biodiversity conservation in Northern Sudan is perhaps even more difficult than the situation in the South. Several recent efforts in response to related international commitments and treaties (see **Box** below) have been undertaken to assess the status of biodiversity and develop an action plan by the Government of Sudan, its environmental agencies and with donor support from UNDP and IUCN. In March, 2000, an Environmental Protection Act was decreed by the President placing the Higher Council for Environment and Natural Resources (HCENR), previously established in 1992, under the Ministry of Environment and Tourism. This body is expected to take on the responsibilities for inter alia making environment policy...and the “Conservation of animals and all living beings and their protection from the threats of extinction by poaching or other dangers” (HCENR 2001).

As part of its early efforts to fulfill its mandate, the HCENR collaborated in the *Sudan Country Study on Biodiversity* as part of a project (National Biodiversity Strategy and Action Plan Project (SUD/97/G31) with technical assistance from the World Conservation Union (IUCN) and funding from the Global Environment Facility (GEF). The outcome of this Study, despite its length, is rather shallow in its treatment of wildlife, offering little more than academic or anecdotal discussions on the topic.¹⁸ While the report offers some considerable narrative insights into the forest, insect, agricultural and fisheries aspects of biodiversity, good information on the status of wildlife is almost completely absent. Although access to the South and its wildlife populations was understandably impossible given present hostilities, there is no information on wildlife present in the north, even in the Dinder National Park in Sennar State still under its control. Accordingly, this assessment can only conclude that the matter of wildlife and biodiversity conservation, as far as Northern Sudan is concerned, remains an open question until more reliable data and information can be compiled.

¹⁸ Two other reports originating in Northern Sudan under the aegis of the Ministry of Environment and Tourism are themselves almost completely devoid of any reliable data and information on wildlife; they are: *First National Report on the Implementation of the Convention on Biological Diversity* (MET 2000) and *The Sudan's National Biodiversity Strategy and Action Plan* (MET 2000a).

Government of Sudan Commitments to International Conventions on the Environment:

- African Convention on the Conservation of Nature and Natural Resources, Algiers, 1968- entered into force in Sudan in 1980.
- Agreement on the Conservation of African-Eurasian Migratory Waterbirds- ratified by Sudan in 1996.
- Convention Concerning the Protection of the World Cultural and Natural Heritage, Paris, 1972- ratified by the Sudan in 1974.
- Convention on Biological Diversity, 1992- signed by Sudan in 1992; entered into force in Sudan in 1996.
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), 1973- entered into force in Sudan in 1983.
- Convention on the Ban of the Import into Africa and the Control of Transboundary Movement and Management of Hazardous Wastes within Africa, Bamako, Mali, 1991- signed by the Sudan.
- U.N. Convention to Combat Desertification in Countries Experiencing Serious Drought and/or Desertification, particularly in Africa, 1994- signed by Sudan in 1994 and entered into force in 1996.
- Montreal Protocol on Substances that Deplete the Ozone Layer, 1987- accession by Sudan and entry into force in 1993.
- U.N. Convention on the Law of the Sea, 1982- ratified by Sudan in 1985.
- U.N. Framework Convention on Climate Change, 1993- entered into force in Sudan in 1994.
- Vienna Convention for the Protection of the Ozone Layer- accession by Sudan in 1993

FRESHWATER AND WETLAND RESOURCES

The experience with the controversy surrounding the Jonglei Canal has amply sensitized the Southern Sudanese to the potential environmental and social consequences of draining and/or degrading wetlands. These imperatives remain as valid today as they once were in the past. Here again, however, up-to-date data and information, particularly dis-aggregated north from south, on the status of water resources is fragmentary or absent. Nevertheless, some indications of the water resources and wetlands situation can be mentioned albeit with considerable reservations about their validity.

The Nile is the major water body of the Sudan, traversing the entire length of the country from the southern border with Uganda to the northern border with Egypt. The Sudan's share of the waters of the Nile, agreed in a 1959 Nile Water Agreement with Egypt, are reported to be 18.5 cubic kilometers (out of a total more than double that) annually (Ejigu 2003 citing the Sudan National Water Policy of 1999). This is enough water to irrigate 3.7 million hectares annually at an average depth of 500mm¹⁹.

The Ejigu Report cites current irrigation water usage at 14.0 cubic kilometers indicating that the country is not able to currently use the full allocation of water user rights agreed in its Treaty with Egypt, owing to limited investment in the irrigation sector and/or present inefficiencies in the existing schemes (ibid). This is in contrast to the perception in the early 1970's that Sudan had "exhausted its share of the Nile waters yet required more water for irrigation projects in the mid-regions of the country" which is what spawned the renewed efforts to build the Jonglei Canal in 1974 (Goldsmith, Abura &

¹⁹ How this figure has been calculated: A cubic kilometer of water is equal to 1 billion cubic meters of water. Irrigating a hectare with 500mm would require 5000 cubic meters. Each cubic kilometer can thus irrigate 200,000 hectares to a depth of 500mm, multiplied by 18.5 cubic kilometers equals 3.7 million hectares.

Switzer 2002). Studies at the time suggested that as much as 50% of the water entering the Sudd Wetlands was lost to evapo-transpiration which could be avoided by linking the Nile directly with a canal between Bor and Malakal.²⁰

In addition, according to the 1999 Sudan National Water Policy Document, the water available annually to the Sudan (after Ejigu 2003) is per the following table (No. 6):

Table No. 6- Annual Water Availabilities to the Sudan

Water Source	Quantity (km³)	Constraints
Sudan Share of Nile Water	20.5	Seasonal pattern, coupled with limited storage capacity.
Non-Nile Streams	5.5	Highly variable, short duration flows which are difficult to monitor or harvest. Some are shared with neighboring states.
Renewable Groundwater	4.0	Deep water entails high cost of pumping especially in remote areas with weak infrastructure.
Present Total	30.0	-----
Expected Additional Share from Swamp Reclamation (e.g., the Jonglei Canal)	6.0	A capital intensive project with significant social and environmental costs (unlikely to go ahead).
Total Water Available to the Sudan	36.0	-----

Groundwater resources in the North are mainly found in the Nubian Sandstone aquifer, a massive non-renewable source of water thought to have been deposited 15,000 years ago as the result of glaciation in north and central Europe. This aquifer is shared by four countries: Libya, Egypt, Chad and the Sudan. There is some concern that the massive water development scheme being built by Libya and known as the “Great Man-Made River” involving thousands of kilometers of canals and piping and hundreds of wells to serve irrigation and domestic and industrial water supply in Benghazi and Sirte areas of Libya may increase the demand for these waters and possibly lead to trans-boundary conflicts among the States concerned (Goldsmith, Abura & Switzer 2002).

There has also apparently been considerable variation in recent years in the flow of the Nile, as a result of drought in the upper catchments in Ethiopia and human impacts on the condition of the watershed. Surprisingly, specialists cite an apparent increase in flooding along the eastern margins of the Sudd as a result of greater flows from its tributaries

²⁰ A more fulsome discussion of the complexities of the Jonglei Canal Project is beyond the scope of the present Assessment; the interested reader may wish to review a copy of the book: *The Jonglei Canal: Impact and Opportunities*. Howell, Lock & Cobb, editors, Cambridge University Press, Cambridge, 1988.

(Howell, Lock & Cobb 1988) which has increased the area of “toich” lands (the grasslands and savannah woodlands immediately adjacent to the Sudd which flood during high water) and is flooding village areas between the Sudd and the Jonglei Canal. What may actually be happening is that the spreading degradation of the upper watershed may be increasing the torrentiality of the tributary rivers. This leads to higher floods as rainfall runs off more quickly as a result of the loss of vegetative cover, carrying with it increased silt, sediments and nutrients as erosion widens. This adds to the nutrient status and growing medium for the swamp plants of the Sudd which further clog the drainage ways, causing the flood waters to spill out of the area.²¹ It also entails lower water levels as the lack of infiltration constrains sub-surface flow that normally runs out longer into the dry season.

Although a casual visitor to the Sudan, either in the North or the South, might conclude that it is an arid country, Southern Sudan is actually well endowed with wetlands. Ipoto (1993) states that “more than 7% (43,631 km²) of the South may be classified as wetlands” (out of a total land area in the “states of Bahr El Ghazal, Upper Nile and Equatoria...of 626,454 km²”).²² These wetlands are categorized as: “permanent and seasonal swamps, floodplains, temporal ponds, lakes and artificial impoundments” (ibid). This paper also points out the importance of wetlands from the ecological perspective, as storage areas for water which reduce flooding (buffering the run-off from increasingly torrential streams) and as wildlands and wildlife habitat, and also from the socio-economic perspective, as the domain of many of the pastoralist groups of the South who use them as grazing areas for their livestock, practice small-scale subsistence farming around their village sites during the rainy season, and use them for fishing as well as hunting areas in the dry season. **Table No. 7** presents an overview of the wetlands of Southern Sudan and their current status.

Table No. 7- An overview of the Wetlands of Southern Sudan

Name	Dominant Vegetation	Area (hectares)	Human Activity	Conservation Status
Major Wetland Areas				
Sudd	<i>Cyperus papyrus</i> , <i>Phragmites karka</i> , <i>Vossia cuspidata</i> , <i>Typha domingensis</i> , <i>Eichhornia crassipes</i>	1,650,000.	Grazing, hunting and fishing	Protected: Zeraf Island (675,000), Shambe (100,00) & Mongalla (7,500)

²¹ This phenomena of the degraded upland catchments may in part explain the spread of water hyacinth (*Eichorina crassipes*) once absent but now found widely throughout the Sudd displacing some of the native swamp plant species.

²² Author’s emphasis on the matter of the size of Southern Sudan, as this figure is the first citation found of the area of Southern Sudan (and which does not include the area of the Nuba Mountains in Southern Kordofan).

Veveno, Adiet, Lilebook	Swampy papyrus, <i>Phragmites</i> , <i>Miscaphtidium</i> and <i>Typha</i> grassy floodplain	645,000.	Settlements, hunting and fishing	Unprotected
Machar	Grassy floodplains, swampy papyrus, <i>Phragmites</i> and <i>Typha</i>	900,000. (500,000 in Ethiopia)	Settlements, grazing, hunting and fishing	Unprotected
Lotilla	Grassy floodplains, permanent swamps, <i>Cyperus papyrus</i> , <i>Phragmites mauritianus</i> , <i>P. karta</i> and <i>Typha domingensis</i>	219,000	Hunting and fishing	Unprotected
Lotagipi	Grassy floodplains, reeds and papyrus	720,000. (505,000 in Kenya)	Some hunting.	Unprotected
Kenamuke, Koboweni	Floodplain	172,000.	Hunting and fishing	Protected as part of Boma National Park
Bandigeru	Swampy papyrus and grassy floodplain	55,000.	Hunting and fishing	Protected as part of Bandigeru Game Reserve
Minor Wetland Areas				
North of Malakal (eastern)	Permanent swampland	85,000.	Sparsely populated with little utilization	Unprotected
North of Malakal (western)	Some semi-permanent lakes	4,100.	Sparsely populated with little utilization	Unprotected
South of Malakal, west of Sudd	Permanent swamp	169,000.	Sparsely populated with little utilization	Unprotected
Bahr El Ghazal	Perennial swamps	90,000.	Fishing	Unprotected
Floodplains of Southern Rivers (east)	Perennial swamps	500,000.	Grazing and fishing	Unprotected

Floodplains of Southern Rivers (west)	Seasonal wetlands	?	Grazing and fishing	Unprotected
Lake Ambadi	?	1,000.	Fishing	Unprotected
Lake Maleit	?	25,000.	Fishing	Unprotected
Lake Virol	?	30,000.	Fishing	Unprotected
Lake Anyi	?	1,600.	Fishing	Unprotected
Lake Nyiropo	?	1,400.	Fishing	Unprotected

Source: Ipoto 1993. *The Wetlands of Southern Sudan*.

Environmental Threats and Opportunities Related to Water Resources and Wetlands

Although Southern Sudanese indicate they remain convinced that the sanctity of the immense wetlands of the Sudd must be respected in their future dealings with the North, a number of observations related to water and wetland use are considered appropriate here. Of greatest concern may be the view, expressed by the Technical Committee on Natural Resources Management and Utilization, that these wetlands “represent prime agricultural lands in the Southern Sudan. Although these wetlands can also be used for livestock watering and grazing, sanctuaries to thousands of bird species, etc., their main function should be for the production of cereals crops such as maize, sorghum, rice, etc.” (Itto et al 2000).

These aspirations are certainly understandable given the need to find important economic development options for Southern Sudan. Hopefully, however, they will be eventually be tempered by effective environmental review which takes into account the well known propensity for adverse environmental impacts related to irrigation (an activity which automatically triggers a full-scale environmental impact assessment under 22 CFR 216– USAID’s environmental procedures should it be proposed for US funding). Experience worldwide has demonstrated that the development of irrigation must be very well planned and its environmental and socio-economic impacts carefully assessed if it is to be sustainable.²³ Similarly, such plans must be developed in close and well-informed consultation with the communities that will be affected by any proposed irrigation scheme.

²³ In 1999, USAID funded an assessment of small-scale irrigation in neighboring Ethiopia. The report it produced includes a Checklist for Planning Environmentally Sound Small-Scale Irrigation. See Catterson et al 1999. *Programmatic Environmental Assessment of Small-Scale Irrigation in Ethiopia*. Catholic Relief Services for USAID. Baltimore, September 1999, pp.- 82 + appendices.

Although no USAID assistance is foreseen for the development of irrigated agriculture, the plans suggested above represent a special opportunity for concerted assistance in the agriculture and environment/natural resources area. Building capabilities for environmental review would be an excellent choice for more targeted activities in the area of Strategic Analysis and Capacity Building currently underway and foreseen under the new ISP. In addition to its importance as a development planning tool, environmental review capabilities represent a special way to bring about improved integration across the sectors which has recently been part of the emphasis among the SACB Working Groups. USAID/REDSO will be sponsoring a training workshop in environmental assessment for implementing partner organizations within the Government of Southern Sudan and NGOs in the summer of 2003.

Nile Basin Initiative

Southern Sudan will also eventually have to find its place and role in the ongoing international Nile Basin Initiative (NBI). This Initiative involving the ten riparian countries of the Basin (Burundi, Democratic Republic of Congo, Egypt, Eritrea, Ethiopia, Kenya, Rwanda, Sudan, Tanzania and Uganda) got underway in 1999 as a mutual effort to harness and safeguard the full potential of the world's longest river and to avoid conflict among its members. Sudan is currently represented on the Council of Ministers of the Nile Basin States (Nile-COM) by the Minister of Irrigation and Water Resources of the Government in Khartoum. Northern Sudanese specialists are also members of the Technical Advisory Committee (Nile-TAC). The NBI was first supported by a coalition of CIDA, the World Bank and UNDP although other bilateral and multilateral donors have been providing assistance to the portfolio of projects being drawn up. USAID, for example, financed and executed the preparation of *The Nile Basin—Environmental Transboundary Opportunities and Constraints Analysis* (Baecher, Anderson, Britton, Brooks & Gaudet 2000).

Although the analysis of the environmental issues facing the Nile Basin in Sudan clearly reflects the realities on the ground in Southern Sudan, the Southern Entity must find a way of participating in the Initiative. Tentative plans call for both cross-cutting programs of interest to all of the riparian states and Subsidiary Action Programs within distinct segments of the Basin, to be considered for support by an International Consortium for Cooperation on the Nile (ICCON). One of these segments—the Eastern Nile Subsidiary Action Program could and should have important potential for Southern Sudan. The program is expected to focus on water and water-related resources in a cooperative way, including for: irrigation and drainage development, hydropower development and trade, watershed management, sustainable management of lakes and linked wetland systems, river regulation, flood and drought management, pollution control and water quality management, water use efficiency improvement and integrated water resources management (ENCOM 2001).

Road Rehabilitation and Wetlands

The enormity of the challenge of road rehabilitation in Southern Sudan will be exacerbated by the major difficulties these roads encounter as they attempt to cross wetland areas along the route. The most significant road engineering problems that will arise will be related to constructing bridges and causeways to traverse the wetland areas. For example on the present route from Rumbek to Yei, the road passes through a number of smaller wetlands or areas of impeded drainage and these are precisely the areas where transit becomes impossible in the rainy season. Enormous potholes develop as heavily laden trucks (typically, according to local informants, “overladen” trucks carrying as much as 45 tons on three axles and often with food aid commodities) attempt to pass and become mired down and easily and often completely ruin the road bed, making it all but impassable.

A number of options (most probably in combination) should be considered, including road realignment to avoid these areas if possible by re-routing the road one way or another to bypass them or at a minimum to cross at the narrowest portion of the drainage; by ensuring the installation of adequate culverts, well engineered, sturdily built and anchored, with a thick layer of strong road bed materials; by enforcing maximum axle loads limits among the transport community (as is being done now in adjacent areas of other East African Community countries); and by using Bailey bridges or strongly constructed local bridges to meet all weather road building requirements.

Unimpeded drainage through a road causeway or under a similar road structure in a wetland is critical to both the durability of the road and to mitigating the impacts of such construction on the local ecosystem. Although an individual wetland site sacrificed for the purposes of transportation infrastructure may seem insignificant, the cumulative impacts of many such sites, given the frequency of wetlands and swamps in Southern Sudan could lead to significant and unacceptable adverse environmental impacts.

If the Rumbek to Yei Road, inspected by this consultant is any example, the engineering design crews that will lay out the specifications for road reconstruction will have to visit each of these potentially problematic sites along each road transect to determine how best to proceed. Using old road designs and materials, as some of the language in the current ISP implies might be possible, will not be sufficient. They will have to ensure that adequate specifications and appropriate cost estimates have been prescribed to guarantee that the selected contractor(s) build the appropriate structures at each of these sites to meet the wet conditions of the rainy season. A special effort should be made to visit these areas during the wet season so as to be able to properly measure the extent of the wetland that needs to be crossed.

It will also be necessary to plan for the costs of bringing adequate quantities of road ballast (stone and crushed rock) and road surfacing materials (gravels) from considerable distances because in many areas of Southern Sudan, these materials are not found locally. Careful inspection of compliance with these road building specifications will also be required to guarantee a well built and durable road.²⁴ Routine surveillance and

²⁴ Any and all concerned with these road rehabilitation activities may find it useful to consult the World Bank’s publication: *Roads and the Environment: A Handbook* (1997). This publication is particularly

maintenance will also be necessary to guard against and/or react in a timely way should there be any breakdown in the structures built along the way or deterioration of the road surface.

Finally, on the subject of road rehabilitation, it is not only in the wetland areas where sound road building and maintenance are needed. Surface water management on the roadbed is key to the durability of the road surface. This can be achieved by properly crowning the road to facilitate its drainage and constructing proper side drains and water bars where needed to carry the run-off away from the road. Maintaining these structures and keeping them free from built-up soil depositions and debris is something that should be done on a regular basis and could provide an opportunity for local employment at the county and payam level. These maintenance needs should be viewed not as a problem but rather as employment opportunities in areas where there are few such opportunities, at least over the short to medium-term. USAID may wish to consider a companion road maintenance facility for the roads it will rehabilitate using food for work or cash for work and as an example of capacity building in the all important area of public works linked to transportation infrastructure that Southern Sudan will eventually require.

Diking Between the Sudd and the Jonglei Canal

The current efforts at diking to protect villages and farm lands between the Sudd and the Jonglei Canal seen by this consultant in the Mabior area are an example of possible inadvertent adverse impacts on wetland ecosystems. At present the activities being carried out by CARE and the local communities do not constitute a hazard to the environment because they are being developed in such a way as to allow water to pass between diked community areas and to reach behind the structures, spreading the water according to the lay of the land. Future efforts to control the increased spread of the waters of the Sudd should be planned and built in a similar and deliberate way.

These diking efforts will, however, eventually present a problem for the development of the much needed, long-term road infrastructure network in the area. At least one solution that might be considered, if it has not already been considered, is using the berm of the Jonglei Canal as the potential road bed for an all-weather road running north and south and serving this area.

ENVIRONMENTAL HEALTH CONCERNS

Addressing environmental health concerns are an important part of the present efforts by the Southern Entity and its donors partners, especially USAID, to meet the basic humanitarian relief needs of the people of the country. Many of these types of emergency relief activities, including all International Development Assistance (IDA) are either considered exempt from USAID's environmental procedures (216.2.b) or under categorical exclusions, including maternal and child feeding programs, or programs involving nutrition and health care, and therefore would not normally be considered

useful in preparing the specifications for private contractors to be engaged in road construction, both from an engineering and environmental perspective.

during an environmental threats and opportunities assessment.²⁵

Nevertheless, during the Rumbek Stakeholders' Workshop (February 2003), a number of SPLM stakeholder participants mentioned two concerns related to environmental health: the potential of contamination of water supplies by latrines and the effects on people of treated bednets for malaria prevention.

The concern that pit latrines in community areas might be the source of contaminants to boreholes supplying potable water is a valid question and one that needs to be addressed. The availability of safe drinking water is an important measure for securing food security and presently constitutes an important activity in the present ISP and in the plans for the next one. The provision of potable water means fewer intestinal diseases, parasites and other related health problems for local people, allowing them to make better use of the food resources they have.

In the experience of this consultant, the potential for such contamination is fortunately very slight. Human wastes in pit latrines percolating through the soil layers and contaminating much deeper boreholes is unlikely along as these latrines are not located in the immediate vicinity. The minimum standards proposed by the Sphere Project are: "Latrines and soakaways in most soils are at least 30 meters from any groundwater source and the bottom of the latrine is at least 1.5 meters above the water table" (www.sphereproject.org).²⁶

There are some other matters related to water quality and potability which warrant mention here.

The most typical situations whereby boreholes and wells become contaminated are instances where surface run-off carrying human or animal excreta flows across the land and down into the boreholes. In Southern Sudan, special efforts of fencing and concrete aprons (see photo below) are already commonplace to ensure that livestock are not watered immediately adjacent to the opening of the borehole. Typically, the structure of the borehole is raised above the level of the land and protected by an enclosure and/or a concrete apron that would protect it from casual surface run-off. In some cases, it might even be recommended that livestock watering troughs be built at some distance from the boreholes and water carried to them by protected piping or canals. Should these boreholes be located in areas subject to flooding, the danger becomes much greater that they could become contaminated during the rainy season and greater efforts will be required to protect them (diking around the site, for example).

²⁵ Initial Environmental Examinations (IEE's) for the USAID in the Sudan program have already documented the many cases of exemptions and categorical exclusions applicable to the humanitarian relief components of the Integrated Strategic Plans of the past. Although the new ISP will also require an IEE, probably for each of its Strategic Objectives, there is considerable likelihood that the same applicability criteria will apply.

²⁶ The Sphere Project was developed by a group of humanitarian NGO's and U.N. system agencies for the purpose of improving the quality and accountability of humanitarian response. They have produced a handbook: *The Humanitarian Charter and Minimum Standards in Disaster Response*, which is available on the web (www.sphereproject.org) or can be purchased from Oxfam Publishing.

Although the number of boreholes is increasing across Southern Sudan, local people still make use of surface waters in many areas, especially during the dry season. The new ISP, in addition to financing the drilling and equipping of boreholes, will promote the construction of shallow hand-dug wells and surface water collection ponds (“haffirs”). While these will increase the availability of water, such structures are easily subject to contamination that could threaten water quality and potability. Awareness raising among community and women’s groups about the potential dangers of unsafe water from surface water supplies and the provision of safe water at the household level by boiling and filtering should be part and parcel of basic health services and campaigns expected to be part of the new development program in the area.

IDPs Returning to Urban Areas in the South

One of the scenarios under a peace agreement is not only the return of IDPs to their home areas like Bor county, but also the return of populations to urban areas in the South, e.g., the garrison towns of Juba, Malakal and Bor. The size of these towns could easily increase by 200 to 300 % causing an unbelievable strain on water and sanitation as well as fuelwood. For the past 7 years USG/USAID has been using OFDA resources to support health and sanitation programs in these locations. With peace they will be asked to look to DA resources to fund some of these activities. Therefore, it will be necessary to analyze the implications of this for the ISP (personal communication, B. D’Silva).

Fortunately, there is considerable information available on meeting the basic needs of refugees and IDP’s that could be employed to assess the needs for water supply and sanitation infrastructure.²⁷ The DART Handbook suggests that minimum water needs are between 15 and 20 liters per day per person (USAID FOG version 3.0). Additional water may be required for livestock (cattle- 30 liters per day, small stock- 5 liters per day), for sanitation facilities and for other community services. The Handbook also notes that “An acceptable and practical system for the disposal of human excreta is the key to reducing health hazards”. Ample guidance on sanitation systems is also available and can be used to enhance the existing, if any, sanitation systems on which these urban areas now depend. Given the present political situation, there is little information available on the water and sanitation infrastructure and its needs in these urban areas and therefore a much more detailed study will be required to address them and to ensure that they meet environmental health concerns.

Insecticide Treated Bednets

Because of the prevalence of malaria in many areas of Southern Sudan (and in the north as well), the use of insecticide treated bednets have been recommended, particularly for pregnant women, children, the old and weak. The idea of sleeping in what is in effect a

²⁷ A number of publications available from the Engineering and Environmental Services Section of the UNHCR may be useful in this regard. See for example, UNHCR Environmental Guidelines, June 1966; Environmental Guidelines: Forestry in Refugee Situations, May 1998; and Energy Strategy for Refugee-Affected Areas of Kagera and Kigoma Regions, Tanzania, June 1997. Similarly, the Field Operations Guide for Disaster Assessment and Response (the DART Handbook) prepared by USAID in cooperation with the USDA Forest Service also provides basic guidelines related to these issues.

tent of insecticide treated cloth strikes some people as counter-intuitive and thus raises questions about their safety. It is a valid concern but not one that has escaped the attention of the many organizations which promote these bednets or which are working to control the spread of malaria in Africa. A PEA (Programmatic Environmental Assessment) for insecticide treated bednets was done for the Africa region last year (Hirsh 2002). It is also likely that USAID will need to conduct a country-wide PERSUAP (Pesticide Environmental Review and Safer Use Action Plan) before the program can be implemented.

The upcoming ISP will seek to work with health authorities in Southern Sudan to promote the use of insecticide treated bednets as part of the national policy for combating malaria. This technology has now reached a point where the World Health Organization (WHO) has approved the use of bednets treated with pyrethroids and permethrin. This is the same household insecticide commonly used in medicated lice shampoo. These chemicals, organic in nature, are not bio-accumulative and rapidly breakdown in both soil and sunlight. They are deadly to mosquitos but do not affect people. Work has been done to develop bednet treatment regimes applying the minimal amount of insecticide needed to control the mosquito vector. Other benefits include killing lice, ticks and bedbugs.

USAID has carefully reviewed the science and practice behind treated bednets (including an environmental review of the technology) and is now promoting them widely. As part of its efforts, the Agency helped to launch NetMark, an innovative regional public-private venture in Africa for the commercial distribution of insecticide treated bednets. Further information on this important malaria prevention technology can be found on the NetMark website (www.netmarkafrica.org).

PART III- ETOA-RELATED PROGRAMMING RECOMMENDATIONS FOR THE NEW INTEGRATED STRATEGIC PLAN

USAID's new Integrated Strategic Plan (2003-2005) is specifically intended to support a transition to peace, recovery and development in the Sudan. Its goal statement—"Foundation established for a just and durable peace with broad participation of the Sudanese People"—reflects the fragility of any peace agreement and the fundamental challenges the country will face. The ISP includes: a special objective to enable USAID to respond flexibly to opportunities to support peace; and four strategic objectives (SO's) in three focus areas: food security, governance and education and health.

It should be noted that the bulk of the USG funding for this program comes from categories of USG/USAID assistance funds that enjoy exemptions and/or categorical exclusions within the framework of USAID's environmental procedures. In large measure, the humanitarian relief and transition and development activities under the ISP, however funded, are expected to help in transforming "Sudan through a peace that is viable and visible in peoples' lives" (USAID 2003). Accordingly, the plan must go ahead as effectively and efficiently as possible without being encumbered by unnecessary bureaucratic requirements related to environmental review. At present, a full and explicit set of activities under each strategic/special objective cannot be identified as the ISP must clearly be responsive to the unforeseeable opportunities of the emerging peace process.

Building a Capacity for Environmental Review

It is therefore recommended that the Mission continue its present proactive approach to the incorporation of environmental procedures, using the environmental screening and review procedure initiated during the last ISP. In addition, however, it is recommended that USAID support the establishment of a capability for environmental review as part of the strategic analysis/capacity building activities. This would be an excellent manner with which to start the practicalities of the integration of the sub-sectoral working groups. Such a capability could have its institutional home in the environmental and natural resources planning unit mentioned above, and ideally housed in the Secretariat for Wildlife and Environment of the Commission for Economy, Production and Physical Infrastructure of the Executive Branch of the SPLM.

Similarly, it is also understood that USAID will carry out an environmental review training workshop in Southern Sudan in the near future, involving participant trainees and resource persons from among many of the program partners. Ideally, as these capabilities build up, USAID would find it possible to depend more generally on Southern Sudanese Specialists for active participation in the environmental review process required for approval of its funding tracks.

Program Activities and the Environment

This environmental threats and opportunities assessment has also been carried out fully cognizant of the all important criterion of expediency in emergency/relief and transition

to peace setting that will characterize the near-term in the Sudan. Overshadowing the transition to development activities and a concern for environmental sustainability will be the enormous and important challenges of the humanitarian situation that must be faced in the near-term, for example, with the return of possibly millions of IDP's and refugees to their former homelands. Satisfying their basic human needs must have primacy in the quest for peace. The intent of this ETOA is, therefore, primarily focused on identifying ways to increase the effectiveness of planned activities over the short to medium-term and enhancing the sustainability of these investments that will be so critical to peace and justice.

This section reviews the Sp/SO's, their IR's and activities as appropriate (in other words, not all of the Program Focus Areas or Immediate Results will be addressed) and where pertinent makes suggestions and recommendations as to their environmental implications. The section concludes with a review of the special circumstances related to tropical forestry and biodiversity conservation thereby fulfilling the stipulations of Sections 118 and 119 amendments to the FAA.

Special Objective 4. Expanded Support to the Sudan Peace Process

Under **Program Focus Areas 1:** Expanded support to Sudanese peace building and maintenance capacities--the Mission may wish to consider the following suggestion:

- Adding language specifically aimed at developing methodologies for natural resources based conflict resolution as part of its support to “grass roots people-to-people peace processes”. There is a growing body of knowledge, experience and understanding about natural resources conflicts that has emerged as the logical nexus with governance programs and which could directly contribute to efforts to maintain the peace agreements in the Sudan. As the report notes above: Building local capabilities to broker basic natural resources use and conservation decisions and avoiding conflict are a prima facie case of governance opportunities. The approach could usefully be used in the agriculture/land-use, wildlife, forestry and water resources sectors in Southern Sudan. These matters of resource use are the building blocks of the social compact in Southern Sudan and an inability to address them in the past has often led to conflict, not only with the North but among Southerners themselves. There are ample cases and levels where support for good governance in natural resources, at various social levels, would be warranted and welcome.

Under **Program Focus Area 2:** “Timely Support to Peace Dividends and Confidence Building Measures”, both the “Quick Impact Program” and the “Confidence Building Measures” would benefit from:

- an interim understanding and efforts to address the land tenure issues. The current lack of guarantees for small holder tenure over their farm lands, whether from the customary perspective of village elites making these decisions or as a result of government imposition of land ownership, can retard the investments in

- the development of more productive farming systems, food security, poverty alleviation opportunities and/or lead to local level conflicts.
- Similarly, as this report notes, “Any efforts to re-establish people on lands more marginal in productivity than those they had in the past, for whatever reason, will likely increase adverse environmental impacts” associated with the land clearing for agriculture that unavoidably will be part of the return of large number of IDP’s and refugees. There is a need for a recognition that agriculture in Southern Sudan, as it is everywhere else in the world, represents a primary opportunity for sound natural resources management-- managing the basic resources of soil and water. An improved understanding of participatory approaches to community based natural resources management as a new paradigm in considering agriculture sector development options is a real opportunity. Using such an approach puts the critical issues of land tenure and land capability/land-use on the table for consideration and could lead to greater sustainability of the land-use development mosaic.

Strategic Objective 5. More Effective and Participatory Governance

Under this SO, “USAID is expected to provide support for local governance strengthening...including expanded support for certain SPLM “national” level institutional development focusing on technical sector strategy, planning and policy development. Here again, the potential for proactively addressing the natural resources conflict resolution methodologies and activities fit well with the governance results being sought under this SO and its activities for “Increased participation of civil society in peace and governance processes”.

It is important as well, as the result of this ETOA, to recall the fact that: “Policy or strategy precedents set now may prove difficult to reverse and are likely to have more profound adverse environmental impacts than site specific interventions.” The view that agriculture and/or natural resources exploitation should be managed and taxed by the State needs to be tempered by the realization that wise use and resource conservation is best achieved by ensuring that local people perceive and benefit from the tangible incentives they bring.

Strategic Objective 7. Improved Equitable Access to Quality Health Care and Water and Sanitation.

Under the activities for “Improved Access to Quality Water and Sanitation”, there is a need to ensure that hand-dug shallow wells and protected water catchments “haffirs” are accompanied with awareness raising and training programs to avoid the environmental health problems from using unsafe water.

Strategic Objective 8. Improved Food Security in Targeted Markets and Communities

Under the activities for “Increased Availability of Food in Targeted Markets and Communities”, there will be opportunities to lessen the pressure on wildlife resources by ensuring that adequate relief supplies reach people moving into areas adjacent to known areas of wildlife concentration. Provision of protein rich food sources, perhaps small ruminants, rabbits and chickens—will help to alleviate the need for hunting.

Under the activities for “Increased Access to Food in Targeted Markets and Communities”, a range of activities need to be conditioned on the basis of the findings of this assessment, as follows:

- Road rehabilitation activities must be sufficiently robust to cope with the challenges of the wet areas and wetlands they must inevitably cross in Southern Sudan. In addition to the cumulative adverse environmental impacts that they generate, proper engineering and construction in these critical places will amply add to their durability. Furthermore, it is unlikely that “food-for-work” options for road rehabilitation in these areas can be sufficient to build a reasonably durable and sustainable road. However, road monitoring and maintenance operations based on village level food-for-work could be a food security and/or income generation option well suited for the continuing durability of well constructed roads.
- Under this IR, there is a discussion of the option of encouraging “change in crop choice and cultivation techniques”. It is recommended that these efforts also promote on-farm soil and water conservation technologies to enhance and/or maintain crop land fertility and improve soil conditions (higher organic matter content) so as to be more resilient in the face of erratic rainfall regimes. It should be noted, however, that these measures will be directly affected by the land tenure situation and efforts to guarantee small holder rights to their farm lands.
- The sense of the agricultural training centers which presumably include those intended and discussed in earlier programs related to wildlife and forestry, emphasize the importance of entrepreneurship and business skills. While such skills may be vital to the agriculture sector and could even have positive implications for the forestry sector, it is unclear how they might be applied to wildlife training. In the short-term, the SPLM needs to try and get hunting under control and develop a better understanding of wildlife resources in order to be able to sustainably manage offtake and exploitation. The long-term potential of the wildlife sector in Southern Sudan as a basis for non-consumptive, ecotourism is riding on the country’s short to medium-term ability to safeguard the wildlife and biodiversity assets that will form the basis for this industry.
- Trunk road rehabilitation activities need to incorporate the recommendations above regarding sound, environmentally conscious design and construction,

solutions to traversing wetland areas, and routine maintenance to ensure the sustainability of these critical and extremely costly investments.

Threats and Opportunities in Tropical Forests

This report has already noted the unavoidable reality that there will be large-scale deforestation as a result of returning residents clearing land for agriculture and tree-cutting associated with rebuilding household and compound buildings and assets. USAID has already begun support for strategic analysis and capacity building in the forestry sector and a continuation and expansion of these efforts will be the best short-term investment to ensure that forests and woodlands occupy their rightful place in the emerging land-use mosaic of Southern Sudan.

The following approaches and activities can also help to mitigate the consequences of these adverse impacts on the tropical forest resource base:

- As mentioned elsewhere in this report, avoid any actions, decisions or policies that force small farmers onto marginal lands where the consequences of deforestation in the form of erosion, desertification and localized climate impacts will be more severe.
- Work with the Southern Sudan Forestry Department to develop their skills in the area of community forestry with the intention of incrementally developing a forestry extension capability that can aid the country's farmers and smallholders to pursue the logical options of on-farm agroforestry, small-scale tree planting and natural forest and woodlands management as part of a productive land-use mosaic geared to inherent capabilities of the land on which they depend.
- Launch a program to bring the now rampant uncontrolled burning of forests, woodlands and grasslands under control through awareness raising, working with county authorities, and promoting the low cost and effective option of early burning. One of the situations requiring early attention in this regard will be the areas around the villages where people harvest poles and branches to build their homes. Community consensus to protect these areas for a few years to allow regeneration or coppice growth to get above fire or grazing/browsing danger would be a useful and practical focus with which to begin to deal with fires in the environment in Southern Sudan.
- Promote a program to license charcoal production in the major charcoal production areas and require compensatory reforestation and/or natural forest protection as part of the permitting system.
- Bring in the expertise to develop an economically and developmentally sound strategy for utilizing the established plantation forest resource base...especially the very valuable Teak resources, both on reserve forest and community areas. Cancel the present extraction contracts until and unless this strategy is in place.

- Encourage reforestation programs and seedling nurseries to supply planting stock ideally at the community and farm levels to plant valuable fast growing species like Teak. Such programs could be assisted with incentives provided through food-for-work, especially on community and farm lands. In addition to forest species, such a program could promote and facilitate fruit tree orchards, especially in the better watered areas of Southern Sudan.
- Work to develop a strategy as well for the wise stewardship, conservation and sustainable management of the natural forests/woodlands, particularly in the high forest areas in the more southerly areas of Southern Sudan which might logically and usefully be integrated with the considerations for management of wildlife and biodiversity (see below).

Threats and Opportunities for Biodiversity Conservation

There is presently no easy way of knowing the status of wildlife and biodiversity conservation in the Sudan although it is very clear that present hunting pressures are out of control and unsustainable. A recent decree at the highest level of the SPLM banning hunting for elephants and hippos in and around Nimule is a step in the right direction and an indication that the government is aware of the issues. USAID has already begun support for strategic analysis and capacity building in the wildlife sector and a continuation and expansion of these efforts will be the best short-term investment to ensure better stewardship of the country's once globally significant wildlife populations in Southern Sudan.

The following approaches and activities can also help to mitigate the consequences of the present pressures and adverse impacts on the country's wildlife and biodiversity assets:

- Wildlife counts are laborious and take time. The SPLM should take an affirmative policy stance on the need for the protection of wildlife resources even before survey and census data are fully compiled. This could include unequivocal and very public pronouncements of absolute prohibitions against the hunting of elephant, rhino and chimpanzee. There is also a need to bring commercial hunting under control; at a minimum, there should also be restrictions on which kinds of game meat can be sold in public.
- The Southern Sudan Wildlife Department senior leadership would benefit from training and/or study tours to neighboring countries to familiarize themselves with the new methodologies of community oriented wildlife and protected area management. A game guards/game scouts orientation to the institutional strengthening of the Department will not be cost effective and may be counter-productive to building community conviction and commitment to biodiversity conservation.
- Given the present situation, a cooperative agreement with one of the major, U.S.

based international conservation organizations to work with the Southern Sudan Wildlife Department and the Southern Sudan Wildlife Conservation Organization is recommended as the most effective means to build skills and capacity and help develop a strategy for the conservation and development of biodiversity in the country. Such a cooperative agreement would constitute a significant response by USAID to the mandate of Section 119 of the FAA. Organizations such as Conservation International bring skills, experience, long-term commitment that is not always donor dependent, and resources of their own, largely raised through private donations, to the challenge of responding to the global imperatives of biodiversity conservation.

- The ready availability of firearms is the leading cause of biodiversity losses. USAID and the SPLM may wish to consider using a special incentives program to promote the decommissioning of firearms as SPLA soldiers and others are being demobilized.
- The present plans to build and operate a Wildlife Training Center at the Boma National Park should be complemented with some resources to ensure that proper control and protection of the Park and its biodiversity assets are possible.

Annex A- Scope of Work for the Assessment Team

The objective of this work is to deliver to USAID/REDSO/NPC and the USAID Sudan Task Force a countrywide Environmental Threats and Opportunities Assessment (ETOA) that will inform the Environmental Annex of the USAID/Sudan Integrated Strategic Planning (ISP) process. This coordination effort will be carried out by the Contractor's short-term consultant(s) with experience in forestry, ecology, hydrology, and/or natural resource management assessment and analysis. Also, the consultant(s) will be familiar with the impacts of government policy on biodiversity conservation and natural resource conditions. This ETOA will comply with Sections 117 - 119 of the Foreign Assistance Act of 1961, and Agency guidance on country strategy development.

This assessment will also identify important issues with respect to environmental conditions and threats which USAID/Sudan must be aware of as it drafts its Integrated Strategic Plan.

1. Background and Purpose

Strategic Planning Process. USAID/Sudan is currently a Non-Presence Country managed out of USAID/REDSO. The Mission is currently in the process of developing a new three-year country Integrated Strategic Plan wherein the Mission will align its proposed strategic objectives with the U.S. Government's (USG's) three principal policy objectives towards Sudan: the War on Terrorism, durable peace, and humanitarian access. An initial USAID Sudan Concept Paper has been drafted based on a three-day consultative workshop held in Nairobi in December 2002. Three focal areas were identified in this initial draft: food security, governance, and basic social services. Next stages in the strategic planning (ISP) process involve research and drafting of supporting analyses on the environment, gender, conflict vulnerability, and the health and food security situations. Once these analyses are completed, a stakeholder workshop is planned in southern Sudan for mid-February, after which the draft ISP will be written and sent to Washington for review and approval. The conditions and funding levels for assistance to Sudan will be contingent upon the outcome of the IGAD-sponsored (Inter-governmental Authority on Development) peace negotiations being held in Machakos, Kenya.

The Northern Sudan region will also be included in the ISP. The Foreign Assistance Act requires that a country strategy contain analyses of a) the actions needed to conserve both tropical forests and biodiversity, and b) the extent to which the actions proposed in the strategy will meet those needs. See FAA sections 118 (e) and 119 (d). Because the North and South of Sudan are politically and developmentally distinct, the Tropical Forest/Biodiversity analyses will be conducted on somewhat different lines. For the South, a field team will be employed -- this is the area where immediate interventions are planned and where DA funds (which are the object of the section 118/119 requirements) may be employed. For the North, security and political considerations militate against a field analysis but the statutory issues will be covered through a desk analysis based on available data. "That analysis will identify any areas for further field study and

assessment that would be conducted as DA-funded interventions are planned in the North, and will identify interventions that take into account the assessment prior to the design and implementation of activities to be carried out in the future. Further, all DA activities will be subjected to the USAID's environmental review procedures under 22 CFR 216. Finally, the principles of minimum quality voluntary standards for humanitarian assistance programs will be promoted by the Regional Environmental Office for activities carried out with complex emergency resources (e.g., Sphere Handbook, www.sphereproject.org).

There is no Environment SO planned for this ISP. However various potential activities that aim to enhance food security and economic growth will have clear impacts on the environment—most notably infrastructure development. Furthermore, incorporation of environmental threats and opportunities into USAID's Sudan strategic planning process will help to ensure that activities are conducted in an environmentally sustainable manner, while at the same time identifying opportunities for enhancing the quality of the natural resource base. An area of focus of this assessment contract will be the review of previously generated relevant reports and documents and the identification of gaps in that data.

Environmental Requirements. The core environmental requirements of USAID operating unit strategic plans are spelled out in 201.3.4.11.b Technical Analysis for Strategic Plans, Environmental Analysis, and are derived from provisions of the Foreign Assistance Act (FAA).

- Environmental Sustainability. USAID/Sudan recognizes that protection of the environment and wise management of the natural resources base are absolute requirements of any successful development program. Section 117 of the FAA "*Environment and Natural Resources*," dictates that operating units will implement their programs with an aim toward maintaining (and restoring) natural resources upon which economic growth depends, and to consider the impact of their activities on the environment. The legal requirements of the FAA are reflected in USAID's *ADS Chapter 204 "Environmental Procedures*," which provides essential procedures and policy on the application of *22 CFR Part 216*. This regulation codifies the Agency's procedures "to ensure that environmental factors and values are integrated into the USAID decision making process." Further, 22 CFR 216.5 requires USAID operating units to conduct their assistance programs in ways that are sensitive to the protection of endangered or threatened species and their critical habitats.
- Tropical Forestry and Biological Diversity. Sections 118 "*Tropical Forests*" and 119 "*Endangered Species*" of the FAA codify the more specific U.S. interests in forests and biological diversity. These two provisions require that all country plans include: 1) an analysis of the actions necessary in that country to conserve biological diversity and tropical forests; and 2) the extent to which current or proposed USAID actions meet those needs. Section 118/119 analyses are specific legal requirements of all USAID operating unit strategic plans.

Translating the intent of the above legal requirements into a practical strategic planning approach, the ADS provides a priority-setting framework for missions to use in determining environmental threats and opportunities. This provision responds to statutory pre-obligation requirements of FAA Section 611(a), which requires that there be adequate technical and financial planning for all obligations in excess of \$500,000. The priority-setting process is intended to guide the setting of environmental strategic objectives, as well as to inform strategic objectives in other sectors.

Further, once a strategic plan is completed and implementation planning begins, every SO under the new ISP will have individual Initial Environmental Examinations prepared prior to obligation of implementation instruments, and by this mechanism the issues of environmental quality and management will be reinforced and mainstreamed (see ADS 201.3.6.3 Pre-Obligation Requirement, Section b, Environment). This is not the role of the present ETOA.

The tasks embodied in this SOW will advance USAID/Sudan's ISP by providing and ensuring:

- an overall assessment of the status and trends in key components of Sudan's biodiversity and tropical forest resources;
- an overall understanding of developmental threats (including existing and proposed policy initiatives as well as the legal and regulatory framework) to environment, biodiversity and tropical forests, and
- an understanding of actions that must be taken to maintain biodiversity, tropical forests and ensure sustainable environmental management given the documentation and analysis of threats.

The result of this consultancy will be used by the USAID/REDSO/NPC, the USAID Sudan Task Force, the Regional Environmental Officer (REO) as well as the Agency's reviewers of ISPs as the basis for the following analyses:

- The positive and negative impacts on FAA 117, 118 and 119 issues of each of these activities/laws/policies/initiatives as currently implemented and/or as projected;
- Plans and outcomes of efforts to mitigate the impacts of the foregoing;
- The effectiveness of relevant public institutions that supervise and govern the utilization, development and/or monitoring of environmental resources in terms of how they achieve environmental sustainability and mitigate negative development impacts, prevent degradation and/or achieve restoration of tropical forests and biodiversity.

Sudan's Biophysical Environment (excerpts from Country Profiles, World Resources Inst. and ISciences. 2002. Terra Viva! World Resources Database. CD and at www.terraviva.net)

Current issues: deforestation results from uncontrolled cutting of trees for fuel; overgrazing; soil exhaustion; overfishing; Sudd wetland threatened by irrigation schemes; threatened biodiversity.

Natural resources: petroleum, gold, petroleum, chrome, asbestos, uranium, hydropower, natural forests, arable land

Protected Areas: 11, consisting of 8.6 million hectares, or 3.45% of total land mass

Wildlife: 21 threatened species

Forests: natural forests: 41 million ha; tropical forests: 12.3 million ha (1995 est)

Land use: cropland 17 million ha; irrigated land: 11.5% of cropland

2. USAID's Program in Sudan

The program seeks to promote economic recovery, civic participation, and a just and durable peace based upon openness and mutual respect between Sudanese and Americans. USAID/Sudan's initiatives support:

- Improved food security through economic opportunity, agricultural revitalization, an enabling policy environment, humanitarian relief, and improved infrastructure;
- Good governance by focusing on civil society, dialogue, public management, local governance, and rule of law;
- Improved access to basic services including education, health care, and water sanitation.

USAID/Sudan's approach transiting to a post-conflict Sudan focuses on food security, governance, basic social services, and infrastructure. The bulk of initial Development Assistance (DA) funds will be directed to activities in southern Sudan. Recognizing Sudanese capability and culture, USAID works to develop and strengthen Sudanese civil society and institutions that will continue long after US assistance ends. USAID seeks to build sustainable partnerships between Sudanese and American organizations, and supports Sudanese non-governmental organizations. USAID will work in reform-minded regions and coordinates its activities closely with other U.S. Government agencies and international donors. USAID complements its use of experienced American technical specialists with local Sudanese expertise when and where possible. USAID's programs seek to make Sudan a full partner in the community of nations, thus promoting prosperity and peace. USAID/Sudan understands that past civil unrest has been at least partly due to the distribution and management of natural resources and the Mission seeks to mitigate further conflict by advocating governance and more sustainable use of limited land resources.

The Initial Environmental Examination summarizes the main elements of the

Development Assistance (DA) portfolio being implemented presently. This ETOA is mainly applicable to the DA portfolio. Three DA funded programs are the newest and most prominent parts of the current implementation portfolio:

Southern Sudan Agriculture Revitalization Program. This new initiative is a direct result of the visit to northern and southern Sudan in early July 2001 by Andrew Natsios, USAID Administrator and Special Humanitarian Coordinator for Sudan. The five year, \$22.5 million Southern Sudan Agriculture Revitalization Project will increase the capacity for agricultural production and marketing by:

- increasing access to agricultural skills and technology;
- increase access to capital for agricultural enterprises; and
- increase the capacity of commodity networks to facilitate expanded trade.

The project will benefit all groups in the opposition held areas of southern Sudan (regardless of political affiliation) including Upper Nile, Bahr el Ghazal, Equatoria, Southern Blue Nile and the Nuba Mountains. It will target agricultural producers and entrepreneurs throughout these areas, with a special emphasis on community involvement and the equitable participation of women in all project components. Specifically, the project will:

- support agriculture and business skills training in six sub-sectors (food crops, agricultural technology, forestry, livestock, wildlife, and fisheries);
- establish a central information and data analysis collection and dissemination unit;
- provide capital to agricultural enterprises through a finance institution; and
- strengthen agricultural commodity networks.

There will be no impact on the environment from the training and technical assistance activities. However, the program will cover the costs of minimal physical rehabilitation of infrastructure, such as agriculture training centers and microenterprise financial institution's branch offices.

Sudan Peace Fund. In FY 2002, USAID is launching a three-year, \$10 million Sudan Peace Fund designed to facilitate reconciliations achieved through the grassroots people-to-people process and consolidate those reconciliations by providing quick access to capital inputs and technical assistance for civil works projects to be undertaken by newly reconciled communities. Local Peace Councils and networks of civil society organizations together with local authorities in opposition-controlled areas will be supported to facilitate people-to-people reconciliations that will culminate in a peace accord and include follow-on implementation measures. These communities will then receive support for the recovery of markets and trade, access to health and education services and safe water supplies and to agricultural extension services (ie. community-based animal health services, seed banks, etc.). Reconciled communities will receive immediate access to communications and transport to facilitate resettlement of displaced populations, prevent renewal of fighting, and to effectively implement provisions of the reconciliation or peace settlement. Activities in support of non-grassroots peace processes, including research and provision of conference facilities, will be implemented on a case-by-case basis. There will be no impact on the environment from the training

and technical assistance activities. However, the program will cover the costs of minimal physical rehabilitation of infrastructure, such as schools, wells, courthouses, markets, seed banks, etc.

Sudan Basic Education Program. This new initiative announced by the USAID Administrator in September, 2001 seeks to increase equitable access to quality education in southern Sudan. It seeks to improve teacher education programs; increase the capacity of primary and secondary schools to provide quality education, especially for girls; and improve non-formal education for out-of-school youth and adult learners. Activities will include rehabilitation of five Regional Teacher Training Institutes owned and managed by Sudanese; training up to 2,000 women teachers using accelerated learning and scholarships; fostering of technical and administrative partnerships between Sudanese teacher training institutes and teacher training institutions in East Africa and the United States; sustainable rehabilitation of up to 240 primary schools and 10 secondary schools; increase in the supply of school materials provided by the Sudanese private sector; and promotion of non-formal education and distance learning for up to 20,000 out-of-school youth and adult learners. There will be no impact on the environment from the training and technical assistance activities. However, some of the sub-grants will cover the costs of minimal physical rehabilitation of infrastructure, such as teacher training institutes, girls' schools and bookshops, etc., for income-generation projects.

3. Scope of Work

Given the current political situation in Sudan and the existence of a separate provisional government in southern Sudan, two consultants will be hired. One will conduct an assessment of the natural resource conditions and policy environment in northern Sudan, while the other will conduct a separate analysis for southern Sudan. A single combined report will be compiled by one of the consultants based on the two regional analyses.

3.1 Specific Tasks

The consultant(s) will:

1. Document the state of key natural resources by quantifying trends in their management, biophysical condition, productivity, abundance and distribution and identifying the threats (e.g., degradation, depletion, pollution) to which they are subjected. For the purpose of this analysis, the key natural resources to be assessed include forests and woodlands, wildlife, natural water bodies (including wetlands, rivers and lakes), and soils (fertility and stability) as related to agricultural systems and other forms of land clearing.
2. Conduct an analysis of how past events and current initiatives (southern Sudanese, northern Sudanese, and donor) have shaped the country's development trajectory. The concern is how both southern and northern Sudan's responses to the global economy, their geo-political positions in the Horn of Africa, and their internal development agendas are impacting (or will impact) environmental sustainability (Section 117), tropical forest conservation (118) and biodiversity (119).

3. Analyze existing and proposed GOS and southern Sudan provisional government laws, policies, and initiatives that have implications for the environment. Of particular relevance are: 1) policies, codes, protocols and regulations (both draft and in force) related to natural resources, e.g. Forest Codes and wildlife conservation; 2) water resources management legislation and wetlands law; 3) land tenure legislation and/or initiatives; agribusiness and private sector promotion provisions; and 4) draft laws on fishing and aquaculture.
4. Identify and analyze gaps in the existing knowledge base, both within and outside the purview of existing agencies. Collect available data, conduct interviews, and recommend needed follow up work.
5. Conduct an environmental review of proposed USAID/Sudan strategy components. This will be a preliminary analysis of potentially negative environmental impacts, as well as opportunities for incorporating sound environmental management principles into proposed activities. Special emphasis should be placed on potential food security actions (including economic rehabilitation, infrastructure development, and agricultural revitalization), and provision of basic services (including health and water/sanitation infrastructure development). The intent is to identify and/or emphasize environmental threats and opportunities relevant to the Mission's SO programs, and the potential impacts with respect to FAA Section 117, 118 and 119 issues. The identification of opportunities and entry-points for USAID/Sudan efforts under the new ISP to positively influence the conservation of tropical forests and biodiversity and improve environmental management will be particularly relevant.

3.2 SOW Approach:

The following activities are considered necessary for the Contractor to deliver a timely and high quality ETOA for incorporation in the USAID/Sudan ISP:

1. Gather and review existing, relevant background information on Sudan's natural resources base and begin identifying organizations and donors involved in the sector. Thoroughly review the following studies and policy papers, which will be made available by the REDSO/FS environment staff and the USAID NPC Sudan Task Force: "Concept Paper in preparation for the USG ISP for Assistance Programs in Sudan, 2003-2005" (December 2002); "USG Integrated Strategic Plan: Assistance to Sudan 2000-2002"; "Kagelu Teak Plantation Survey" (January 2002); and "Impact of Conflict on Wildlife and Food Security" reports for Nimule and Boma.
2. Attend the strategic planning workshop with Sudanese stakeholders to be held in Rumbek, southern Sudan from February 9 – 15, 2002. Present ETOA objectives, acquire understanding of potential directions for USG assistance, and gain perspectives of participants with respect to key environmental threats as well as appropriate areas for intervention.
3. A. Southern Sudan analysis: Conduct up to three priority site visits, which would supplement understanding of USAID's program, or of forestry, biodiversity and

other relevant environmental issues that arise in interviews and literature, or would confirm information in previous assessments. Field visit sites and logistics will be determined prior to departure and in consultation with the USAID/Sudan Task Force and REDSO/NPC.

B. Northern Sudan analysis: Conduct interviews with key environmental policy makers and program managers in Khartoum and surrounding area. These interviews could include visits with the Wildlife and Environment General Administration, the Ministry of Irrigation and Water Resources, Higher Council for Environment and Natural Resources, the Sudanese Social Forestry Society, the Faculty of Forestry at the University of Khartoum, the Forest National Corporation, and the Directorate of National Parks, among others.

4. Consider opportunities to engage the non-DA funded activities (OFDA, OTI, FFP/Emergency, etc.) with the principles of minimum quality voluntary standards for humanitarian assistance programs, to be promoted by the Regional Environmental Office for activities carried out with complex emergency resources (e.g., see the Sphere Handbook, www.sphereproject.org).

4. Expertise Required

International Technical Assistance (2). **Senior Natural Resources Team Leader, and Senior Natural Resources & Environmental Management Specialist** with post-graduate qualifications in biology, zoology, forestry or closely related field in natural resource management. Background in tropical biodiversity, water resources management, and/or natural resource conservation. Knowledge of Sudan and of USAID Strategic Planning process related to Environmental Threats and Opportunities Assessment. Knowledge of 22 CFR 216 and of FAA Sections 117, 118 and 119, and related USAID and USG directives. Demonstrated expertise in assessing development programs for impacts on environment and tropical ecosystems. Demonstrated expertise in the design and production of environmental impact assessments (EIA).

Local Technical Assistance (1). **Environmental Policy Analyst** with demonstrated experience in Sudanese environmental law, the policy and legal frameworks governing natural resources, environmental management and agriculture in Sudan, and the analysis of relevant policies.

5. Period, Level of Effort and Supervision

- A. Team Leader: A maximum of 35 working days based on a six-day work week is authorized. The team leader consultancy will be carried out within the period o/a 1 February to March 31st, 2003. About 3 days will be spent for pre-departure document review and planning, 6 days will be in-country at the Rumbek workshop, 14 days of field work, ten days of writing and wrap-up, and 2-4 days travel. The southern Sudan international consultant will oversee the work of the local-hire consultant, and will incorporate the findings of the northern Sudan consultant into the final report. The

international consultant will work under the technical direction of the USAID/REDSO Sudan Team Leader, a USAID/REDSO Environment Officer and the Sudan Task Force. The Senior Regional Environmental Officer based at USAID/REDSO, Nairobi, will also have an advisory role.

- B. Senior Natural Resource Specialist: A maximum of 25 working days based on a six-day work week is authorized. The Northern Sudan consultancy will be carried out within the period o/a January 25th to March 3rd, 2003. About 3 days will be spent for pre-departure document review, 7 days of field work, and 14 days for research, writing, and wrap-up, and 2 days for travel. The northern Sudan international consultant will take sole responsibility for the research, drafting, and presentation of the northern Sudan environmental analysis. The international consultant will work under the technical direction of the USAID/REDSO Sudan Team Leader, a USAID/REDSO Environment Officer and the Sudan Task Force. The Senior Regional Environmental Officer based at USAID/REDSO, Nairobi, will also have an advisory role.
- C. Local Natural Resource Technical Assistant: A maximum of 21 days based on a six-day work week is authorized. The natural resource technical assistance consultancy will be carried out within the period o/a February 9 to March 2, 2003. Six days will be spent in-country at the Rumbek stakeholder workshop and 14 days of field work will be included. The natural resource technical consultant will be supervised by the Team Leader and Southern Sudan consultant.

6. Deliverables (The Team Leader will have primary responsibility for all work products/deliverables)

- Work plan/schedule within three working days of start date.
- Oral debriefing within five days before ending date (Team Leader and Sr. Specialist).
- One report containing the information described in 3.1, items.1 to 7 above (Team Leader).
- A copy of the draft report will be delivered to USAID/REDSO/NPC and the USAID Sudan Task Force--within ten days of departure from the field--in electronic (saved to MS Word 97) as well as hard copy.
- Following a two week comment and review period, a revised final report incorporating all comments will be submitted within three weeks of the end date.
- Fifteen copies of the bound final draft will be made available when the final is approved by the Mission.
- A short (10-15 p.) ISP Environmental Annex, which consists of a summary and syntheses of the findings and recommendations of the full ETOA. The complete parent document, "Sudan environmental threats and opportunities" will be in the master Mission ISP files and available on request. The introduction to the Summary will include this statement: "The Environmental Annex is an ISP-specific analysis that examines environmental threats and opportunities inherent to the Mission's strategy and assesses the extent to which the Mission's strategy incorporates or addresses tropical forests and biodiversity concerns. This assessment does not substitute for the Initial Environmental Examination (IEE). Each SO Team is responsible for ensuring that an IEE or a Request for a Categorical Exclusion is

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*- indicates that copies of these reports are available in the personal library of T. Catterson.

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James Mindo	Director, Southern Sudan Forest Department, Yei	

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Annex D: ETOA for Northern Sudan

Partnership for African Environmental Sustainability (PAES)

FINAL DRAFT

SUDAN (NORTHERN) ENVIRONMENTAL
THREATS AND OPPORTUNITIES ASSESSMENT
WITH SPECIAL FOCUS ON BIOLOGICAL
DIVERSITY AND TROPICAL FOREST

Report Submitted

TO USAID

FOR CONSIDERATION IN

USAID/Sudan Integrated Strategic Plan (ISP)

MERSIE EJIGU
APRIL 4, 2003

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EXECUTIVE SUMMARY

Purpose and methodology

1. As provided in the Terms of Reference, the "objective of this work is to deliver to USAID/REDSO/NPC and the USAID Sudan Task Force a countrywide Environmental Threats and Opportunities Assessment (ETOA) that will inform the Environmental Annex of the USAID/Sudan Integrated Strategic Planning (ISP) process." This study covers Northern Sudan or the area under the control of the Government of Sudan in Khartoum. The work involved one person nine days field mission (27 January – 4 February 2003) to Khartoum, preceded by three days of preparatory and followed by 15 days of analytical work and write up.
2. In undertaking the study, the following steps were taken: preparation that included understanding the TOR, preparing budget and travel schedule, identifying and recruiting local staff, identifying key institutions and personnel to contact; developing assessment methodology and conceptual framework; information gathering that involved literature review and interviews with relevant government officials, selected civil society, the University of Khartoum and research organizations' and experts; and lastly data analysis and write up. The list of persons contacted is provided in Annex II of the main report.
3. The mission has been warmly welcomed in all places it has been. The Higher Council for Environment and Natural Resources of Sudan (HCENR) hosted the mission. As the Council also hosts the project, "Capacity Building for the Formulation of Sudan's National Strategy for Sustainable Development" funded by the United Nations Department of Economic and Social Affairs – Division for Sustainable Development (UNDESA-DSD) and executed by the Partnership for African Environmental Sustainability (PAES) headed by the consultant, it made this study a logical continuation of the strategy development process.
4. The detailed report of the mission, below, covers the conceptual methodology for assessment, review of key natural resources, policies, legislations and institutions for natural resource management, Sudan's development experience and key environmental threats and opportunities.

Key findings of the review of the natural resource situation

5. Lying between 4-22°N and 22-36°E latitude, Sudan is the largest country in Africa with an area of 2.5 million square kilometers. The country's population is estimated at 33 million (2000) growing at 2.7% per annum. About 70% of this population resides in rural areas.
6. Sudan is endowed with vast natural resources extending from desert in the north to tropical rain forest in the South. The size of area that can be developed for agriculture is estimated at 80 million hectares. Sudan's share of the Nile waters set at 18.5 billion cubic meters remains unutilized. Sudan is also endowed with various mineral resources that include gold, petroleum, chrome, asbestos, uranium, hydropower, natural forests and huge arable land. Added to this is a well-trained human resource base, despite huge brain drain to Saudi Arabia and other countries in the Gulf and Middle East.

Governance, economic policy and trends

7. Classified as one of the least developed countries of the world, Sudan ranks 143rd out of the 174 countries listed in the Human Poverty Index (HPI), (UNDP, 1998). In the early 1990s, the International Monetary Fund declared Sudan non-cooperative because of its

nonpayment of arrears to the Fund. Despite the IMF decision, the Government embarked upon several initiatives that included liberalization of exchange rates, privatization that started in 1992, and decentralization since 1995. In 1998, IMF had put in place a three-year staff monitored program that ended on 31st December 2001. Although the economy has grown by 6% in 1999 and 8.3% in 2000, IMF has reported failure of the Government to pay its commitments to the Fund. Nor were there any indication of weakening of both poverty and environmental degradation.

8. Agriculture is the mainstay of the national economy with about 80% of the people engaged in crop and animal production. This makes millions of people in the country directly dependent on natural resources for their livelihood and employment. Very recently, petroleum has become the biggest export earner, and in 2001 accounted for 81% of the total export earning. The structure of the Sudanese economy is bound to change over the coming years as a result of petroleum; depending upon how the petroleum income is used, which is now largely used to finance the war in Southern Sudan.
9. Sudan is in the process of formulating a national strategy for sustainable development (NSDS) and a national poverty reduction strategy (PRS) advocated by the World Bank. These two strategies will be prepared within the framework of Sudan's National Comprehensive (25 years) strategy; a preliminary draft document is currently under consideration by the Council of Ministers. The National Council for Strategic Planning (NCSP) chaired by the President of the country oversees the formulation of the 25-year strategy. The detailed contents of the Strategy are not much known outside the Secretariat of the Council. The broad contents of the strategy as presented to the NSDS workshop are briefly explained in the main report.
10. Since independence in 1956, the country had three civilian rules that governed ten years since then. The system of government has oscillated between secularism, Marxism and Islamism with the current government in Khartoum practicing Islamism. Government decision-making process is characterized by frequent policy and personnel changes. Although designed to quickly respond to global and domestic changes, it has brought instability in the operations of civil service.
11. The structure of government up to 1960 was essentially central, and since then different approaches had emerged with the different political regimes that came to power. More devolution of the central government powers took place in 1992 with the launching of the Federal Government Act. The country was divided into twenty-six States. Each State was also divided into provinces. Provinces were further subdivided into localities. Each State has a legislative body and a state government. Lower levels of government exist in each state. At the time of writing this report, restructuring was undergoing with the view to reducing the number of localities.

Biological diversity and forests

12. The wide range species and ecosystem diversity that Sudan is endowed with include: 12 orders of flowering plants out of the 13 found in Africa. Of the 3132 species of flowering plants found in the country, 409 species are endemic; of the 265 species of mammals, seven are endemic. Sudan has also 938 of bird species, 105 Nile fish species, 91 reptile species, The IUCN list of threatened species in Sudan includes: 9 plant, 17 mammals, 8 birds, and one reptile, although the Forest National Corporation's recent study shows 42 threatened species. The protected wildlife area in the country is estimated at 14% of the country's area. There are 8 national parks, 15 game reserves and 3 sanctuaries. Five of these game reserves are located in the Sudd swamps in South Sudan along the White Nile.

13. Of its diverse ecological zones, more than half the country can be classified as desert or semi-desert, with another quarter classified as arid savannah. Reflective of the diverse ecological zones, soils of Sudan fall into six main categories: desert soils, semi desert, Qoz soils (sands), alkaline catena soils, alluvial and lacustrine soils, iron stone plateau soils.
14. The tree cover of Sudan estimated at 36-43% at the time of independence in 1956 (Harrison and Jackson (1958) has now declined to 19% (FAO estimate). But if bushes are taken into account Forest National Corporation estimate the forest cover at 27%. Sudan's forest resource is mostly woodland savannah with 65% found in the southern states and the remaining 35% in the north. It is estimated that there are about 533 tree species in the Sudan, 25 of which are exotic and 184 shrub species, 33 of that are exotic. Trees are used for timber, fuelwood, building material, fodder, honey production, gum, tannins and medicine production. The forest sector accounts for 12% of GDP.

Sudan and post Rio global environment conventions

15. The Government of Sudan has been quick in responding to the call made by the UN Conference on Environment and Development (UNCED) and adoption of Agenda 21 in 1992. It has put in place a ten year (1992 – 2002) Comprehensive National Strategy (CNS) Strategy that provided the policy directions of all economic and social sectors. It established the Higher Council for Environment and Natural Resources (HCENR) in 1992; formulated the National Biodiversity Strategy and Action Plan (SNBSAP) and the Sudan National Action Plan to Combat Desertification (SNAP). It has also initiated climate change mitigation project under the UN Framework Convention on Climate Change (UNFCCC),” that aims at building Sudan's capacity to prepare Sudan's communication to the Convention. In 1999, the Government issued a National Water Policy.
16. Nevertheless, assessments made by the Government of Sudan and the NGO community in preparation for the World Summit on Sustainable Development (WSSD), Johannesburg 2002, show that many of these initiatives remain unimplemented. The National Biodiversity Strategy and Action Plan (SNBSAP) issued in 2000 has not yet been sanctioned by the Government. There is limited awareness about the environment in many government institutions. Horizontal coordination is also lacking between SNBSAP and SNAP and also with other sectoral strategies. Sudan's Comprehensive 25 year-strategy overseen by the Office of the President does not make a reference to the national biodiversity strategy. Further, the Higher Council for Environment and Natural Resources that coordinates and houses the formulation of these strategies remains weak and marginalized.

Threats

17. The review and analysis of the natural resource base reveals that today much of Sudan's land area remains fragile with high sensitivity to changes in temperature and precipitation. The key driving forces of the continued environmental degradation are:
 - i. **Government policies and strategies.** Sudan's economic policy since the late 1960s has encouraged expansion of rainfed mechanized agriculture, ostensibly to improve the country food security and make Sudan food self-sufficient. Sudanese authorities today admit that until the late 1960s, traditional (tribal) administrations controlled most of Sudan's arable land, pastures and forests enforced rules about land use, in particular, on fallowing land and establishing fire lines and crossings for nomads and their animals to avoid unnecessary destruction of biodiversity. Nevertheless, the modern local administrations that replaced the traditional ones ignored the tradition and encouraged

the expansion of mechanized agriculture. This resulted in extensive clearance of forests and bushes for cultivation purposes, conversion of pasture into farms, and forced traditional farmers and pastoralists to overuse the land left to them for cultivation and grazing. Reports of the Forest National Corporation (FNC) show that an estimated 455,000 ha of forestland is being cleared annually for agriculture and other purposes. Traditional agriculture that engages huge segment of the population has no or limited access to modern agricultural inputs that left farmers to rely on extensive farming practices as the only coping mechanism. Today, many of the environmental threats are triggered, amplified or caused by horizontal expansion of mechanized and traditional agriculture.

- ii. **Weak policy and legislation enforcement mechanisms.** Although the Government has issued a number of high sounding decrees and legislation that would have gone a long way to protect the environment, many of the post-Rio environment-related policies remain unimplemented. Nor were there strong mechanisms put in place to monitor implementation of these policies and enforce legislation. For example, the Forest National Corporation has limited means for enforcing the various forest acts. The government has not yet sanctioned the National Biodiversity Strategy and Action Plan issued in May 2000 as well as the Sudan's National Action Plan to Combat Desertification (SNAP) in 1998. There is also no clearly articulated and multi-sectoral action plan for the implementation of the strategy.
- iii. **Inadequate institutional capacity and proliferation of institutions.** Many Government institutions remain deprived of the necessary budgetary resources that would enable them provide basic services or perform basic duties and responsibilities. Years of diplomatic isolation and economic sanctions appear to have deprived Sudan of the technology, trade opportunities and investment that globalization has offered. The Ministry of Tourism and Environment is responsible for environmental policy and regulations, and also oversees the Higher Council for Environment and Natural Resources, but lacks the technical capacity to do so. There is also lack of coordination, say between the Ministry of Agriculture and Ministry of Animal Resources, between the Forest National Corporation (FNC) and Wildlife Conservation General Administration (WCGA). While the lack of coordination is a common problem in many developing countries, what makes the Sudanese situation worrisome is the existence of many institutions at the ministerial level.
- iv. **Land tenure legislation and land use.** Sudanese authorities that the Land Settlement and Registration Act, issued in 1925, had provided for individual rights and interests over land that included cultivation, pasture, woodcutting, and holding. In 1970, the government promulgated the Unregistered Land Act that bestowed ownership of any wasteland, forest or unregistered land on government. Private ownership of land is limited to the registered rights before the coming into force of the Unregistered Land Act of April 1970. Unregistered land is almost 95% of the Sudan land area. Although the government has the formal ownership of the unregistered land, it has not been able to exercise effective control over land allocation and utilization. The land allocation and judicial powers which provided a certain measure of control, regulation and conservation were taken from the native administration and vested in the local government officers and later in the state government. Neither level of government has the knowledge of the traditional use of neither land, nor the means for planning and control of land use.
- v. **Demographic changes.** Sudan's population grows at 2.7% per annum. Population growth in Sudan has direct consequences on the environment through the growing

demands for fuel wood. The demands for more land to produce more food means shortening of the fallow or resting period in the rain fed agricultural. This in turn contributes to the gradual loss of soil fertility through the exhaustion of the soil. Recurrent drought has also forced people to migrate into relatively fertile areas carrying with them the very forest clearing and slash and burn agricultural practices that caused the recurrent drought.

- vi. **Heavy reliance on biomass energy.** Of Sudan's total energy, 88 percent originates from biomass (83% wood and 5% residues) while oil accounts for 11 percent and hydropower 1 percent. Within the household sector, which accounts for 69% of all energy consumption in 2000, the share of biomass reaches 98%. The national energy policy of the government accords priority to oil production through the promotion of large-scale thermal generation. The government has invested some 3.3 billion USD in oil production including in setting up a central petroleum lab.
 - vii. **Poverty.** According to official figures of 1998, 94% of Sudan's population is below the poverty line. Liberalization of the economy without the necessary social safety nets is blamed for this high level of poverty. The rural population has been the hardest hit as many of the poor people are in the rural areas, and live in marginal lands and drought prone areas. The poor have limited access to modern agricultural inputs and also to alternative biomass sources of energy. This means heavy reliance on forest clearing to expand agricultural output, and even to maintain it in most cases. Further, both historical and contemporary records of famines in Sudan and other neighbouring countries show that environmentally degraded areas, where the poor mostly live are prone to natural calamities, particularly to droughts and crop failures, and consequently to famine and outbreaks of diseases.
 - viii. **Sudan's diplomatic isolation and economic sanctions.** The economic sanctions imposed on Sudan have denied the country access to foreign direct investment, development assistance and also normal trade relations. Sudan has accumulated a large foreign debt since the oil boom of the early 1970s and debt repayments did not give room for maintenance of productivity in either the modern or traditional sectors.
 - ix. **Refugees from neighboring countries.** Sudan had hosted refugees displaced by war and drought for the last three decades. Eastern Sudan is the main reception and camp centre for Eritrea and Ethiopian refugees. Refugees protracted presence negative impacts on the environment through indiscriminate clearing of trees for domestic energy and housing.
18. *From the findings of the mission and the review of SBNAP and SNAP, the following key environmental threats have been identified:*
- i. **Land degradation.** Sudan's natural resource is characterized by severe and continuous land degradation. This is attributed to horizontal expansion of agriculture, cultivation of marginal lands, overgrazing and heavy wood energy consumption (firewood and charcoal constitutes approximately 87.6% of Sudan wood harvest). Severe wind erosion - in areas north of latitude 14°N and water erosion -in Equitoria (South Sudan), Jebel Mara and Nuba mountains in the west and southeast Gedarif in eastern Sudan, are the key forms of land degradation.
 - ii. **Deforestation.** As explained above, over the past few decades, Sudan has seen a dramatic decline in its forest reserves. Horizontal expansion of rain-fed mechanized and traditional farming, heavy reliance on forest biomass energy, overgrazing, bush

fire, etc. have been the key factors. Although there have been several forest legislations issued, institutional mechanisms for enforcing these laws were lacking. Today, the Forest National Corporation remains operational only at the federal level.

- iii. **Climatic variability.** Climatic variability manifests itself in the form of severe drought and occasional floods, and Sudan faces both problems. For over three decades, recurrent drought, with occasional severe droughts, had become normal phenomenon in Sudan and indeed in the Sudano-Sahelian region. In particular, the severe droughts of the early mid 1970s and ten years later of the early mid 1980s, have destabilized the population, broken down family and tribal structures, traditional practices of resource management and forced people to migrate. There were also series of localized droughts often every two years, but mainly in western Sudan in Kordofan and Dafur regions and parts of central Sudan. As with drought, two types of floods affect the country: localized floods, caused by exceptionally heavy rainfall and runoff (flash flood) and widespread floods caused by overflow of the River Nile and its tributaries.
- iv. **Desertification.** Fifty one percent (about 1,259,440 square kilometers)²⁸ of Sudan's land area) between latitude 10 to 18 degrees north is affected by desertification ranging from light to severe. This area is characterized by extreme arid conditions continuously fed by recurrent drought, land degradation, deforestation, soil nutrient loss. Studies conducted by NDDU showed the shift of the rainfall isohyets during the period 1930-1990 from north to south indicating the expansion of arid condition from north to south. Sudan's National Action Plan to Combat Desertification (SNAP) covers thirteen of the 26 Sudan's states classified as desert or semi-desert.
- v. **Soil nutrient loss.** Mono-cropping farming system, years of extensive cultivation practices by the mechanized and traditional rain fed sectors, with limited or no access to fertilizers and improved farming techniques compounded by wind and water erosion have left most soils of Sudan nutrient depleted.
- vi. **Unsustainable agricultural practices.** This has manifested itself in the form of reliance on seasonal bush and grassland fires for purposes of preparing land for cultivation, pastoralism, overgrazing in some regions of the country, limited extension services and farmers' shift to early maturing crop varieties in response to drought. Sudan's livestock population stands at 124 million. This means that every Sudanese, regardless of age, owns 4. The Range and Pasture Administration estimates the minimum area of rangelands required for sustaining the national livestock herd at about 190 million ha, Sudan has at present only 116 million ha of natural rangelands. The difference represents overgrazing.
- vii. **Wetland degradation and loss.** The lack of awareness of the hydrological, economic, climatic and social benefits of wetlands, the Jonglei Canal Project and the War in Southern Sudan pose serious threat to wetlands of Sudan. Given the global significance of Sudan's wetlands, halting wetland degradation would require immediate regional and global attention.
- viii. **War and civil strife.** Sudan has suffered from more than 40 years of war and civil strife in the southern part of the country, which is the richest area in biodiversity. This had devastating effects on biodiversity arising from indiscriminate clearing of forests to meet military requirements, hunting of endangered animal species and also cutting of endangered plant species to finance the war, destruction of national parks and

²⁸ Sudan National Action Plan to Combat Desertification (SNAP), p. 15

protected areas. The cutting of forests is a known defense mechanism employed by both sides. Burning and cutting of Papyrus, Phragmites and Typha for access, also occurs.

- ix. **Pollutants and pollution of water resources** – siltation, sedimentation, aquatic weeds (water hyacinth) and POPs, though quantitative evidence is not strong, have emerged as potential threats to consider. Water hyacinth, for example, has infested 3200 kilometers of the White Nile.²⁹
19. Sudan's knowledge base for sound natural resource management remains weak. This is manifested in the lack of recent vegetation, forest, wildlife periodic surveys; frequent changes in the structure of government institutions and subsequent lack of continuity of personnel; years of diplomatic isolation and economic sanction; and successive wave of brain drain, first to the oil rich countries and lately to North America and Europe for fear of political oppression or seeking better economic opportunities. The 2000 FAO commissioned Sudan Forestry Outlook Study for Africa (FOSA) and the National Biodiversity Strategy and Action Plan have identified serious knowledge gaps in such areas as: wildlife population and distribution (the current survey dates to the pre-war status); plant and wildlife taxonomy; ecology of forest montane vegetation; ecology of the Red Sea and coastal vegetation; land tenure regimes and southern Sudan forestry.

Opportunities

20. Sudan has huge development and investment potential. There are several opportunities for intervention derived from environmental threats identified earlier. But at the same time, any intervention needs to take full cognizance of efforts currently being made by the government, private sector and civil society. The above assessment of environmental threats suggests an immediate need for intervention in a number of areas, and the key ones are:
 - i. **Improving land use through the development of land use plan and policy.** Land degradation has now become serious threat to the survival of a majority of Sudanese population. Its impact, in terms of loss of biodiversity, reduced atmospheric and subterranean carbon sequestration, and pollution of international waters, is significant. The National Biodiversity Strategy and Action Plan (SNBSAP) and Sudan's National Action Plan to Combat Desertification (SNAP) have also identified improper land use as a leading threat to the country's biodiversity and have recommended the need to develop land tenure policy and legislation. It is thus important to undertake a review of existing land tenure regimes and land use practices, on the basis of which land use policy can be developed. The development of the land use plan could give priority to areas hardest hit by land degradation.
 - ii. **Developing the knowledge base for sound natural resource conservation, management and use.** Rational use of natural resources and sound management of the environment require the availability of environmental information on, for example, vegetation, soil, water, weather condition and on socio economic activities that influence environmental change. Such information in Sudan is highly scattered, lacking and/or often outdated. Institutions that employ modern techniques such as remote sensing and geographic information systems, lack the necessary soft ware and hard ware that would enable them to generate decent information. Thus,

²⁹ SNBSAP, p.35

mapping soil and key resources need to be undertaken, in addition to strengthening the Remote Sensing Authority in soft ware and hard ware.

- iii. **Strengthening the Higher Council for Environment & Natural Resources (HCENR).** The HCENR, despite its huge responsibility as the coordinating agency for the formulation and implementation of the National Biodiversity Strategy, has only one senior staff member, i.e., the Secretary General, and the institutional infrastructure is weak. The NDDU of the Ministry of Agriculture, currently housed in the HCENR, coordinates the implementation of the SNAP, but operates with only one senior permanent staff member.
- iv. **Restructuring and strengthening of the Forest National Corporation (FNC).** The Forest National Corporation would also require strengthening and redefinition of its mandate based on a policy that promotes the conservation and sustainable use of forest biodiversity through the involvement of communities. At present, the FNC operates only at the federal level, but shares with States the revenue from forest products and services. The respective roles and responsibilities of FNC and the state governments need to be redefined too.
- v. **Mainstreaming the Sudan National Biodiversity Strategy (SBSAP) and the Action Plan to Combat Desertification (SNAP) in the national development decision-making process.** As both the SNBSAP and SNAP lack detailed and operational implementation strategies and action plans for their realization, one possible entry point would be to assist the development of a detailed implementation strategy and action plan. Such initiative has the potential to trigger the formal adoption of the two strategies by the government and may also play a catalytic role to mobilize local and external resource for their implementation.
- vi. **Promoting conservation of Sudan's genetic resources.** One of the priority activities identified by the SNBSAP is the collection of plant and animal genetic resources throughout the country to preserve genetic resources threatened by war, pollution and recurrent drought.
- vii. **Improving the conservation and management of wildlife.** The wildlife and National Park Act of 1987 is mainly focused on the conservation and protection of wild animals and neglects or excludes wild plants. It does not provide for zoning of parks and classifications of areas with potential for multi-purpose uses, in particular the exclusion of people residing around national parks in wildlife management constitutes unsustainable practice. In general, current wildlife conservation is reported to be inadequate. Most parks and protected areas are inadequately staffed and financed. In addition, there are no land use plans, and most protected areas are left open to human settlement, cultivation and livestock grazing. Therefore, surveying of wildlife areas and preparation of wildlife management plans merit priority attention.
- viii. **Strengthening and expanding environmental education and communication.** Sound management of the environment requires the participation of all groups of society. Effective participation requires awareness about the environment, which is lacking in Sudan.
- ix. **Conflict resolution and building sustainable peace in the Sudan.** Any effort made to achieving peace in the Sudan would contribute enormously to the protection of the environment.

- x. **Supporting the development of sustainable agricultural practices.** Soils rehabilitation programs will be required which would include: investment in new farming technology; improved extension services and actively involving and engaging farmers in land-use planning; management and supporting local organizations to preserve local ecosystems; and move toward integrated crop culture.

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My thanks also go to Dr. Nadir Awad Mohammed, Secretary General of HCENR, for facilitating my meetings with various government officials. However, I am alone responsible for any word or statement that appears in the report.

Partnership for African Environmental Sustainability (PAES), which I am the President, Chief Executive Officer and Founder of, is a non-governmental organization established to promote environmentally and socially sustainable development based on science and best practices. With transboundary issues as its focus, the PAES programme centers on policy development and seeks to address the causes and effects of environmental degradation in an integrated fashion. Please visit us at: www.paes.org.

Mersie Ejigu

LIST OF ACRONYMS

CBNRM	Community-based Natural Resources Management
CBOs	Community-Based Organizations
DNPP	Dindir National Park Project
ETOA	Environmental Threats and Opportunities Assessment
EU	European Union
FNC	Forest National Corporation
GEF	Global Environmental Facility
HCENR	Higher Council for Environment and Natural Resources
IGAD	Intergovernmental Authority on Development
IES	Institute of Environmental Studies (University of Khartoum)
IMF	International Monetary Fund
JMRDP	Jebel Marra Rural Development Project
NCS	National Comprehensive Strategy (1992 – 2002)
NCSP	National Council for Strategic Planning
NDDU	National Drought and Desertification Unit (within the Ministry of Agriculture)
NWRC	National Water Research Council
PAES	Partnership for African Environmental Sustainability
RPA	Range and Pasture Administration (within the Ministry of Agriculture)
SECS	Sudanese Environment Conservation Society
SES	Sudanese Environmental Society
SNAP	Sudan National Action Plan for Combating Desertification ,
SSFS	Sudanese Social Forestry Society
UNCBD	United Nations Convention on Biological Diversity
UNCCD	United Nations Convention to combat Desertification
UNCED	United Nations Conference on Environment & Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UN FAO	UN Food and Agriculture Organization
USAID	United States Agency for International Development
VCDC	Village Council Development Committee
WCGA	Wildlife Conservation General Administration

SUDAN: BASIC STATISTICS

Population (2000) million	33
Annual population Growth Rate	2.7
Area (million kilometers)	2.5
GNP Per Capita	\$250-300
Life expectancy at birth (year)1995	52.2
Urban population as % of total (year) 1995	46.1
Population below poverty line	
Rural (year) 1996	93.9%
Urban (year) 1996	84.5%
Infant mortality rate (1997 est.)	74.3 deaths /1,000 live births
Children under age of 5 suffering from. Malnutrition	55%
Population with access to health care services	70%

Education

Net primary enrollment or attendee (year) 1995	51.13
Adult literacy rate (year) 1995	46.1
Unemployment rate (year) 1996	16.6

Energy

Biomass	88%
Electricity	3%
Petroleum	12%

Current issues: deforestation results from horizontal expansion of agriculture; uncontrolled cutting of trees for fuel; overgrazing; soil exhaustion; overfishing; Sudd wetland threatened by irrigation schemes; threatened biodiversity.

Mineral resources: gold, petroleum, chrome, asbestos, uranium, hydropower, natural forests, arable land

Parks and Protected Areas: 8 national parks, 15 game reserves, 3 sanctuaries 11, consisting of 8.6 million hectares, or 3.45% of total land mass

Wildlife: 21 threatened species

Forests: natural forests: 41 million ha; tropical forests: 12.3 million ha (1995 est)

Land use: cropland 17 million ha; irrigated land: 11.5% of cropland

Global Conventions that Sudan is party to:

Convention on Biological Diversity, Climate Change, Desertification, Endangered Species, Law of the Sea, Nuclear Test Ban, Ozone Layer Protection,- Convention on Biological Diversity (CBD) ratified in October 1995.

PURPOSE OF ASSESSMENT AND METHODOLOGY

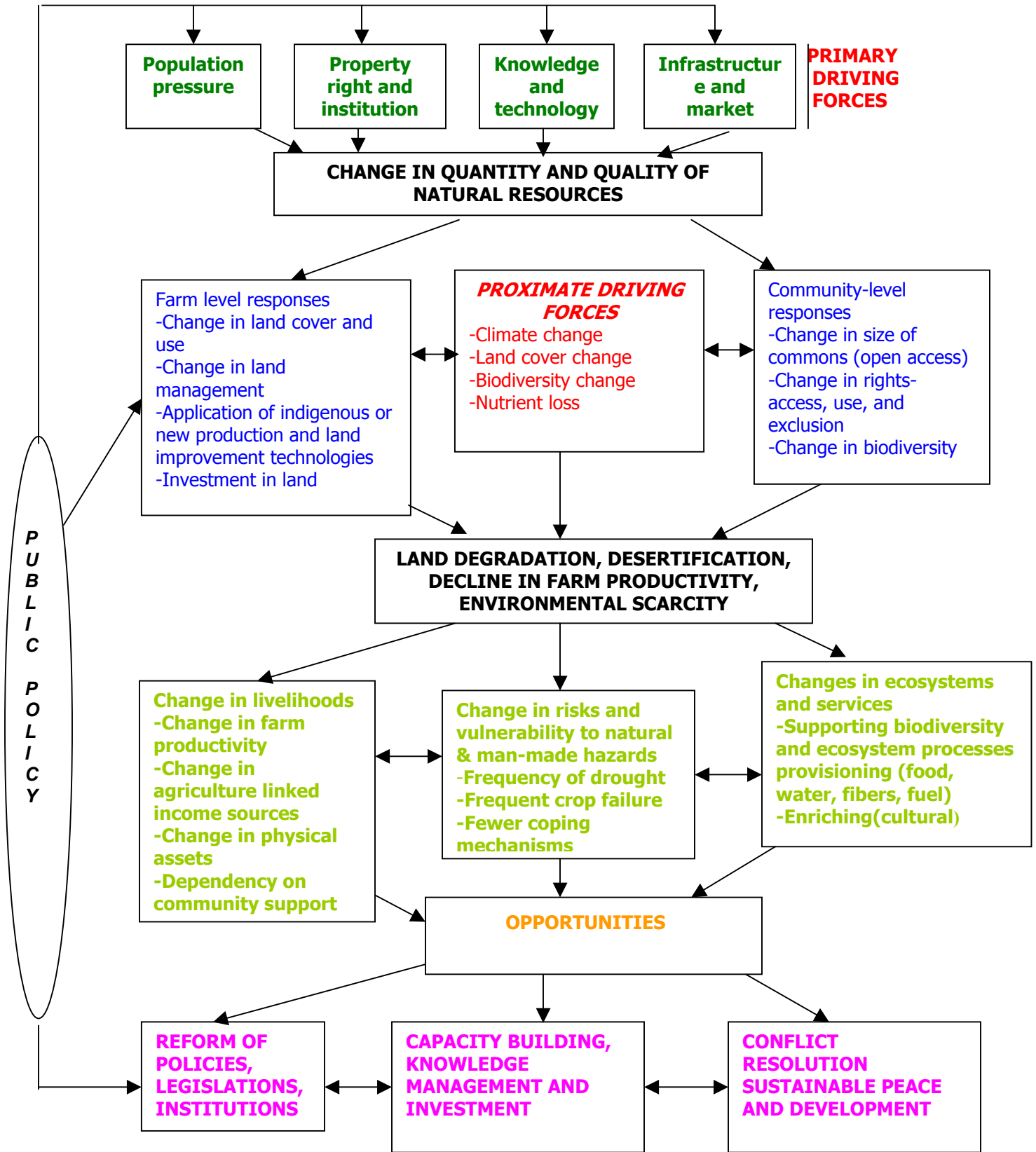
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This study covers Northern Sudan or the area under the control of the Government of Sudan in Khartoum. The work involved ten days field mission to Khartoum. This was followed by 15 days of analytical work and write up.

In undertaking the study, the following steps were taken:

- Preparation - Understanding the TOR, preparing budget and travel schedule, identifying and recruiting local staff, identifying key institutions and personnel to contact
- Developing assessment methodology and conceptual framework
- Information gathering
 - Literature review
 - Interviews with relevant government, selected civil society and research organizations' officials and experts
- Data analysis and write up

CONCEPTUAL FRAMEWORK FOR ENVIRONMENTAL THREATS AND OPPORTUNITIES ASSESSMENT



Accordingly, the first part of the report makes a tour d'horizon of the baseline natural resource conditions, i.e., natural resource (land, water, forest etc.) endowment; population and its distribution and local institutions and initiatives in the exploitation of natural resources. To the extent data permits, the changes in quantity and quality of the natural resource base and the primary driving forces (population pressure, property rights and institutions, knowledge and technology, infrastructure and marketing) as well as the proximate driving forces (climate change, land cover change, biodiversity loss, nutrient loss) have been analyzed.

Individuals and communities respond to changes in natural resource conditions in various ways. Farm level responses take the form of change in land cover and use; change in land management; application of indigenous or new production and land improvement technologies; and investment in land. On the other hand, community level responses take the form of change in size of commons (open access); change in rights –access, use and transfer; benefit accrual and exclusion. The nature and timing of response both at the individual and community level is greatly influenced by public policy and institutions. Inadequate and inappropriate policies and institutions can amplify, trigger or cause environmental degradation while appropriate and responsible policies encourage nature conservation and promote sustainable development.

The combined effect of responses at the household and community levels to changes induced by the primary and secondary forces result in changes in livelihoods (change in farm productivity, change in agriculture linked income sources, change in physical assets, dependency on community support); change in risks and vulnerability to natural & man-made hazards (frequency of droughts, frequent crop failure and fewer coping mechanisms); and changes in biodiversity and ecosystems and services (supporting biodiversity and ecosystem processes, provisioning (food, water, fibre, fuel) and enriching (cultural). Opportunities for interventions are derived from all these analysis as well as from country strategies.

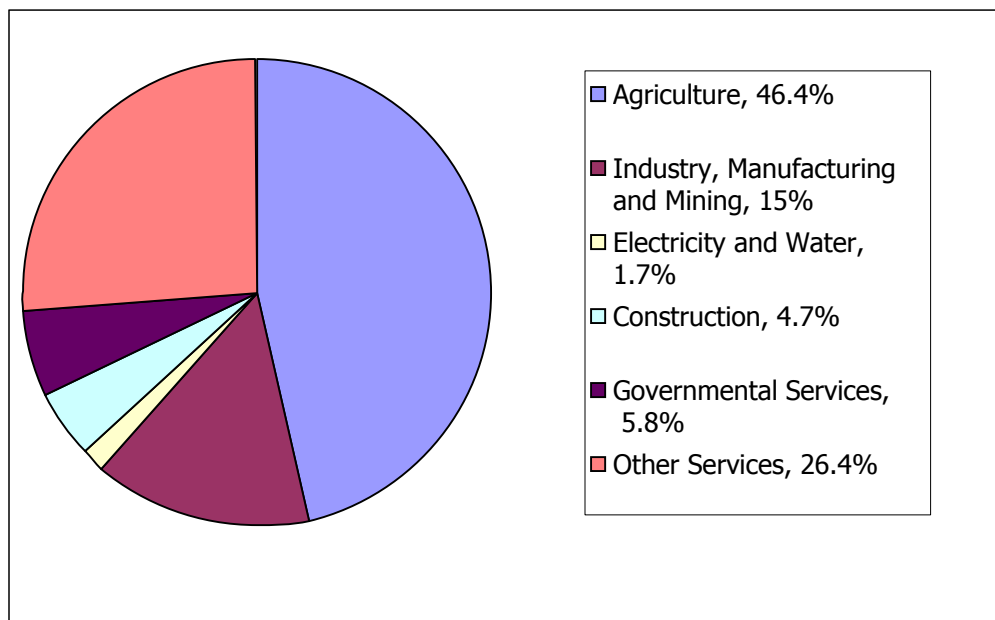
This study is presented in six sections: review of the environmental resource base; analysis of Sudan's economic and social trends; identification and analysis of threats to the environment; review of the knowledge gap; and analysis of opportunities. In presenting these sections, attempt was made to assess, based on secondary sources, conditions, pressures, trends and changes in environmental resources and the impact of primary driving forces such as population, technology, markets and infrastructure and also the impact of secondary forces, e.g., climate change. This is supplemented by the assessment of the strengths and weaknesses of various policy, legislative, technological, or other actions that have been taken or proposed to improve the management of ecosystems. Threats and opportunities identified by the two major strategies that Sudan has put into place, notably, the National Biodiversity Strategy and Action Plan (NBSAP) and Sudan's National Action Plan (SNAP) to Combat Desertification have been considered.

1. SUDAN: PHYSICAL AND ECONOMIC FEATURES

Sudan has a total area of 2.5 million km² including desert and water bodies. This area lies between 4-22°N and 22-36°E. The span over 18 degrees of latitude has given Sudan its characteristic variety of environments, hence diverse ecosystem and biological life.

Sudan's population is estimated at 33 million (2000) and represents 597 different tribes. About 70% of this population resides in rural areas. Agriculture is the mainstay of the national economy with about 80% of the people engaged in crop and animal production. This makes millions of people in the country directly dependent on natural resources for their livelihood and employment.

This heavy dependence of Sudanese economy on natural resources is reflected in the contribution of the agricultural sector of Sudan GDP, which stood at over 46% in 2000 (See chart below).



Source: The Bank of Sudan, Annual Report, 2000

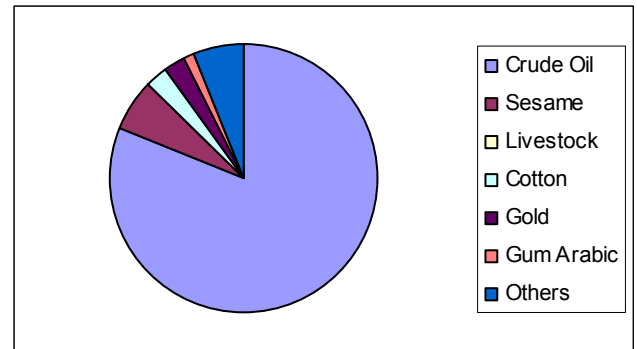
The share of industry, manufacturing and mining is estimated at 15%, although the emergence of petroleum as Sudan's primary export is like to change the situation in the years to come. As shown in Table 1, crude petroleum exports increased by five-fold between the years 1999 to 2001.

Table 1. Exports for the years 1999-2001
Value in US\$ Million

Commodity	1999	2000	2001
Crude Oil	275.9	1,350.8	1,376.2
Sesame	126.9	146.9	104.5
Livestock	114.3	66.4	1.7
Cotton	44.8	53.0	44.4
Gold	55.4	46.2	43.7
Gum Arabic	26.4	23.1	24.3
Others	136.4	120.3	103.9
Total	780.1	1,806.7	1,698.7

Source: The Bank of Sudan, Annual Report 2001

Chart 2. Value of Exports 2001



In the early 1990s, the International Monetary Fund declared Sudan non-cooperative because of its nonpayment of arrears to the Fund. Despite the IMF decision, the Government embarked upon several initiatives that included liberalization of exchange rates, privatization that started in 1992, and decentralization since 1995. In response to the 1992 Earth Summit, several policy initiatives to protect the environment were also taken. However, with the war and civil strife in the South, Sudan's isolation from the world community and pervasive poverty, no significant progress was made in biodiversity conservation. All available data suggests that the response to the economic hardship took the form of indiscriminate forest clearance and horizontal expansion of agriculture, the only coping mechanisms. Land degradation and desertification continued unabated in the 1990s.

Although the paucity of data did not permit undertaking trend analysis, the general freshwater, forestry and energy consumption status is as follows.

Land Area (Million km ²)	2,376.0
Freshwater Resources (Available per capita m ³ 1997)	3,191
Freshwater Annual Use (% of Total 1990-1997)	21.1
Forest Coverage Total Area (Thousand km ² 1995)	416
Forest Coverage (% of Total Land Area 1995)	18
Average Annual Deforestation (% 1990-1995)	0.8
Energy Use (per capita kg 1996)	397
Energy Use (GNP per kilogram oil equivalent 1996)	0.7
Carbon Dioxide Emissions (per capita metric tons 1996)	0.1

Source: World Atlas 2000

Geological formations have left Sudanese terrain predominantly flat. Rock protrusion occurs, occasionally, in some parts of the country. The Red Sea Hills in the east, Jebel Marra in the west, the Nuba Mountains in the center and the Imatong Mountains in the southeast are the only significant elevations. The altitude varies from 900-3,000m. The river Nile system forms a prominent incision in the terrain. The rest of the terrain comprises extensive clay plains in the center, and the southeast. The western part of the country is stabilized sand dunes while the southern Sudan contains Sudan's wetlands of the Upper Nile, Bahr el Ghazal and Machar swamps.

Sudan is endowed with the most diverse ecosystems created by climatic variations. There are

five distinct ecological zones: desert that covers a land area of about 726,000 square kilometers; semi-desert that is dominated by acacia and semi desert grassland on clay and sand; woodland savanna with varying rainfall pattern and a wide variety of plant and animal species; flood region (25,000sq. km) that is largely a swamp area; and montane vegetation (6500sq. m) that includes the Dongotona and Didinga Hills, the Immatong Mountains, the Red Sea Hills and Jebel Marra.

The high rainfall woodland that results from the rain forest ecosystem stretches in the form of a belt along the boundary with Uganda, Congo and Central Africa, covering an approximate area of 24,000 km². There is also a detached area of nearly 5,000 km² over Boma plateau in East Equatoria. The tree species are generally over 30 m in height and 250 mm in diameter. The northern part of Sudan is desert with mean annual rainfall of 0.75mm.

Rain Distribution



Source: Remote Sensing Authority of Sudan.

Rainfall (mm)	Total Area (1,000 Km ²)	N	Area Affected 1994 (1,000 Km ²)	Desertification Class
0-100	307	14-18	74,908	Desert
100-300	414	13-14	136,206	Very Severe
300-800	513	12-13	208,791	Moderate
600-800	25	11-12	500	Very Slight
>800	0.8	10-11	0.8	Very Slight
Total	1,259.8 (a)		420,405.8 (b)	(b/a)= 32.9%

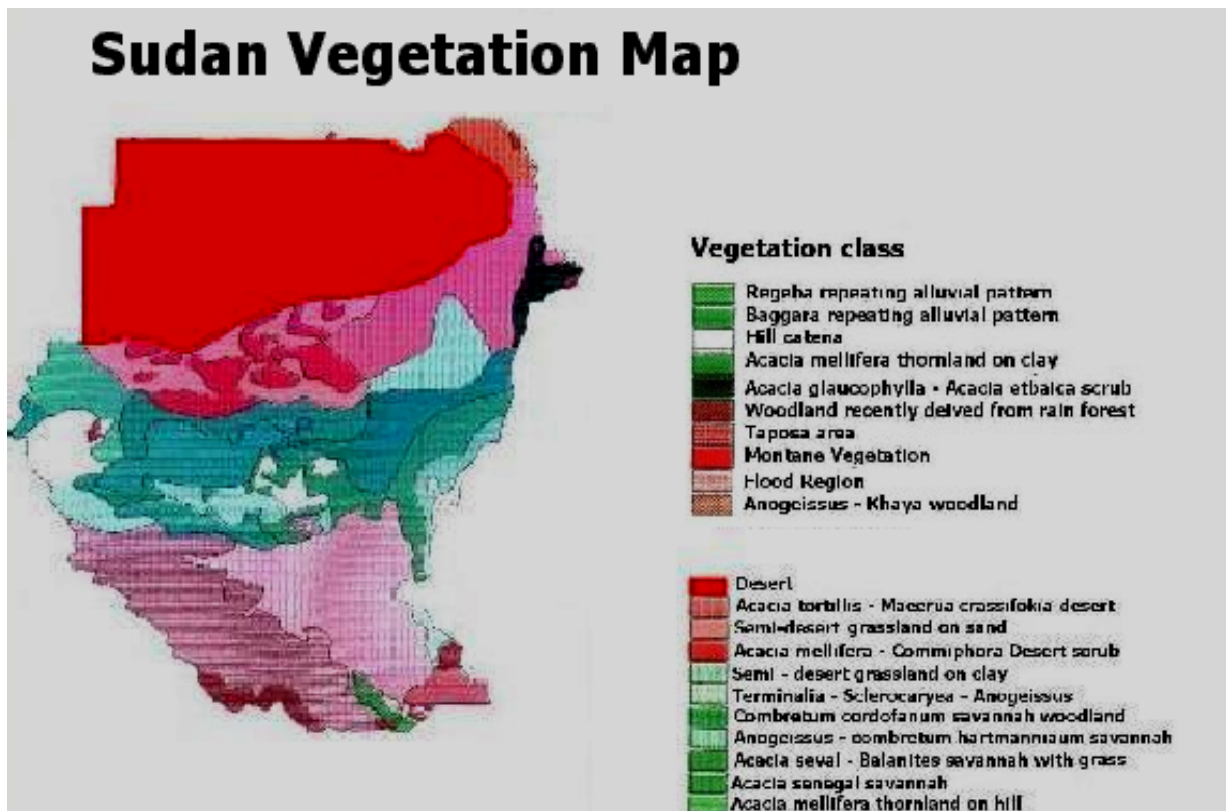
Source: Ministry of Agriculture, NDDU, 1999

Sudan's species and genetic diversity of both flora and fauna is of global significance. However the excessive harvesting of resources as means livelihood and survival had negatively impacted large of the original primary vegetation. Recurrent droughts, in the past two decades, have also conspired to amplify the fragility of ecosystems.

2. STATE OF KEY NATURAL RESOURCES

The NBSAP reports that there are 224 species of mammals and 871 species of birds and their habitats in the Sudan. It also suggests that wildlife habitats and diversity of wildlife species have shrunk due to the horizontal expansion in mechanized agriculture, overgrazing, war and civil strife, poaching and recurrent drought.

Spanning over 18 degrees of latitude, Sudan has a variety of ecosystems. These form a gradation from the desert zone to the rich tropical rain forest vegetation in the extreme southwest corner of the country. (See vegetation map).



Data obtained from the Forest National Corporation (2000) shows the area in square kilometers of selected ecosystems.

Arid and semiarid	1,188,000
Low rainfall savannah on clay	122,000
Low rainfall savannah on sand	83,000
The high rainfall southwest Sudan	120,000
The Wetland	85,000
Montane vegetation	2,500

Source: Forest National Corporation, 2000

2.1. Agricultural ecosystem

Agriculture is the main stay of the Sudanese economy. It contributes over 46% to the gross national product and provides livelihood to over 80% of the population.

Until recently, the agriculture sector has been the primary source of exports, with cotton, sesame, groundnuts and livestock as the primary exports.

2.1.1 Crop farming

Sudan grows a variety of food crops, dominated by cereals. The cereal crops, the staple food, are sorghum, pearl millet, wheat, maize, rice, finger millet and barley.

Traditional farming accounts for 60-70% of the agricultural output, and is basically subsistence production based on shifting cultivation and livestock rearing. This sector is characterized by low productivity. The extreme rainfall variability has made traditional farmers highly vulnerable to drought, while the extensive farming and slash and burn practices pose serious environmental threats.

The Table below shows that, (a) irrigated agriculture accounts for close to 60% of the crop output while the traditional rain fed agriculture account for over 35%. (b) The rain fed agricultural output, especially the rain-fed mechanized agriculture is characterized by extreme fluctuation, i.e., an increase by 47.7% in 1999 and a decline by over 55% in 2000.

Sectors	1999		2000	
	Value	Rate of Growth	Value	Rate of Growth
Agriculture	619.7	8.5	624.4	0.8
Irrigated Agriculture	159.2	4.8	171.3	7.6
Rain fed Mechanized Agriculture	33.6	47.7	14.9	-55.7
Rain fed Traditional Agriculture	108.6	24.6	102.2	-5.9
Livestock	277.8	8.9	293.5	5.7
Forest and Others	40.5	4.0	42.5	4.9

Source: The Bank of Sudan Annual Report, 2001.

The government of Sudan has promoted mechanized rain fed agriculture since the 1960s, as part of its policy to encourage agricultural investment. The 1976 and 1980 Acts³⁰ are considered to be instrumental for the expansion of rain fed mechanized agriculture. Nevertheless, this unregulated expansion has played havoc to the country's environmental resources resulting in extensive removal of trees, land degradation and destruction of habitats. Although there were efforts made to issues regulation on environmental protection, there were no means of enforcement mechanisms.³¹ In 2001, a Ministerial Decree was issued preventing any new areas for mechanized agriculture.³²

The biggest challenge Sudan faces in the agriculture sector is low productivity, says the Under Secretary for Agriculture. Major transportation will be required in the use of modern agricultural inputs, as the traditional sector is reported to have no access to fertilizers, as well as in finance and marketing. Malaria, salinity, and water hyacinth are the biggest problems. In addition, the Under Secretary argues, there is 500 tons of obsolete insecticides that need to be thrown out.

³⁰ Sudan Country Study on Biodiversity, 2002, p.177.

³¹ Ibid. p.177

³² Interview with Head, Technical Sectors, Forest National Corporation

2.1.2 Livestock production

Livestock accounts for 47% of the agricultural GDP and 22% of total GDP in 2000. It is an important sector that provides a source of livelihood for a huge segment of the population. It is also an important foreign exchange earner. But at the same time a threat to the environment. Over-grazing has now become one of the primary causes of land degradation in Sudan.

Livestock production comprises pastoralism, sedentary, semi sedentary and commercial fattening and dairy. Pastoralists are concentrated in two states: Kordofan and Darfur. Mainly camel and cattle owners, the pastoralists in these two states account for 80-90% of the total number of cattle and 100% of the camel.³³

As the Table below shows, there has been an increase in the livestock population over the past few years owing to the vast improvement in animal health care, which had drastically reduced outbreaks of epidemics.³⁴ The small rate take of take-off for export or national consumption has contributed to the increase.

Livestock population
For the period 1998 – 2000 (in million)

	1998	1999	2000
Cattle	35	36	37
Sheep	42	45	46
Goats	36	37	38
Camels	3	3	3
TOTAL	116	121	124

Source: The Bank of Sudan, Annual Report, 2000

2.2 Forest ecosystem

The forest cover of Sudan estimated at 34% of the total land area at the time of independence in 1956 has declined to 18%³⁵ in 1995. The 2000 survey undertaken by FNC in collaboration with UNFAO placed the forest cover at 17%. But according to the FNC, if shrubs are taken into account the forest cover reaches 27%³⁶. This is attributed to a combination of factors, horizontal expansion of agriculture, overgrazing, population increase and heavy reliance on forest biomass as a source of energy.

According to FNC report³⁷, Sudan's forests are found in a wide range of rainfall conditions, although the Southern Sudan states account for 68% of the country's forestry biomass resources and 85% of the total timber production.³⁸ Apart from the desert, which covers 25% of Sudan's land area and has no vegetation, the forest is distributed as follows:

- (i) Semi-desert. This represents about 20% of the total area with annual rainfall of 75-300 mm. Vegetation is sparse with grassland and/or small thorn shrub
- (ii) Low rainfall Savannah. Representing about 30% of the total land area has rainfall of 300-900 mm. Vegetation is mainly Acacia species. The drier northern portion of

³³ The Sudan National Biodiversity and Action Plan, p.27

³⁴ Interview with the Range and Pasture Department

³⁵ World Atlas, 2000.

³⁶ Interview with the Head, Technical Sectors, FNC

³⁷ Unpublished report given to the Consultant.

³⁸ Sudan Country Study on Biodiversity, 2002, p.66

- mixed deciduous species of *Anogeissus*, *Combretum* and *Terminalia* in the moister southern portion.
- (iii) High rainfall Savannah. This represents about 15% of the total area and has annual rainfall of 900 – 1500 mm. Vegetation is mainly deciduous species of *Anogeissus*, *Khaya* and *Isoberlina*.
 - (iv) Flood plain and Montane: The latter is in scattered mountains mainly in the Imatong, Jebel Marra massif in the west and Red Sea hills in the east; rainfall is 500 – 1000mm. Vegetation in the Flood Plain is mainly *Papyrus* swamps and that of the Montane are mainly broad leafed species with two conifers, *Podocarpus milanjanus* and *Juniperus procera*.

2.2.1 State forestry

Sudan started forest reservation in 1923. The designation of a forest reserve area goes through a lengthy approval process by local and federal authorities. According to the FNC, today Sudan has 22.5 million fedans of forest reserve (1 fedan is 4,200 sq. km.). The Forest Reserve has dual objectives: environmental protection and forest production. Some of the Forest Reserves are in their natural form while others are managed through a Ten Year Management Plan. The Plan describes harvesting and serviculture operations on a sustained basis.

Below are the estimates of FNC of the forest reserves:

Type	Area (ha)	Status and Management
Riverain forests	523,000	Under management
Jebel Marra Montane Forests	180,000	Under management
Dahara or rain fed forests on clay soil and Sand dunes	7,000,000	Most of the area is natural forests, the rest had been degraded so reforestation took place
Community Reserved Dahara Forests	250,000	Reserved to the community as natural forests in the period 1994/99
Mangrove forests of the muddy shores at the entrance of seasonal streams into the Sudanese Red Sea Coast.	About 42 Km ²	There are 19 forests. They provide a wide range of services and functions

Source: Forest National Corporation, 2000

There are three types of forests in Sudan,

- (i) Federal forests. This includes riverian forests along the Blue Nile and its tributaries, White Nile and its tributaries, and AIN forest; forests in Imatongs, Jebel Marra, Nuba Mountains, Ingessana, Fau, El Mugrah, and all other montane forests; and forests north of latitude 13 degrees.
- (ii) State forests. All state forests away from the rivers, and all those forests under registration according to the National Comprehensive Strategy (NCS).
- (iii) Community/private forests. All forests established and to be established by communities and private sector, for example, Gezira Board forests, Kennana, Rahad, Singa community forest and private forests in Jabal Marra and Mazmum.

Following a forest sector review by the World Bank, a new Forest Act was issued and the Forests National Corporation (FNC) was created in 1989 with broad mandates. FNC is self financing and there is no government budgetary support. Partly as a result of this, FNC today is a weak organization both in technical and financial terms. Many forest related legislations remain largely un-enforced and its operations concentrate at the federal level.

2.2.1 Community forests

Sudan's community forests development and management experience is less than two decades old. Driven by fuel wood scarcity and environmental protection, community forestry started in early 1984³⁹ through extension and awareness raising campaigns. Activities in community forestry include afforestation (plantations) and natural forests development and management. Table 4.3 below shows the list of community forests by area in different states.

Shows Community forests up to 2000 by State

State	Number of Forest	Area ha
River Nile	1	44
North Kordofan	17	2470
Sennar	1	21
Total	19	2535

Source: Forest National Corporation, 2002

The Forest Act of 1989 provided legal option for reservation of local forests as community forest reserves. Accordingly, the management of community forests is assigned to committees designated by the communities for this purpose, and this committee is the management body responsible for planning, protection and investment of forest resources.

2.3. Freshwater ecosystem

2.3.1. The Nile System

Sudan's major water resources are the Nile, its tributaries and basins aquifers. Thus, Sudan shares with its neighboring countries, notably Ethiopia and Uganda, both its surface and ground water. For example, the Eastern Nile tributaries extend from Baro, Akobo and Pibor in the south to those of Atbara in the north. The Baro originates from the southwest Ethiopia and forms part of the borders between Sudan and Ethiopia before joining Akobo and Pibor in Sudan. Akobo mark the Sudanese – Ethiopia borders in most of its length. Pibor originates from south of Sudan. The three tributaries join the Sobat River which join the White Nile at Malakal. Dinidir and Rahad join the Blue Nile at Hag Abdalla and Wad Medani in Sudan. The average annual flow at the Sudan-Ethiopian borders is around 48 cu kim. The Blue Nile meets the White Nile in Khartoum.

According to the 1959 Nile Water Agreement between Sudan and Egypt, Sudan has a share of 18.5 Km³ of water. The total water used for irrigation, estimated at 14.0 Km³. This below potential use of water for irrigation is attributed to the limited investment in the irrigation sector, collapse of the infrastructure in some areas in the aftermath of economic liberalization midst economic sanctions imposed on Sudan. No source of agriculture credit has been possible.

Other resources of the Nile, according to the archival data of the Ministry of Irrigation and Water Resources⁴⁰ include:

- 1,860 km of year-round navigation between Khartoum and Juba along the White Nile and Bahr El Jebel;
- 1,000 km of navigation on the Main Nile between Khartoum and Old Halfa;

³⁹ CBNRM study

⁴⁰ Sudan Country Study on Biodiversity

- 300 km of seasonal navigation along the River Sobat;
- An annual fish crop estimated at 100,000 tons;
- 1.5 million feddans of river summer grazing in the southern region of Sudan created by seasonal fluctuations of river flow in the wetlands.

2.3.2. Groundwater

The sedimentary Nubian Sandstone and the Um Ruwaba formation are the main aquifers in Sudan. They extend from a depth of 40-400 m. The annually renewable ground water is approximately 4 cu km.⁴¹

2.3.3 Available water and constraints

According to the 1999 Sudan National Water Policy document, the water available annually to Sudan is:

Source	Quantity (Km ³)	Constraints
Sudan Nile water share	20.5	Seasonal pattern, coupled with limited storage capacity
Non-Nile streams	5.5	Highly variable, short duration flows, which are difficult to monitor or harvest. Some are shared with neighbors
Renewable groundwater	4.0	Deep water and entails high cost of pumping. Remote areas and of weak infrastructure
Present Total	30.0	
Expected share from swamp reclamation	6.0	Capital intensive projects, social and environmental cost
Total	36.0	

Source: Sudan National Water Policy 1999

2.3.4 Wetlands of Sudan

Sudan is endowed with several wetland areas. The most important ones are the Sudd swamps, the Machar Marshes of the upper river Sobat on the Ethiopian-Sudan border, and the Bahr El Ghazal swamp. The amount of water lost through the passage of the main swamps is some 50% of the water entering from the lake plateau of East African lakes.⁴²

The range and swamp ecology survey conducted in 1980, based on LANDSAT images and low-level aerial reconnaissance, by Mefit Bati Consultants under European Development Bank contract estimated at 16,000 Km² the permanent swamp below Mongalla, the southern tip of the wetland, and, at 16,200 Km² below Bor, the northern tip.

Variation in the size of the permanent and temporary swamps is dependent both on the discharge of the rivers as well as rainfall. The greatest expansion of the swamps normally occurs toward the end of the rainy season in September. After October, with the absence of rain and heavy evaporation, the swamp area gradually shrinks.

The swamps of Bahr El Ghazal basin are formed by the torrential rivers, which run out of the slopes of the Nile-Congo Divide. Because of the torrential nature of these rivers, the swamps they

⁴¹ Nile Basin Initiative, Eastern Nile Subsidiary Action Program: Terms of Reference for Integrated Watershed Management Study in the Eastern Nile sub Basin with special reference to Sudan side. October 2002.

⁴² Sudan Country Study on Biodiversity, 2002

form soon dry out when the rains cease. Although this area is estimated at 14,500 km², there are no indicators that these areas have ever been surveyed because of the remoteness of the area.

The swamp and range ecology surveys of the Upper Nile conducted in connection with the Jonglei canal water diversion project suggest that for several thousands years, the wetlands of the Upper Nile have enjoyed stable condition and that there were no indications of significant anthropogenic interference.⁴³

Flood plain species of buffalo and tiang have been reported to be side-lined by the increased flooding and changed vegetation, while species, which were able to tolerate the new conditions such as hippo and elephant, increased their numbers. The main conclusion of this survey was that there is clear dynamic interaction between upstream hydrology, local topography, and pattern of flooding, vegetation and land use.

Aquatic weeds have emerged as a potential threat to the fresh water ecosystem in the Sudan. Up to 1957, the Nile cabbage, *Pistia stratiotes*, was the largest free-floating macrophytes in the Nile system in the Sudan. In 1957, the exotic water hyacinth, *Eichhornia crassipes*, reached the Nile system in southern Sudan. It has since spread and largely replaced the once abundant Nile cabbage. Water hyacinth, for example, has infested 3200 kilometers of the White Nile.⁴⁴

The civil war in Southern Sudan and the Jonglei Canal project pose the greatest threat to Sudan's wetlands, and indeed to the biophysical environment of Africa's largest wetlands.

2.4 Coastal ecosystem

Sudan's Red Sea coastal line extends 720 square kilometers. Because Khartoum, the capital city, is some 1,200 kilometers from Port Sudan, there has not been much attention given to studying the marine ecosystem. Some isolated research done by the Institute of Environment Studies of the University of Khartoum suggests that the Sudanese coast has rich biodiversity that includes diverse marine life, mangroves, coastal water and barrier reefs. Of the 450 bony fish species identified in the Red Sea, 250 species are found in the Sudanese coast and 93 species are of commercial importance.⁴⁵ However, the region has been exposed to recurrent drought and environmental degradation without any government support to protect the area.

2.5 National parks and protected areas

The protected wildlife area in the country is estimated at 14%⁴⁶ of the country's area. Protected areas fall under three categories:

- National Parks with highest degree of protection
- Game Reserves with limited permission for use of the resources permitted
- Game Sanctuaries with protection for specific species.

There are 8 national parks, 15 game reserves and 3 sanctuaries, see Table below. Five of these game reserves are located in the Sudd swamps in South Sudan along the White Nile.

The wide range species and ecosystem diversity that Sudan is endowed with include: 12 orders of flowering plants out of the 13 found in Africa. Of the 3132 species of flowering plants found in the country, 409 species are endemic; of the 265 species of mammals, seven are endemic. Sudan has also 938 of bird species, 105 Nile fish species, 91 reptile species, The IUCN list of

⁴³ Sudan Country Study on Biodiversity, 2002

⁴⁴ SNBSAP, p.35

⁴⁵ The Sudan's National Biodiversity Strategy and Action Plan, p.26

⁴⁶ SNAP, p. 10, Please note that other sources show a lower figure.

threatened species in Sudan includes: 9 plant, 17 mammals, 8 birds, and one reptile, although the Forest National Corporation's recent study shows 42 threatened species.

National Parks and protected areas

	National Parks	Area (ha)
Dinder		890,790
Radom		1,250,000
Southern		2,300,000
Shambe		62,000
Boma		2,280,000
Bandigilo		1,650,000
Nimule		41,000
Sanganeb		26,000
	Game Reserves	
Tokar		630,000
Sabaloga		116,000
Rahad		350,000
Ashana		90,000
Chalkou		550,000
Zeraf		970,000
Fanyikang		1,000
Numatina		48,000
Bangangai		210,000
Bire kpatous		17,000
Mbarizinga		50,000
Juba		1,000
Mongalla		20,000
Badingera		7,000
Kidepo		120,000
	Sanctuaries	
Sinkat		12,000
Khartoum Sunt Forest		1,500
Arkawit		82,000

Source: Wildlife Conservation General Administration 2001

Wildlife management in Sudan is government based. The Wildlife Conservation General Administration (WCGA) is the official government agency responsible for wildlife conservation and management in the country. Conservation practices appear to follow traditional (protectionist) approach with no local community participation in wildlife management.

Wildlife reserves under the government based management system include three classes of protected wild animals: -

- Class I include completely protected group
- Class II are to be hunted according to special license approved by the Minister
- Class III Hunted by holders of an ordinary license.

The wildlife and National Park Act of 1987 focused on the conservation and protection of wild animals and neglects or excludes the wild plants, which are also wildlife. It does not provide for zoning of parks and classifications of areas with potential for multi-purpose uses, in particular the exclusion of people residing around national parks in wildlife management constitutes unsustainable practice. In general, current wildlife conservation is reported to be inadequate.

The IUCN's List of 17 threatened mammal species in Sudan includes the Oryx gazelle, Dama gazelle and Adox gazelle⁴⁷.

Hunting is prohibited except on license. WCGA issues these licenses, which is its major source of revenue. However, WCGA has limited capacity to enforce legislation. Most parks and protected areas are inadequately staffed and financed. In addition, there are no land use plans, and most protected areas are left open to human settlement, cultivation and livestock grazing.

2.5.1 Dinder National Park:

The Dinder National Park is considered one of the most important wildlife reserves. FAO sponsored survey of the park conducted in 1993 by the WRC & SECS and additional UNESCO sponsored surveys of 1998 indicated the serious threat to the park arising from expansion of agriculture and settlements in and around the park. The surveys suggested the creation of the following management areas:

- A natural resources management area (west of the park)
- An experimental game utilization in north of the park
- Game reserves area

At about the same time, Sudan's Environment Conservation Society (SECS) embarked upon awareness raising aimed at community leaders using documentary films, slides show and a visitor guide book.

Indeed, since 1964 many efforts were made with view to evaluating existing management system and development of approaches to improve and enhance sustainable management of the park. Based on this review, the Dindir National Park Project (DNNP) was designed. The objective of the project is to conserve the park's biodiversity through the involvement of local communities in the sustainable use of the natural resources of the park. The project currently housed in the Higher Council for Environment and Natural Resources is funded by UNDP/GEF. The management of the park will be based on a well articulated management plan that sought to involve local communities in the management of the park to ensure sustainability of the future management of the park.

Supporting technical activities include: habitats rehabilitation for endangered and threatened species; fire control; personnel training in environmental management; conduct problem solving oriented research; and development of 8-park buffer zone land use plan. The involvement of the local communities in the sustainable use of resources forms the main strategy of the park management.

2.6 Energy resources: threat and opportunity

Of Sudan's total energy, 88 percent originates from biomass (83% wood and 5% residues) while oil accounts for 11 percent and hydropower 1 percent. Within the household sector, which accounts for 69% of all energy consumption in 2000, the share of biomass reaches 98%. The national energy policy of the government accords priority to oil production through the promotion of large-scale thermal generation. The government has invested some 3.3 billion USD in oil production including in setting up a central petroleum lab.

2.6.1 Biomass

Forest biomass provides a total of 4.11 million tons of oil equivalent. Biomass is consumed in the

⁴⁷ SNAP, p. 6

form of firewood and charcoal. Vast areas of natural forest are harvested each year to provide the needed supply.

Demand for wood-fuel has been increasing over the past years mainly owing to the increase in population, particularly in the rural areas where this source forms the only source of domestic energy. Nevertheless, wood-fuel consumption is expected to decrease from the current consumption level, especially in household and traditional industries sectors as a result of the increase in petroleum production.

Currently, the government focuses on improving energy distribution leaving much of the investment in the sector to private organizations and individuals.

The table below shows the present Sudan pattern of total energy supply sources.

Source	Supply (1,000 Tons Oil Equivalent)	%
Hydroelectricity	102	1
Petroleum	1,460	13
Wood-fuel (fire wood and charcoal)	9,016	81
Agricultural Residues	560	5
Total	11,139	100

Source: Ministry of Energy and Mining Figures

2.6.2 Hydropower

The hydropower potential of Sudan, apart from the installed and operating capacity on the Blue Nile at Sennar (15 Megawatt) and Roseries (280 Megawatts), exists in Bahr El Jebel between Nimule and Juba. On the Main Nile, north of Khartoum the potential is in the cataract region.

The power potential, as estimated by studies conducted by the Ministry of Irrigation in the early 1960s is as follows

Site	Megawatts
3 rd Cataract.	500
4 th Cataract	1250
5 th Cataract	250
6 th Cataract	120
Bedden Rapids	300
Fula Rapids	200
Kinyetti River,	25

Source: Ministry of Irrigation and Water Resources

2.6.3 Petroleum

Sudan began exporting petroleum in 1999 after an investment of 3.2 billion US dollars. Production in 2000 was 10.426 million tons and increased to 19.902 million in 2001. The immediate effect of this development was improvement of Sudan balance of payments, and also its credit standing.

Petroleum is now produced in the area of the rich savannah grazing where very large herds of cattle are reared. The impact of exploration and production is at the moment not fully known. It remains an important area of ecological concern. Sudanese authorities, however, see oil production as mixed blessing. While oil production is bound to negatively impact on the natural

habitat in the oil production area, they argue that biomass saved as a result of consumers shift to petroleum as a source of energy will far outweigh the direct damage done by the oil fields. Further, oil revenues will increase the overall income of people thus inducing the transformation of the economy from natural resource dependent economy to industry.

3. The social capital base for sound environmental management

3.1. People

Sudan population is young and is growing. Seventy percent is under 30 years; literacy is low. The population is however characterized by diversity of ethnic backgrounds and cultures.

Population 1997	27,737,000
Population (1998)	30.3 00,000
Population Estimate 2000	33,000,000
Population Growth Rate (% per year 1990-1997)	2.0
Density per sq.km.	12
Safe Water (% of population with Access 1995)	60
Life Expectancy at Birth (years 1997)	55
Infant Mortality (Per 1,000 Live Births 1997)	71
Child Malnutrition (% under weight 1992-1997)	34
Female Labor Force (%)	29

Source: World Bank Atlas 2000

3.2 The Higher Education System

Nearly all institutions of higher learning offer degree courses in environment and natural resources at the undergraduate and graduate levels. While it is acknowledged that encouraging advances have been made in the past twenty years in designing courses, almost all universities currently suffer from field and laboratory training resources. The quality of higher education has also gone down primarily due to budgetary constraints. Most textbooks are old and outdated. As a result, many university graduates would require additional training in order to be meaningfully engaged in natural resource management.

On the biodiversity research side, the situation is hardly encouraging. Research done is at best modest owing to the lack of funding. Thus, the higher education system finds itself in vicious circle where poor training is breeding poor researchers and trainers and that in turn is producing weak students.

4. The evolution of structure of government and its impact on natural resource legislation and management

The structure of government up to 1960 was essentially central, with only few local government units in selected rural and urban areas given power to raise revenue to fund the provision of basic services. Beginning 1960, several initiatives were taken towards decentralization. Sudanese authorities seem to have realized, as far back in the 1960s that Sudan can only be governed through a decentralized form of government. Different approaches had, therefore, emerged with the different political regimes that came to power.

4.1 The Federal System of government

In 1971, the Peoples' Local Government Act expanded the local government system established in 1951, by the creation of more provinces, districts within the provinces

and urban and rural councils within the different districts. Further development took place in 1980 with the promulgation of the Regional Government Act that divided Sudan into regions, each with a legislative body and a regional government.

More devolution of the central government powers took place in 1992 with the launching of the Federal Government Act. The country was divided into twenty-six States. Each State was also divided into provinces. Provinces were further subdivided into localities. The prime objective of the federal system of government was to ensure the equitable sharing of power and resources and facilitates economic and social development.

Today, Sudan has twenty-six states. Each State has a legislative body and a state government. Lower levels of government exist in each state. At the time of writing this report, restructuring was undergoing with the view to reducing the number of localities.

The present day states are: Northern, River Nile, Khartoum, White Nile, Blue Nile Sennar, Gezira, Northern Kordofan, Western Kordofan, Southern Kordofan, Northern Darfur, Western Darfur, Southern Darfur, Upper Nile, Jonglei, Warab, Unity, Western Bahr El Ghazal, Northern Bahr El Ghazal, Warab, East Equatoria, West Equatoria, Bahr El Jebel, Gedaref, Kassala, Red Sea.

4.2. Natural resources legislation, management and institutions

Matters relating to the exploitation of natural resources had been incorporated in the responsibilities and terms of reference of the central government departments. Each department has been given responsibility for the management of a single resource, i.e., forestry, wildlife, rangelands, water, agriculture, throughout the country. The gradual processes of decentralization and devolution of power seems to have very little impact on this basic set up as the sector-based legislation, professional practice and tradition continued.

4.2.1 Land tenure legislation and land use⁴⁸

The Land Settlement and Registration Act, issued in 1925, provided for individual rights and interests over land that included cultivation, pasture, woodcutting, and holding. In 1970, the government promulgated the Unregistered Land Act that bestowed ownership of any wasteland, forest or unregistered land on government. Private ownership of land is limited to the registered rights before the coming into force of the Unregistered Land Act of April 1970.

Unregistered land is almost 95% of the Sudan land area. Although the government has the formal ownership of the unregistered land, it has not been able to exercise effective control over land allocation and utilization.

The land allocation and judicial powers which provided a certain measure of control, regulation and conservation were taken from the native administration and vested in the local government officers and later in the state government. Neither level of government has the knowledge of the traditional use of neither land, nor the means for planning and control of land use. This resulted in uncontrolled expansion of mechanized farming wrecked havoc to the country's natural resources.

At present, Sudan has no a national land use policy, nor is there a legislation that deals with land use. Sudanese authorities believe that it is the absence of land use plan that is the cause of conflict between farmers and pastoralists over the use of natural resources.

Sector-based legislation that influenced land use were issued from time to time.

⁴⁸ Contributed by Prof. Mahdi Beshir and Dr. Ahmed S. El Wakeel

Examples are the forestry act 1989, crop control act 1972, food protection act 1973, pesticides act 1974, environmental health act 1975, wildlife and national reserves conservation act 1986, the seeds act 1990 and the land disposition and construction-planning act 1994.⁴⁹

The basic feature of Sudan legislation pertaining to environmental issues is that it is sector-based. The greatest proportion falls in the agriculture, forestry, fisheries, public health and animal resources. The notable exception is the pasture and range departmental sector. There has been no central legislation regulating the use of pasture, although recently, state legislations and local government orders defined demarcation of grazing routes and fire lines.

At the present time the line ministries with direct mandate on various aspects of the environment and natural resources are agriculture and forests, animal resources, internal affairs, energy and mining, irrigation and water resources, health and industry. Their mandate covers biological diversity as defined in the international convention.

The number of institutions, ministerial units, semi-state public corporations, with direct or indirect jurisdiction over biological diversity, has been put at ninety. Their functions range from planning and management, training and extension to research and data gathering.

A recent questionnaire issued by the National Biodiversity Strategy Project showed that 50% of these institutions have their environmental mandate backed by laws. However the law in question usually assigns responsibility to the minister or to a corporate body. By-laws and regulations then outline and detail terms of reference in accordance with the organizational structure within these bodies.

There is also dual affiliation. For example the department of wildlife is affiliated to both the ministry of internal affairs and the ministry of environment and tourism. Law governs the first relationship. The second is prescribed in the warrant establishing the ministry of environment and tourism.

At the state level after the launching of the federal system of government environmental matters and concerns became divided between the portfolios of the state ministries for agriculture and animal resources, health and engineering affairs. The ministry of agriculture has responsibility over agriculture, forests, and the environment and animal resources. The mandate of the ministry of engineering affairs includes overseeing land and surveys, construction and housing, roads and public waters, transportation and communication, water resources and energy and electricity. The ministry of health is responsible for preventive and curative medicine.

Legislations dealing with natural resource management have several shortcomings. There is no co-ordination or interactive mechanism that brings these bodies together over a joint issue and common concern. There is also duplication of responsibility between federal and state institutions.

⁴⁹ Sudan Country Study on Biodiversity, 2002

4.2.2 Key natural resource management and policy development institutions

4.2.2.1 Institutions for water resources management and policy

Matters pertaining to water have priority in Sudan's political and decision-making process. Today, much of this responsibility rests with the Ministry of Irrigation and Water Resources. The Minister of Irrigation also heads the National Water Resources Council (NWRC), which is a policy formulating and supervising body for all water related activities. The NWRC includes members from institutions responsible for water availability and use, notably the ministries of irrigation, agriculture, health, foreign affairs, finance, energy, legislation, research, training as well as users associations, for example, state governments, private sector and NGO's. The NWRC has the power to set up specialized committees within the Council or even Water Resources Councils at the level of one or more states affiliated to the NWRC.

More than 15 universities in Sudan have under-graduate course in water related fields. Some have even post-graduate courses e.g. the UNESCO Chair for Water Resources in Umdurman Islamic University, the Institute for Irrigation Water Management of the University of Gezira and the post-graduate courses at the Universities of Khartoum and Sudan.

The Hydraulic Research Station in the Ministry of Irrigation deals with research in all aspects of water resources management. Some private consultancy offices and NGOs are actively working in the field of water replacing some of the foreign offices. A specialized committee in the NWRC and the Hydrology section in UNESCO Sudan are coordinating research and training work in the water domain. A lot of research work has been done especially in physical and mathematical modeling to simulate and optimize water management.

4.2.2.2. Institutions for forestry research and education

Forestry research in Sudan dates back to 1940s, but was formalized in 1962 with the establishment of Forest Research Center (FRC) at Soba. Research was closely connected to forestry activities in Sudan. It remained part of the Forestry Administration for many years, until it is joined to Agricultural Research Corporation, which is responsible for all the agricultural research activities.

Forestry education as part of higher education has undergone substantial institutional changes. The latter included the establishment of 19 federal and state universities beside 24 private institutes of higher education. Whereas forestry education was available at degree and diploma levels in only five institutions before 1980s, now it is available in nine universities, with two full fledged faculties: Faculty of Forestry - Khartoum University and Faculty of Forestry and Range /Sudan University.

The Faculty of Forestry, Khartoum University was established as a department (Forestry Department) in the Faculty of Agriculture in 1975, and continued till it became the Faculty of Forestry in 1994. The Faculty consists of 4 sections: management, silviculture, protection and conservation, forestry products and industry. The number of graduates from the Faculty with B.Sc, which was 20 per year until 1994, went up to 60 per year since then.

The faculty qualifies students to get their Master and PhD. Degrees in forestry science. It also provides short and long term training on forestry related subjects. Available resources include: teaching staff, forestry analytical lab, an Internet/computer unit, good communication and liaisons with international organizations, institute and research programs.

4.2.2.3 Institute of Environmental Studies (IES), University of Khartoum

The Institute of Environmental Studies (IES) was formally established in 1979, although it was created in 1972 following United Nations Conference on Human Environment in 1972 and subsequent call by the Arab League Educational Cultural and Scientific Organization (ALECSO) that universities should respond to environmental problems and challenges. Since then, the IES (the first in Africa and the Middle East) has pursued a program which blends (a) post-graduate education in environmental studies (b) short-term training in natural resources (c) research and consultancies in project design, environment impact assessment and education. IES executes projects funded by international organization e.g (i) Dry Land Husbandry project (OSSREA & EPOS) (ii) Environment Impact Assessment projects (UNEP, UNICEF, US-AID, CPECC UNSO) and (iii) Acted as coordinators between Research Institutions and NGOs (Ford Foundation). Project proposals are coordinated through the IES pertaining to the fields of coastal zone, arid lands, wetlands, meteorology, and urban planning.

IES qualifies teaching assistants and lecturers to obtain MSc. and Ph.D degrees in environmental sciences. Available resources are: teaching staff (1 professor, 4 associate professors, 3 lecturers due to obtain their PhD, lecturers from pertinent departments of the University of Khartoum, laboratories, environmental analytical lab, floating lab for freshwater ecosystem research, specialized library in environmental studies, Internet/computer unit and liaisons with international organizations, institute and research programs.

4.2.2.4 Forest National Corporation

The Forest National Corporation (FNC) is one of several institutions within the Ministry of Agriculture and Forestry. It was first established in 1902 as Forest Department of the Ministry and is thus one of the oldest government institutions in the civil service. It has changed through the time affected by the political, socio-economic and environmental changes and development that took place in Sudan and worldwide.

Its major functions are:

- Lay down the general policies for forests, the growing stock and development thereof, and make the rules and methods, which secure the good utilization of the stock and achieve full protection of the environment.
- Propose law, which achieve the implementation of the approved policies for the development of forests.
- Follow-up the implementation of the forests general policies and technically supervise all forests, at the country's level.
- Conduct studies and lay down the necessary plans for taking stock of forests, survey and development thereof, at the country level.
- Increase the reserved forest areas up to a minimum of 20% of the total area of the country (presently 3.2%).
- Intensify tree plantation, for the purpose of protection and production, and rally the people's efforts, in this respect.
- Develop the production of gum, especially Gum Arabic and care for the minor forest products.
- Coordinate the various bodies to implement forests' general policies and undertake research
- Levy or fees on forest produce in accordance with the law or as approved by the minister of in accordance with normal business practices.

Due to budgetary and organizational constraints, FNC today operates mostly at the federal level with limited capacity to enforce forest legislations and perform effectively the duties mentioned above.

4.2.2.5 Range and Pasture Administration

This Administration was first established in early 1950s as a section within the Ministry of Animal Wealth to carry out activities related to range conservation and management. These activities included; proper distribution of water resources to allow balanced utilization of grazing resources and production of fodder crops under irrigation. In 1973 it shifted to the Ministry of Co-operation and Rural Development, then, later in 1975 to the Ministry of Agriculture, as a general administration with three main divisions: rangeland, irrigated pasture and pastoral studies.

Many factors have affected the capacity of the administration to effectively handle its responsibilities. These include; lack of land-use plan, lack of laws that control grazing practices and protects pasture from being misused, lack of clear policy objectives and shortage of manpower and financial resources.⁵⁰

4.2.2.6 Ministry of Animal Resources

The first Ministry for Animal Resources was established after independence and continued till 1971 when it was unified with the Ministry of Agriculture and Natural Resources (MANR). It was separated again in 1986, then reunified in 1989 to finally be separated in 1996. This created a situation of institutional instability, which largely affected the performance, policies and management structure of the ministry. Many of the corporations which used to be part of the Ministry of Animal Wealth were privatized in 1992 upon the creation of state governments e.g. Corporation for Livestock Marketing and the General Corporation for Animal Production. These arrangements shifted responsibility of direct technical supervision on production and marketing from the central ministry to the corresponding state ministries.

The key mandates of the Ministry of Animal Resources include:

- Formulation of Policies related to development of animal resources and production within the national policy framework.
- Planning and organization of scientific researches and applications for the development of animal resource sector.
- Organization of extension, veterinary services and animal health programs and development and maintenance of rangelands.
- Development of fisheries and aquatic lives sector and formulating necessary regulations controlling animal resource exploitation
- Supervision of animal and meat marketing programs in coordination with relevant authorities and management of national level programs on Veterinary services and quarantines.
- Training and capacity building of human resources in the field of animal resources management and development.
- Supervision of imports, exports and local manufacturing of inputs, machineries, vaccination and inoculation necessary for the sector in coordination with relevant institutions.
- Supervision of animal slaughterhouses, exports specifications, treatment and disposal of animal waste.
- Supervision of animal production, market performance, quality control and upgrading to stand market competition at local, regional and international markets

⁵⁰ Ali, 1999

4.2.2.7

Wildlife Conservation General Administration (WCGA)

Established in 1902 by the colonial authorities, WCGA was part of the Game and Fisheries Department of the Ministry of Animal Resources. Today, it is administratively accountable to the Ministry of Interior while technically it is accountable to the Ministry of Environment and Tourism.

The WCGA is entrusted with the conservation of wildlife in the Sudan. Wildlife includes also ecosystems and habitats where species are living. WCGA is also entrusted with the task of establishment and management of protected areas in Sudan. Among its main responsibilities are:

- Sustainable management and utilization of wildlife resources in the country.
- Origination of hunting (issuing licenses and setting by limits)
- Cropping of wildlife, trade in wildlife parts and live animals.
- Establishment of zoological gardens for wildlife public education.
- Control of wildlife damaging problems
- Management of marine national parks and protected areas

WCGA is the focal point for CITES (Convention on International Trade in Threatened and Endangered Species (includes botanical or animal species.))

One of the problems that WCGA faces is the lack of official link with the Fisheries Administration, Fisheries Research and Wildlife Research Center (WRC), which are all under the Ministry of Animal Resource.

4.2.3 Local government units

The Local Government Act 1998 has set the general framework for the operation of local governments. It has defined functions of local governments, where each local government is a legal entity empowered to exercise devolved powers. These powers include powers on matters related to the environment, land, forests and animal wealth. Each locality has a council composed of elected members, 75% of them from geographical constituencies and 25% representatives of professionals and women. However, most units lack the financial resources for disposing their duties.

4.2.4 Traditional (tribal) administration

Traditional (tribal) administration played important roles in the management of natural resources, administration of local affairs and maintenance of rural livelihoods. The 1932 Forest Ordinance employed these structures and put them in a legal order within the framework of the judicial and administrative systems. These laws together with the local customs and traditions made traditional administrations a powerful representation of the government at the local level and strong and powerful leader of local communities. Traditional leaders are mostly elected from the same families. Thus the holding was semi-hereditary one.

Until they were abolished in 1970, their responsibilities included:

- Land allocation and settlement of conflicts
- Protection of the common natural resources
- Organization of usage of natural resources
- Construction of fire lines
- Keeping order of security and organization of foreign tribes presence in their areas
- Definition of nomadic routes
- Organization of communal public activities e.g. pest and bush fire control
- Settlement of tribal disputes

The change from the tribal system to local government system created leadership gap. The link with communities, which the traditional leaders provided for example in the use and management of natural resources, was lost. Many Sudanese authorities argue that it is the abolition of traditional administration that accelerated land degradation and deforestation.

4.3. Non-Governmental Organizations

Like many developing countries, extended family system as well as voluntary and collective work characterizes the Sudanese society. A number of teamwork models (nafir, fazaa... etc) are old practices during harvests time or when someone is building a house or during emergency situation (fire outbreak at village or in fields). But, organized forms of NGOs have become well known after 1980⁵¹.

Today, there are several legally registered and active NGOs in different fields of the environment and rural development. There are also some networks for coordination between NGOs e.g. the NGOs National Coordination Committee on Desertification (NCCD). The most relevant and active NGOs in natural resources are the Sudanese Environmental Conservation Society (SECS) and the Sudanese Social Forestry Society (SSFS).

4.3.1 Sudanese Environmental Conservation Society (SECS):

SECS is one of the most active NGO groups in promotion of environmental awareness and lobbying for better environmental policies and actions. It achieves this through initiating and supporting small projects with grassroots involvement designed to improve living conditions and well being. Examples of these projects include tree planting, waste management and awareness raising. SECS have more than 80 branches distributed all over Sudan, with more than 6000 members. The main objectives of SECS include:

- Conservation of the environment and mitigation of any action that may lead to environmental degradation.
- Dissemination of environmental information and education.
- Cooperation with the government in law enforcement for environmental conservation.
- Strengthening the links with the local, national, regional and international institutions endeavoring to conserve the environment.
- Encouraging scientific research and studies aiming at the conservation of the environment, in addition to writing of the natural history of the Sudan.

SECS works in close collaboration with government agencies and other non-governmental organizations in the implementation of biodiversity conservation and reforestation projects. Currently, SECS is involved in promoting environmental awareness in Dinder National Park.

4.3.2 Sudanese Social Forestry Society (SSFS):

The Sudanese Social Forestry Society (SSFS) was established in November 1995 under the name "Sudanese Social Forestry Network" under the auspices of the Forests National Corporation. In March 1997 it was registered at the Humanitarian Aid Commission as a Non Governmental Organization (NGO).

The Ford Foundation provided the financial support to the Society in the form of grants. The first grant installment assigned for establishment of the Network extended from June 1995 to June 1996, the second from July 1997 to December 1998 and the third grant covered the period July 1999 to July 2000.

The Executive Committee established technical sub-committees (training committee, information

⁵¹ Mohamed, 1999

and publication committee and financial committee) for efficient implementation of the work plan.

The main objectives of SSFS are: -

- To promote the concept and practices of social forestry, through networking and linkages between social forestry and extension units in Sudan.
- Enhance the standards of awareness of the community participation in social forestry.
- Encourage the scientific applied research in social forestry and promote the output of the same among the interested persons.
- Assist in the fund raising and appropriate resource funding of the social forestry projects.
- Facilitate and forward the technical consultancy in the field of social forestry projects.
- Preserve the natural forests as a natural heritage.

The society endeavors to achieve its objectives through: -

- Cooperation with the Forest National Corporation as regards to the technical aspects of social forestry.
- Enhance awareness among the sectors of citizens, for the importance of social forestry, through audio-visual and read media.
- Conduct appropriate studies and researches for social forestry.

SSFS works in close collaboration with the government and other NGOs institutions, particularly NCCD and other coordination bodies. SSFS implemented a number of projects that directly involve local communities in the planning and management, examples include establishment of shelterbelts and woodlots in areas prone to desertification.

4.4 Trends in biodiversity conservation

In preparation for the WSSD in Johannesburg, civil society organizations in Sudan and the Government have undertaken assessment of achievements in environmental protection and sustainable development. With funding from the Heinrich Boll Foundation, the civil society organizations, in particular, came up with a book, "Sustainable Development in Sudan: Ten Years After Rio Summit - A Civil Society Perspective of Sudan," a collection of contribution from various Sudanese intellectuals on a variety of subjects.

These documents suggest that biodiversity conservation does not have a long history in the country. The earliest reference to conservation objectives in development planning in Sudan may be in the Six-year Development Plan (1977-1983) where conservation of the country's natural resources was considered one of the methods for attaining the objectives of the development plan. In 1986, the National Economic Conference recommended adoption of policies on natural resources conservation, ecological balance, desertification control and environmental planning. This was later reflected in the Four-year salvation and Recovery Development Programme (1988-1992), but without the necessary policy and institutional mechanisms for the realization of conservation objectives.

The post UNCED era saw, among other things, serious attempts made to develop legislation and institutions. The key initiative was the establishment of the Higher Council for Environment and Natural Resources (1992) as the government advisory and coordinating unit in the field of the environment and natural resources.

The National Comprehensive Strategy (1992-2002), the ten-year comprehensive development plan of the country, recognized that each Sudanese citizen has the right to safe environment that ensure health, self-sufficiency and well-being and advocated sustainable development. However,

the legal framework, institutional mechanism and political commitment were not there to enable the country achieve the stated objectives.

Current practices in Sudan suggest that policies relating to environmental protection, in general, are joint or concurrent responsibilities of the federal and state governments. Federal government has exclusive jurisdiction to legislate on matters relating to natural resources, mineral resources and subterranean wealth. Detailed regulations on environmental protection, however, are a state responsibility subject to federal planning and coordination. In case of conflict, federal jurisdiction over the environment and natural resources prevails over state jurisdiction.

The most conservation-oriented legislation has been the Wildlife and National Park Act (1987). The stated objectives of the Act are:

- Conservation of wildlife and protection of national parks and game areas in Sudan;
- Wise use of wildlife resources and its development;
- Implementation of the Sudan's commitment to the convention on International Trade in Endangered Species of Wildlife Fauna and Flora (CITES) 1973;
- Providing information on wildlife resources and promote scientific research.
- Describing the procedure of establishing natural parks.

Abd Alla (2002) summarizes Sudan's pre UNCED experience to conserve biodiversity and tackle environmental degradation as ad hoc, nonintegrated, lacked understanding of the environment and development linkage and ignored the NGO sector.

4.5 Sudan and the global environment conventions

At the Earth Summit (UNCED, Rio 1992) Sudan signed the Conventions on Climate Change and Biological Diversity (CBD) and later in 1994, the Convention to Combat Desertification (CCD). By ratifying these conventions, the government of Sudan committed itself to work with global community to mitigate the negative effects of this environmental phenomenon on our social and biological systems.

These are:

- i. The Comprehensive National Strategy (CNS). This was a 10-year (1992 - 2002) Strategy that provided the policy directions of all economic and social sectors. The Strategy emphasized the protection and improvement of environment, which will lead to a balanced development. But with low rate of implementation, the strategy has limited success.
- ii. Establishment of the Higher Council for Environment and Natural Resources (HCENR). Created in 1992, HCENR's mandate is to coordinate environment related activities and develop policies and strategies. The Secretariat hosts the National Biodiversity Strategy and Action Plan, the Sudan National Action Plan to Combat Desertification (NAP) in collaboration with the Ministry of Agriculture, the implementation of the UN Convention on Climate Change, UNDP Capacity 21 project and the formulation of the national strategy for sustainable development.
- iii. UNDP Capacity 21 Project. This project housed in the HCENR and launched in 1996 aimed to support the government in preparing a Sudanese national strategy for environmentally sustainable development. The project ended in 2000 and has produced two assessment reports: Assessment of Environmental Capacities in the Sudan and Assessment of Environmental NGOs capacities in the Sudan. Nevertheless, there has not been any follow up project activity.

- iv. The National Biodiversity Strategy and Action Plan (SNBSAP). The preparation has been funded by GEF through UNDP with IUCN Eastern Africa as the technical agency. Regional biodiversity assessment reports were completed in 16 of the 26 states. The key objectives of the Strategy are:
- Reducing, halting and ultimately reversing the over-exploitation of biological resources through appropriate land use, especially the horizontal expansion in crops on marginal lands of fragile ecosystems, overgrazing and deforestation, and by promoting efficient farming techniques and multiple use of the resources to realize their inherent potentials;
 - Promoting political goodwill for the cause of biodiversity and availing incentives to stakeholders;
 - Strengthening the institutional technical capacity by improving the technical infrastructure and strengthening the manpower base through training to carry out the tasks;
 - Enacting a comprehensive and effective biodiversity conservation policy and practice that addresses, among other things, issues such as land allocation, land tenure and possible conflicts;
 - Adopting economically and socially sound measures that act as incentives for the conservation and sustainable use of components of biodiversity (CBD Article 11).

Issued in May 2000, the Strategy has not been yet sanctioned by the Government. It is not also not much known outside the few organizations in the environment area that were involved in its preparation. Further, the Strategy lacks a comprehensive action plan for its implementation. The few project ideas listed toward the end of the strategy document are ones to be implemented by the Higher Council for Environment and Natural Resources (HCENR).

- v. The National Action Plan to Combat Desertification. A National Action Plan (NAP) to combat desertification has been initiated in 1998 in 13 out of a total of 26 States considered to be affected by recurrent drought and slight to severe desertification. A bottom up approach has been followed in the formulation of the Action Plan where each State has been invited to identify problems and set its priorities. Like the SNBSAP, the NAP is little known outside the Land Use Administration and the Higher Council the Environment and Natural Resources (HCENR). In addition, there appears little cross-sectoral linkage either with the NBSAP process or Capacity 21 project.
- vi. National Communication on Climate Change. Under the title, " Capacity Building to enable Sudan's Response and Communications to the UN Framework Convention on Climate Change (UNFCCC)," this GEF/UNDP supported project aims at building Sudan's capacity to prepare Sudan's communication to the Convention. Specifically, it aims to strengthen institutional networks, develop GHG inventory assessments, train personnel, establish policy dialogues and develop and evaluate climate change mitigation measures. Here again, the limited awareness about the impact of climate change and the lack of horizontal coordination with such strategies like the NBSAP and the NAP are the major shortcomings.
- vii. Sudan National Water Policy. Issued in 1999 as a draft document, the policy seeks to bring together policies related to water resources management, utilization and conservation in an integrated manner.

5. Sudan Development Trajectory

Sudan is among the least developed countries of the world. According to the Human Poverty Index (HPI), Sudan ranks 143rd out of the 174 countries listed (UNDP, 1998). About 93 percent of the population is below the poverty line.

Sudan economy had been under various IMF Structural Adjustment Programmes for the past two decades. In the early 1990s, the International Monetary Fund declared Sudan non-cooperative because of its nonpayment of arrears to the Fund. Despite the IMF decision, the Government embarked upon several initiatives that aimed at promoting economic growth and social transformation.

In 1992 Sudan economy went into full swing liberalization. All commodity subsidies were removed together with import controls and pricing. The only two regulations, which remain are controls over wages and foreign currency transactions. Sales of public sector enterprises commenced immediately, while a countrywide decentralization process was initiated in 1995. The change from a regulated to deregulated economy was accompanied by severe economic hardship to the people. The decision was taken at a time of very strained Sudan relations at the regional and international level.

In 1998, IMF had put in place a three-year staff monitored program. The program ended on December 31st 2001. IMF reports that Sudan has failed to pay its commitments of \$5.5 million to the Fund by the end of 2001. Subsequent IMF efforts focused on finding mechanisms for convincing Sudan to pay its commitments to the Fund.

On the economic growth side, IMF reports show that the overall economic performance slowed to 5.3%, to be compared with the Bank of Sudan reported GDP growth rates of 6% in 1999 and 8.3% in 2000. The average CPI inflation remained at 4.9%. The growth in the economy is attributed to the increase in petroleum production, which is likely to dominate the economy in the years to come.

Sudan's economy heavily depends on the extraction of natural resources. For many years to come, Sudan's development potential will continue to reside in the vast resources of land and water that are amenable to development. The size of area that can be developed for agricultural is some 80 million hectares. The Nile water share of Sudan is 18.5 billion cubic meters. Another source of irrigation water that has not yet been tapped is water harvesting. In addition to the resources of land and water petroleum has been struck and exported. Gold is also mined and exported.

GDP: sectoral origin

46 percent of the gross domestic product originates from the agriculture sector, with industry accounting for only 15% of GDP.

Gross Domestic Product GDP
At Constant prices of 1989/2000 (Million Dinars)

Sectors	1999		2000	
	Value	Rate of Growth	Value	Rate of Growth

Agriculture	619.7	8.5	624.4	0.8
Irrigated Agriculture	159.2	4.8	171.3	7.6
Rain fed Mechanized Agriculture	33.6	47.7	14.9	-55.7
Rain fed Traditional Agriculture	108.6	24.6	102.2	-5.9
Livestock	277.8	8.9	293.5	5.7
Forest and Others	40.5	4.0	42.5	4.9
Industry	113.8	19.1	201.9	77.4
Mining and Quarrying	23.7	125.5	101.4	327.8
Manufacturing	90.1	6.0	100.5	11.5
Electricity and Water	21.9	2.0	23.2	5.9
Building and Construction	60.8	2.4	62.8	3.3
Services	427.2	0.4	433.9	1.6
Government Services	76.7	0.0	78.2	2.0
Other Services	350.5	0.5	355.7	1.5
GDP at Constant Prices 1981/82	1243.40	6.0	1,346.2	8.3
GDP Deflator	1969.5	16.0	2,205.8	12.0
GDP at Current Prices	2,448,876.3	-	2,969,448.0	-

In the year 2000, GDP grew by 8.3 but decreased to 6.4% in 2001. The contribution of the agricultural sector, which is the most important sector, was 46.4 and 45.6% respectively. This is a very percentage, even by African standards. It suggests that Sudan other economic sectors have not grown.

The phenomenal growth of 327.8% that the mining sector registered is due to the discovery of oil and commencement of production.

Despite this improvement and growth of the economy at about 6% annually, the level poverty is on the increase.

Contribution of Economic Sectors In Gross Domestic Product (GDP) 1998-200

Sectors	1998	1999	2000
	% Share	%Share	%Share
Agriculture	48.7	49.8	46.4
Industry, Manufacturing and Mining	8.1	9.1	15.0
Electricity and Water	1.8	1.8	1.7
Construction	5.1	4.9	4.7
Governmental Services	6.5	6.2	5.8
Other Services	29.8	28.2	26.4
G.D.P	100.0	100.0	100.0

Source: Bank of Sudan, 2001

Petroleum production has now emerged as the main export earner, accounting for 81% of total export earning in 2001.

Trade Balance (1999 –2001)
(Value in US\$ million)

	1999	2000	2001
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Exports	<u>780.1</u>	<u>1,806.7</u>	<u>1698.7</u>
Crude Petroleum	275.9	1,350.8	1,376.2
Non-Oil Exports	504.2	455.9	322.5
%Change of Exports	31%	131.60%	-6%
Imports	<u>1,414.90</u>	<u>-1,552.70</u>	<u>-1585.5</u>
% Change of Imports	-26.5	9.7	2.1
Trade Balance	<u>-634.8</u>	<u>254</u>	<u>113.2</u>

Source: Bank of Sudan, 2001.

Sudan had begun exporting crude petroleum and refined products since 1999. Petroleum had improved Sudan balance of payments. However, as IMF reports show Sudan has failed to pay its commitments of by the end of 2001, and the time Sudan's international reserves were \$45 million (equivalent of two weeks imports).

6. KEY ENVIRONMENTAL THREATS

The review of the state of natural resource and its management presented above suggests that Sudan has experienced severe and continuous environmental degradation for the past few decades or so. Although the paucity of data on the nature, magnitude and causes of environmental degradation may not permit to determine precisely the driving forces behind the degradation and their relative contribution, economic policies pursued by successive governments top the list of factors. Because Sudan has a natural resource dependent economy, government investment, fiscal, monetary policies and strategies of development have direct bearing on the management and use of natural resources.

These policies have promoted mechanized agriculture and extensive farming practices of traditional agriculture. In response to the 1992 Earth Summit, several policy initiatives to protect the environment were also taken. However, with the war and civil strife in the South, Sudan's isolation from the world community and pervasive poverty, no significant progress was made in biodiversity conservation. All available data suggests that the response to the economic hardship took the form of indiscriminate forest clearance and horizontal expansion of agriculture, the only coping mechanisms. Land degradation and desertification continued unabated in the 1990s. Today, Sudan's state of natural resources can be characterized by severe land degradation deforestation, desertification, worsening poverty, soil nutrient loss, wetland loss and degradation and continuing war and civil strife.

Changes in the natural environment are caused by a host of complex and intertwined human and non-human factors. It is thus difficult to distinguish between what is driving these changes and what is being driven, and establish clear cause/effect relationship both in space and time. For example, land degradation is caused by multiple economic, social, cultural, political and biophysical factors. These same factors cause deforestation, and deforestation is one of the major causes of land degradation. Then there is the issue of desertification, which is generally believed, albeit debatable, to be the cumulative effect of both land degradation and deforestation. What this paper has done is to identify and discuss each environmental threat from a variety of angles with the view to broadening policy options.

The Sudan National Biodiversity Strategy and Action Plan (SNBSAP) and the Sudan National Action Plan to Combat Desertification (SNAP) have identified the following as the key environmental threats: environmental changes; absence of land use planning; socio-economic factors; modern agriculture; overgrazing; biotic factors, fire; inadequate institutional capacities;

war and civil strife; farmers' practices; legislation; economic distortion and failures. Building on this and distilling the key threats that emerged from the review presented above, this paper has identified ten key environmental threats.

- Land degradation
- Deforestation
- Desertification
- Climatic variability
- Soil nutrient loss
- Wetland loss and degradation
- Unsustainable agricultural practices – over fishing, overgrazing,
- Poverty
- War and civil strife
- Pollution and pollutants

Attempt is made below to discuss the nature and magnitude of each threat and its possible causes to the extent data permits, there are factors that could be regarded as common causal factors. These are:

- Horizontal expansion of mechanized rain fed cultivation. Sudan's economic policy since the late 1960s has encouraged expansion of mechanized agriculture, ostensibly to improve the country food security and make Sudan food self-sufficient. Reports of the Forest National Corporation (FNC) show that an estimated 455,000 ha of forestland is being cleared annually for agriculture and other purposes. On the sandy soils of the Sudan, the shortening of the fallow period brought a negative impact by retarding the natural regeneration of the gum Arabic tree. Another aspect of the horizontal expansion of agriculture affected the natural rangeland. Inter-communal tension and conflict resulted between herders and cultivators, and Jebel Marra is at the present a real hotspot. Conflict is the rule rather than the exception. The reason is that the area had become the only source of available grazing in the whole of greater Darfur.
- Dependence on biomass energy. As indicated earlier, Sudan's household energy is largely derived from biomass. This combined with the horizontal expansion of agriculture, resulted in clearance of forest has rendered vast areas treeless in central and northern Sudan.
- Demographic changes. Sudan's population grows at 2.7% per annum. Population growth in Sudan has direct consequences on the environment through the growing demands for fuel wood. The demands for more land to produce more food means shortening of the fallow or resting period in the rain fed agricultural. This in turn contributes to the gradual loss of soil fertility through the exhaustion of the soil. While population growth is the cause of land degradation, it is rarely the primary one. There are other factors.
- Brain drain. There has been steady movement of labor from the Sudan to the Arab oil rich countries. This included migration of able-bodied males, the loss of whose labor is felt in the rural areas and the loss of trained manpower or the brain drain to the industrial countries. Although the problem created has been partially offset by the remittances sent back home, Sudanese authorities report that it has created undue dependence of the rural population on income and goods and services originating outside the country.
- Refugees from neighboring countries. Sudan had hosted refugees displaced by war and drought for the last three decades. Eastern Sudan is the main reception and camp

centre for Eritrea and Ethiopian refugees. Refugees protracted presence negative impacts on the environment through indiscriminate clearing of trees for domestic energy and housing.

- Poverty. 94% of Sudan's population is below the poverty line. Many of the poor people are in the rural areas, and live in marginal lands and drought prone areas. The poor have limited access to modern agricultural inputs and also to alternative biomass sources of energy. This means heavy reliance on forest clearing to expand agricultural output, and even to maintain it in most cases. Further, both historical and contemporary records of famines in Sudan and other neighboring countries show that environmentally degraded areas, where the poor mostly live are prone to natural calamities, particularly to droughts and crop failures, and consequently to famine and outbreaks of diseases.
- Sudan's diplomatic isolation and economic sanctions. The economic sanctions imposed on Sudan have denied the country access to foreign direct investment, development assistance and also normal trade relations. Sudan has accumulated a large foreign debt since the oil boom of the early 1970s and debt repayments did not give room for maintenance of productivity in either the modern or traditional sectors.

From the findings of the mission and the review of SBNAP and SNAP, the following key environmental threats have been identified:

6.1 Land Degradation

According to the UN Convention to Combat Desertification, land degradation refers to "a reduction or loss, in arid, semi arid and dry sub humid areas of biological or economic productivity or complexity of rain fed cropland, irrigated cropland, or range, pasture, forest and woodlands resulting from land uses or from a process or combination of processes, including process arising from human activities and habitation patterns such as: soil erosion caused by wind and /or water; deterioration of the physical, chemical and biological or economic properties of; and long term loss of natural vegetation."

All available evidence suggests that Sudan has experienced continuous deterioration of physical, chemical and biological properties of the land, and decline in agricultural productivity arising from population growth, horizontal expansion of agriculture, deepening poverty and a host of policy and institutional factors, among others.

This is attributed to horizontal expansion of agriculture, cultivation of marginal lands, overgrazing and heavy wood energy consumption (firewood and charcoal constitutes approximately 87.6% of Sudan wood harvest). Severe wind erosion - in areas north of latitude 14°N and water erosion - in Equatoria (South Sudan), Jebel Mara and Nuba mountains in the west and southeast Gedarif in eastern Sudan, are the key forms of land degradation.

Based on the current uses of land it is projected that horizontal expansion of rain fed agricultural will continue to occur. This would be necessary to at least maintain current levels of food and cash crop production. Given the current economic difficulties no expansion of irrigated agricultural production is projected in the short term. Areas are expected to remain the same, as investment flows are unlikely to be tempted into Sudan.

According to the on-going climate change project, the natural forest cover is

projected to continuously decrease for use in biomass energy and building material. Natural ranges and pastures are also projected to decrease in area.

Land Use Category	Projected Area (1,000 ha)		
	2000	2005	2010
Forest land with > 20% Crown Cover	3,069.5	2,939.0	2,808.5
Forest land with 10-20% Crown Cover	4,486.5	4,283.0	4,079.5
Scattered Trees/Shrub Range land	42,751.3	40,810.5	38,869.5
Grass Range land	20,110.0	20,110.0	20,110.0
Wasteland	15,882.0	16,065.5	16,249.0
Irrigated Agriculture	1,860.0	1,860.0	1,860.0
Mechanized Rain Fed Agriculture	7,599.5	8,949.0	10,298.0
Traditional Rain Fed Agriculture	8,561.5	9,303.0	19,944.5

Source: National Programme Adaptation Climate Change Project 2002

Sudanese authorities report that there are two factors that have aggravated land degradation:

- a. **Insecurity of land tenure. The government of Sudan owns all land in Sudan but it does not exercise any effective control over its use. At the same time the government has not fully recognized the customary use of land by the different groups of people. The communal use of land particularly in the rural Sudan is a very strong institution. Lack of a coherent policy is believed to be a cause of resource mismanagement.**

- b. **Improper land use. Land use is affected by the modes of harvesting of the existing natural resources in different ecological zones of the country. Sudan has put in place multiple arrangements that may have contributed a lot to land degradation. For example, livestock grazing in the open natural ranges in the centuries old, nomadic and communal system while wood harvesting from forests under the supervision of the Forests National Corporation and planned gravity-irrigated agricultural schemes under partnership of the government, etc.**

6.2 Deforestation

Deforestation has, or is, occurring in every country where there is a forest cover. Indeed, forest clearance for agriculture has been going since time immemorial. While some countries have succeeded maintained a comfortable level of forest cover through strong reforestation programs, many developing countries have failed to do so. Sudan is not exception. With 68% of Sudan's forest found in the war affected southern states, and with Sudan experiencing dramatic decline in its forest reserves, deforestation clearly merits to be treated as an environmental threat in its own right. Further, because of global benefits that accrue to forests, the forest crisis has received increasing global attention and has prompted many initiatives by governments and intergovernmental agencies.

Forests provide valuable services, for example biodiversity, water, and have spiritual meaning for individuals, communities, and society as a whole. Deforestation, thus, means: soil erosion, flooding (change in hydrological cycle turco) and sedimentation; global warming; habitat loss and reduction in biodiversity. Ecologists in fact argue that the main factor in the extinction of plant and animal species in the last quarter of the 20th century has been the destruction of the habitat. For example, some species of insects rely on one single species of tree, or some species exist in small number and are restricted to their geographical area and clearing of the forest makes them

vulnerable.

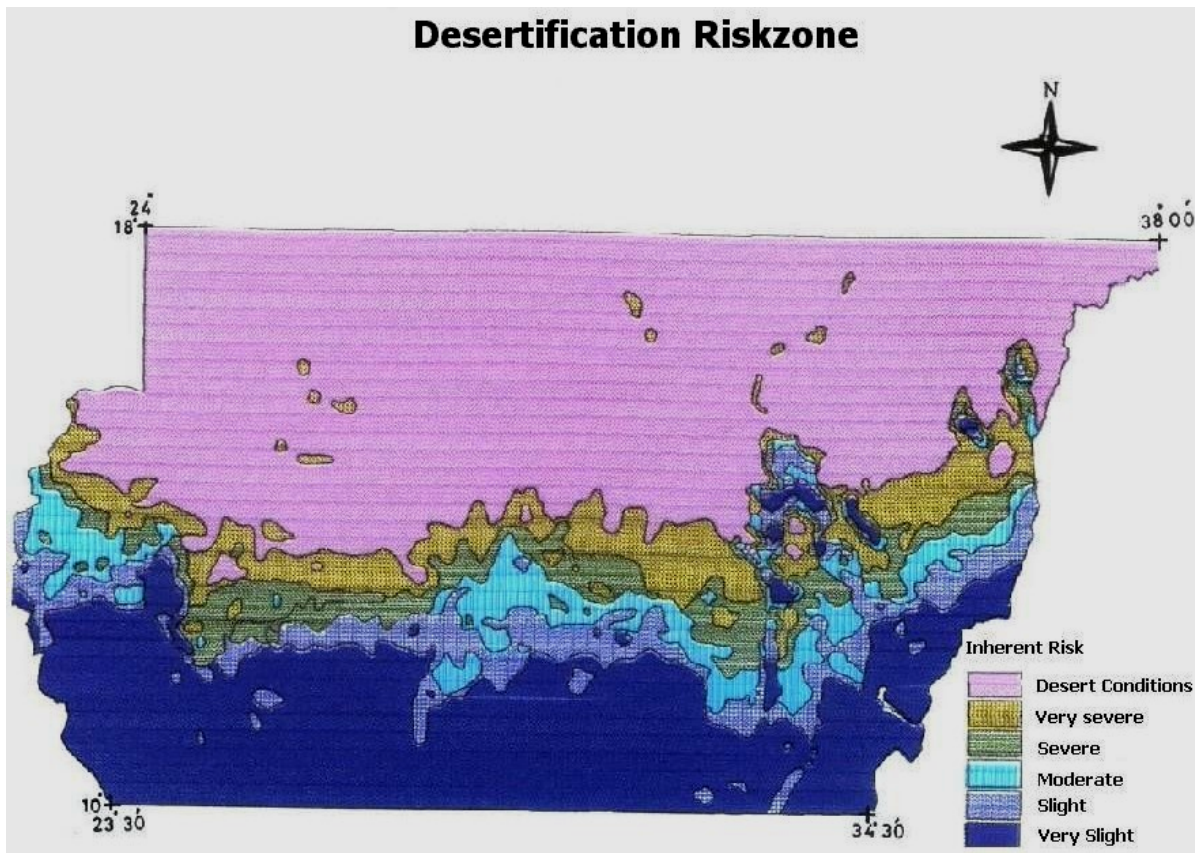
Horizontal expansion of rain-fed mechanized and traditional farming, heavy reliance on forest biomass energy, overgrazing, bush fire, etc. have been the key factors. Although there have been several forest legislations issues, institutional mechanisms for enforcing these laws were lacking. Today, the Forest National Corporation remains operational only at the federal level.

The greater proportion of Sudan stock (68%) is found in southern Sudan. As stated above the conflict situation has halted any official forest presence. The actual situation on the ground is unknown. It had been mentioned in some environmental reports that both parties to the conflict use forest clearance as defense mechanism around big settlements or military zones.

6.3 Desertification

The UN Convention to Combat Desertification (UNCCD) defines desertification as: "land degradation in arid, semiarid and sub-humid tropics caused by a combination of climatic factors and human activities." One might argue that the two environmental threats discussed above, notably land degradation and deforestation would cover almost every aspect of desertification as defined by UNCCD. In a country like Sudan where over half of the country, or thirteen of the sixteen northern states, are affected by light to severe desertification, desertification would obviously merit a special treatment.

The map below obtained from Sudan Remote Sensing and Mapping Authority, shows the different desertification zones.



Source: Sudan Remote Sensing and Mapping Authority

Fifty one percent (about 1,259,440 square kilometers)⁵² of Sudan's land area) between latitude 10 to 18 degrees north is affected by desertification ranging from light to severe. This area is characterized by extreme arid conditions continuously fed by recurrent drought, land degradation, deforestation, soil nutrient loss. Studies conducted by NDDU showed the shift of the rainfall isohyets during the period 1930-1990 from north to south indicating the expansion of arid condition from north to south. Sudan's National Action Plan to Combat Desertification (SNAP) covers thirteen of the 26 Sudan's states classified as desert or semi-desert.

Sudanese authorities explained that it was a land and aerial survey of 1975 that drew attention to the accelerating process of desertification. It was in response to that the Government created a special unit, the National Drought and Desertification Unit (NDDU), within the Ministry of Agriculture for monitoring and reporting on the process.

In its early years the NDDU received donor support, but these dwindled with the passage of time, owing to Sudan's strained foreign relations and the low priority position given to the UN Convention to Combat Desertification in the donor agenda.

The consensus among environmentalists and the general public is that desertification is the number one Sudan environment problem. The figures given above in the baseline description attest to the situation.

In 1976 a field study alerted Sudan to desertification. One of its recommendations was to halt millet production north of latitude 13 N. Unfortunately the recommendation was not easy to implement.

6.4 Climatic variability

Climatic variability manifests itself in the form of severe drought and occasional floods, and Sudan faces both problems. For over three decades, recurrent drought, with intermittent severe droughts, had become normal phenomenon in Sudan and indeed in the Sudano-Sahelian region. In particular, the severe droughts of the early mid 1970s and ten years later of the early mid 1980s, have destabilized the population, broken down family and tribal structures, traditional practices of resource management and forced people to migrate. There were also series of localized droughts often every two years, but mainly in western Sudan in Kordofan and Darfur regions and parts of central Sudan.

The rain-fed traditional and mechanized farms of western, central and eastern Sudan are most affected by drought. Severity of drought depends on the variability of rainfall both in amount, distribution and frequency. The most heavily affected are the northern Kordofan and Darfur states. Drought is thus threatening the existing cultivation of about 12 million hectare of rain-fed mechanized farming and 6.6 million hectare of traditional rain-fed lands. Pastoral and nomadic groups in the semi-arid areas of Sudan are also affected.

Despite the prevalence of drought hazards, floods also affect Sudan. As with drought, two types of floods affect the country: localized floods, caused by exceptionally heavy rainfall and runoff (flash flood) and widespread floods caused by overflow of the River Nile and its tributaries. Floods in both forms are highly unpredictable due to the nature of rainfall variability in time and space. Thousands are reported to have migrated.

The Ministry of Irrigation and Water Resources monitors the Blue Nile, which is the main cause of the floods, once it enters Sudan territory. However, localized flash floods, which occur during the months of August and September, are associated with above normal rainfall and are more

⁵² Sudan National Action Plan to Combat Desertification (SNAP), p. 15

difficult to monitor. In the last 38 years, floods caused by localized heavy rainfall affected parts of central, eastern and western Sudan during the years 1962-1965, 1978-1979, 1988, 1994 and 1998. Even in northern Sudan there were cases where heavy rain caused localized floods (e.g., October 1999). The most vulnerable groups to both forms of flooding are people who live in low lands and along the riverbanks. Reports of the Ministry of Irrigation and Water Resources show that of the most severe floods recorded for the River Nile (1878, 1946, 1988, 1994 and 1998, 1998), three were in the past fifteen years.

6.5 Wetland loss and degradation

The lack of awareness of the hydrological, economic, climatic and social benefits of wetlands, the Jonglei Canal Project and the War in Southern Sudan pose serious threat to wetlands of Sudan. Given the global significance of Sudan's wetlands, halting wetland degradation would require immediate regional and global attention.

Wetlands are the least understood but most important environmental resource of any country. They have huge economic, social, climatic and hydrological benefits. Wetlands can also be easily lost or degraded through direct drainage for cultivation, grazing, and/increase water supply down stream (e.g., the Jonglei Canal project) or indirectly through sedimentation and pollution.

The Jonglei Canal project poses perhaps the greatest threat to the wetlands of Sudan. The project, halted by war today, started in 1980 and was designed to make full use of the River Nile. The project would divert the course of 25 per cent of the water that flows annually to the low plains from the River Zaraf and the al-Jabal Sea estuary, via a canal to dams. The construction of the Canal is expected to reduce the seasonally river-flooded grasslands. Some of the wetland will also be lost because of reclamation. It is also expected to affect the settlement pattern and agricultural practices of around two million people inhabiting the Jonglei Canal region. The decline of the volume of water passing through the swamps, caused by the canal, is expected to affect the type and distribution of vegetation. The most prone to change are the emergent species. *Vossia* and *Cyperus* are likely to retreat down-stream. Substantial reduction may also be expected in the zone occupied by *Typha*. Further, the seasonally flooded grasslands dominated by *Oryza longistaminata* and by *Echinochloa pyramidalis* have been predicted to decrease in area by 10-32%. (Source: SNAP)

In the freshwater sector in general, siltation, sedimentation, aquatic weeds (water hyacinth) and POPs, though quantitative evidence is not strong, have emerged as potential threats to consider. Water hyacinth, for example, has infested 3200 kilometers of the White Nile.⁵³

6.6 Unsustainable agricultural practices

This has manifested itself in the form of reliance on seasonal bush and grassland fires for purposes of preparing land for cultivation, pastoralism, overgrazing in some regions of the country, limited extension services and farmers' shift to early maturing crop varieties in response to drought. Sudan's livestock population stands at 124 million. This means that every Sudanese, regardless of age, owns 4. The Range and Pasture Administration estimates the minimum area of rangelands required for sustaining the national livestock herd at about 190 million ha, Sudan has at present only 116 million ha of natural rangelands. The difference represents overgrazing.

Mono-cropping farming system, years of extensive cultivation practices by the traditional sector, with limited or no access to fertilizers and improved farming techniques compounded by wind and water erosion have left the soils of Sudan nutrient depleted.

⁵³ SNBSAP, p.35

Further, Sudanese authorities reported that food crop varieties and cultivars, which constitute the staple food for people in dry regions, have been threatened. The survival of local pearl millet strains especially the late maturing ones in western Sudan has been adversely affected by the recurrent droughts and land degradation. There is a shift to early maturing and improved seed varieties. The local varieties are, thus, slowly giving way to the modern and mostly imported varieties.

6.7 War and civil strife

Sudan has suffered from more than 40 years of war and civil strife in the southern part of the country, which is the richest area in biodiversity.

The effect of the war and civil strife in Sudan is not exactly known. McNeely, Jeffrey (1998) tabulates the possible positive and negative impacts of war on biodiversity as follows:

Impacts of war on biodiversity

Negative Impacts	Positive Impacts
<ul style="list-style-type: none"> • Causes deforestation • Increases wildlife poaching • Destroys habitat • Pollutes land and water • Reduces funds for conservation • Stops conservation projects • Forces people on to marginal lands • Creates refugees who destroy Biodiversity 	<ul style="list-style-type: none"> • Creates "no-go" zones • Slows or stops developments that lead to loss of biodiversity • Focuses state resolve • Reduces pressure on some habitats • Disarms rural populations, thereby reducing hunting • Can increase biodiversity-related research

War and civil strife can be triggered or caused by actual or perceived environmental scarcity arising from the loss of biodiversity. In Sudan, the eruption of war in 1983 after a relatively calm period after the signing of the Addis Ababa Peace Accord is the expansion of mechanized farming (Suliman, 1996a). Large-scale commercial farming and ranching projects displace and dislocate peasants and pastoralists, thus forcing confrontation.

Undoubtedly, war and civil strife have devastating effects on biodiversity because of indiscriminate clearing of forests to meet military requirements, hunting of endangered species of animals and also cutting of endangered plant species to finance the war, destruction of national parks and protected areas. The cutting of forests is a known defense mechanism employed by both sides. Burning and cutting of Papyrus, Phragmites and Typha for access, also occurs.

On the other hand, there are instances where war had prevented destruction of biodiversity by keeping biodiversity rich areas inaccessible to mechanized farming. As Myers (1979) put it, "In some respects, indeed, wildlife benefits from warfare: combatant armies effectively designate war zones as 'off limits' to casual wanderers, thus quarantining large areas of Africa from hunters and poachers". As McNeely (1998) argues "any benefits of war to biodiversity are incidental, inadvertent, and accidental rather than a planned side-effect of conflict." In the case of Sudan, the termination of the Jonglei Canal project because of the war appears to have contributed to the conservation of the wetland ecosystem and the wild life species and ethnic groups that derive their livelihood there from.

Regardless of the possible positive effect that the war and civil strife had on biodiversity, it remains one of the key environmental threats.

6.8 Policy failures and inadequate institutional capacity.

Although the Government has issued a number of high sounding decrees and legislation that would have gone a long way to protect the environment, many of the post-Rio environment-related policies remain unimplemented. Nor were there strong enforcement mechanisms for government policies and legislation. For example, the government has not yet sanctioned the National Biodiversity Strategy and Action Plan issued in May 2000 as well as the Sudan's National Action Plan to Combat Desertification (SNAP) in 1998. There is also no clearly articulated and multi-sectoral action plan for the implementation of the strategy.

Government institutions remain deprived of the necessary budgetary resources that would enable them provide basic services or perform expected duties and responsibilities. Years of diplomatic isolation and economic sanctions have deprived Sudan of the technology, trade opportunities and investment that globalization has offered.

7. Gaps in existing natural resource knowledge base

Sudan's knowledge base for sound natural resource management remains weak. Sudanese authorities and also the SNBSAP and SNAP indicate:

- The lack of current vegetation, forest, wildlife periodic surveys;
- Frequent changes in the structure of government institutions and subsequent lack of continuity of personnel;
- Constrained interaction and flow of information from the outside world because of Sudan's years of diplomatic isolation and economic sanction;
- Successive wave of brain drain, first to the oil rich countries and lately to North America and Europe for fear of political oppression or for seeking better economic opportunities.
- The 2000 FAO commissioned Sudan Forestry Outlook Study for Africa (FOSA) and the National Biodiversity Strategy and Action Plan have identified serious knowledge gaps in such areas as: wildlife population and distribution (the current survey dates to the pre-war status); plant and wildlife taxonomy; ecology of forest montane vegetation; ecology of the Red Sea and coastal vegetation; land tenure regimes and southern Sudan forestry.

8. Opportunities

Opportunities for intervention are derived from environmental threats identified earlier. But at the same time, any intervention needs to take full cognizance of efforts currently being made by the government, private sector and civil society. In addition, any intervention ought to be based on existing processes and practices to ensure sustainability. For this reason, the first two sections discuss the development planning process and Sudan's relation with the international donor community.

8.1 The development planning process

Sudan is in the process of formulating a national strategy for sustainable development and a national poverty reduction strategy (PRS) advocated by the World Bank. These two strategies will be prepared within the framework of Sudan's National Comprehensive (25 years) strategy; a preliminary draft document is currently under consideration by the Council of Ministers. A national

council for strategic planning chaired by the President of the country oversees the formulation of the strategy.

The 25 Year Strategic Plan (2003 – 2027) contains five sectors:

- Political development and sovereignty – achievement of peace and national unity
- Economic growth – restructuring, expanding and diversifying the economic base through private sector participation and social transformation
- Guidance and social care – comprehensive human development
- Services – electricity, water, highways, etc.
- Private and civic society – raise the private sector’s contribution to 70% of investment

The first draft of the Strategy has been submitted to the Council of Ministers for discussion. Although the document is unavailable to the public and even to people at senior officials level, the discussion with the secretariat of the Strategic Planning Council suggests that the “environment” has been neglected.

Under the coordination and leadership of the Ministry of Finance and National Economy, Sudan is also in the process of formulating a national poverty reduction strategy. This strategy is expected part of the country’s long-term strategic plan and seeks to involve all groups of Sudanese society.

With assistance from the UN Department of Economic and Social Affairs, the Higher Council for Environment and Natural Resources in collaboration with the Strategic Planning Council and the Ministry of Finance has embarked upon organizing a series of workshops that would lead to the formulation of a national sustainable development strategy. It is hoped that this process will give ample opportunity to integrate the “environment” into both poverty reduction and the long-term strategic plan.

8.2. Development assistance and foreign investment

Today, virtually no development assistance or investment flow was received between 1992 and the present. The donor community to the humanitarian side only limited foreign assistance. The Table below provides an overall picture.

Name of the project	Assisted by	Starting Year	Duration	States
Rehabilitation social forestry	Irish Aid	Jan.1992	3 years	Gezira Sennar
Forestry development in the Sudan	Netherlands Government	April 1992	4 Years	Red Sea ,Kasha, Gedarif, Gezira, Sennar, HO
Restocking of gum belt for desertification control	UNSO	April 1990	4 Years	Northern Kordufan
Restocking of gum belt	Norway&Gulf			N. &S Darfur
Afforestation and reforestation in N. state	DANIDA	April 1989	6 Years	Northern River Nile
Manag, Jebel Marra forests	GTZ	July 1989	8 Years	South Darfur
Village extension section	SOS Sahel UK Netherlands	Phase 11 June 1990	3 Years	River Nile Shendi
Nat. forest manag.t El Ain	SOS Sahel Int. UK	Oct. 1989	4Years	N. Kordufan El Ain
El Giteina G. Belt Project	SOS Sahel	Jan. 1992	3 Years	Wite Nile
Northern Province SOS Sahel Comm.Forestry	SOS Sahel	March 1989	4 Years	N. state El Deba

source: Higher Council for Environment and Natural Resources (2002)

8.3 Key opportunities for intervention

The above assessment of environmental threats suggests an immediate need for intervention in a number of areas, and the key ones are:

- i. **Improving land use through the development of land use plan and policy.** Land degradation has now become serious threat to the survival of a majority of Sudanese population. Its impact, in terms of loss of biodiversity, reduced atmospheric and subterranean carbon sequestration, and pollution of international waters, is significant. The National Biodiversity Strategy and Action Plan (SNBSAP) and Sudan's National Action Plan to Combat Desertification (SNAP) have also identified improper land use as a leading threat to the country's biodiversity and have recommended the need to develop land tenure policy and legislation. It is thus important to undertake a review of existing land tenure regimes and land use practices, on the basis of which land use policy can be developed. The development of the land use plan could give priority to areas hardest hit by land degradation.
- ii. **Developing the knowledge base for sound natural resource conservation, management and use.** Rational use of natural resources and sound management of the environment require the availability of environmental information on, for example, vegetation, soil, water, weather condition and on socio economic activities that influence environmental change. Such information in Sudan is highly scattered, lacking and/or often outdated. Institutions that employ modern techniques such as remote sensing and geographic information systems, lack the necessary soft ware and hard ware that would enable them to generate decent information. Thus, mapping soil and key resources need to be undertaken, in addition to strengthening the Remote Sensing Authority in soft ware and hard ware.
- iii. **Strengthening the Higher Council for Environment & Natural Resources (HCENR).** The HCENR, despite its huge responsibility as the coordinating agency for the formulation and implementation of the National Biodiversity Strategy, has only one senior staff member, i.e., the Secretary General, and the institutional infrastructure is weak. The NDDU of the Ministry of Agriculture, currently housed in the HCENR, coordinates the implementation of the SNAP, but operates with only one senior permanent staff member.
- iv. **Restructuring and strengthening of the Forest National Corporation (FNC).** The Forest National Corporation would also require strengthening and redefinition of its mandate based on a policy that promotes the conservation and sustainable use of forest biodiversity with greater involvement of communities. At present, the FNC operates only at the federal level, but shares with States the revenue from forest products and services. The respective roles and responsibilities of FNC and the state governments need to be redefined too.
- v. **Mainstreaming the Sudan National Biodiversity Strategy (SBSAP) and the Action Plan to Combat Desertification (SNAP) in the national development decision-making process.** As both the SNBSAP and SNAP lack detailed and operational implementation strategies and action plans for their realization, one possible entry point would be to assist the development of a detailed implementation strategy and action plan. Such initiative has the potential to trigger the formal adoption of the two strategies by the government and may also play a catalytic role to mobilize local and external resource for their implementation.
- vi. **Promoting conservation of Sudan's genetic resources.** One of the priority activities identified by the SNBSAP is the collection of plant and animal genetic

resources throughout the country to preserve genetic resources threatened by war, pollution and recurrent drought.

- vii. **Improving the conservation and management of wildlife.** The wildlife and National Park Act of 1987 is mainly focused on the conservation and protection of wild animals and neglects or excludes wild plants. It does not provide for zoning of parks and classifications of areas with potential for multi-purpose uses, in particular the exclusion of people residing around national parks in wildlife management constitutes unsustainable practice. In general, current wildlife conservation is reported to be inadequate. Most parks and protected areas are inadequately staffed and financed. In addition, there are no land use plans, and most protected areas are left open to human settlement, cultivation and livestock grazing.
- viii. **Strengthening and expanding environmental education and communication.** Sound management of the environment requires the participation of all groups of society. Effective participation requires awareness about the environment, which is lacking in Sudan.
- ix. **Conflict resolution and building sustainable peace in the Sudan.** Any effort made to achieving peace in the Sudan would contribute enormously to the protection of the environment.
- x. **Supporting the development of sustainable agricultural practices.** Soils rehabilitation programs will be required which would include: investment in new farming technology; improved extension services and actively involving and engaging farmers in land-use planning; management and supporting local organizations to preserve local ecosystems; and move toward integrated crop culture.

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