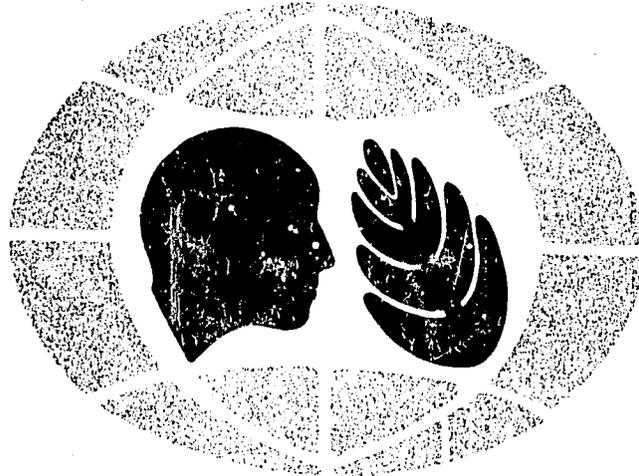


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LEGAL REGULATORY AND INSTITUTIONAL ASPECTS OF
ENVIRONMENTAL AND NATURAL RESOURCE MANAGEMENT
IN DEVELOPING COUNTRIES

A COUNTRY STUDY OF SUDAN



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May, 1982

International Institute for
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Legal, Regulatory, and Institutional Aspects of Environmental and Natural
Resources Management in the Sudan

CHAPTER ONE

General Background: Geography and Natural Resource Base

Covering almost ten percent of the African continent, the Sudan is the largest country in Africa, with a total surface area of almost one million square miles. This is close to the size of the U.S. east of the Mississippi. A variety of ecological regions are represented in this great expanse of land, ranging from desert in the North to tropical forests in the South. In between these two extremes are semi-arid areas, open semi-tropical savanna, and swamplands, the most well-known of which is the Sudd, the permanent swamp in the flood plain of the Southern Sudan. Climatic conditions are similarly varied, with zero rainfall in the arid (Northern Desert) areas to equatorial rainfall (2000mm annually) in the extreme south. In addition, the Sudan has a great variety of soils, from pure sand through highly fertile soils to heavy clay. The country's population consists of many cultures, which form two distinct groups: the Arabic-speaking Moslems in the North and the Nilotic-African tribes in the Central-Southern and Southern Sudan. Through this mosaic of terrain, vegetation, climate, and culture flow the waters of the Nile, the overwhelmingly important natural resource and "backbone" of the country.

The Nile in the Sudan consists of the White and Blue Niles, which flow through the country's diverse regions to meet in Khartoum (literally, "the trunk," because of the shape of the two rivers' confluence).

The White Nile, Bahr-al-Abyad, consists of the tributaries Bahr-al-Jebel and Bahr-al-Ghezal (the mountain river and the gazelle river,

respectively), which originate in Uganda and Zaire, respectively. The Bahr-al-Jebel flows northward through the Sudd (where it dissipates most of its waters) until it meets the Bahr-al-Ghezal, near Malakal, to become the White Nile. The waters of the Blue Nile originate from Lake Tana in Ethiopia. It flows south and west before it loops round into the Sudan. From here it flows northwards to its rendezvous with the White Nile. The Nile is the major artery of communication, commerce, and agriculture in the Sudan. Its waters have offered the possibility of irrigation for many agriculture and irrigation schemes which play such a predominant role in the Sudan's agricultural production. It provides some hydroelectric power as well. Implementation of the controversial Jonglei Canal scheme will produce an increase in the yield of the Nile waters (the main objective of the project) and potentially offer a major increase in benefits for the economy of the country.

The Sudan's economy is based on agriculture, which contributes almost 40% of the Gross Domestic Product and accounts for more than 90% of its foreign exchange earnings. Hence, in the current Six Year Plan of Economic and Social Development, 1977-78-1982/83, agriculture is declared to be the "pivot of development and the leading sector of the economy," and that "development in other sectors would be interlinked with agricultural expansion." It has been estimated that in the 15 years preceding the commencement of the current plan, an average of about 35% of the total public sector investment has been channelled into agriculture. Agricultural activities are mainly crop cultivation and grazing. Crops such as dura (sorghum) and wheat are grown primarily for domestic consumption. The main cash crops cultivated for export are cotton, cottonseed, and sugar. Attempts are being made under the present Plan to diversify the export potential of cash crops (e.g., cotton's share to drop from 60%-43% to include sesame seeds and groundnut among cash crops.

In Sudanese agriculture, modern methods exist side by side with traditional ones, but one of the Plan's objectives for the agricultural sector is the development and modernization of traditional farming and the modernization of pastoral activities generally; traditional farming depends on rainfed cultivation, while the more modern farming techniques rely on irrigation. Forestry constitutes about 11% of the GDP. The Sudan is the sole supplier of gum arabic, a forestry product, to the United States. It also produces nearly 99% of the world's supply of this product.

Livestock production is another major agricultural activity. Fisheries, forestry, and wildlife currently provide only minor inputs to the national economy. But again, there are plans to inject public funds to re-activate these potentially viable sectors.

As with many developing countries, the Sudan is intensifying and diversifying its industrial development. The main industrial activities include textile manufacture, and the processing of agricultural products. The mining industry is also increasing its activities, with prospecting being undertaken for lead, zinc, copper, iron ore, asbestos, and chrome. Exploration for oil has produced positive results and drilling is underway in the South and parts of Kordofan to determine whether these hydrocarbon deposits are in commercially exploitable quantities. Plans are also afoot for further hydroelectric and some thermal energy output schemes.

Even without the country's considerable mineral potential, the Sudan has a vast and varied natural resource base. Its most important resource is inevitably that main artery of economic, social, and political vitality -- the Nile. The other natural resource of capital importance is the land, especially the "arid, dead" alluvial soils, with which the country is so plentifully supplied. Sudan has over 200 million acres of arable land alone. Groundwater resources are generally plentiful and account for the

indiscriminate drilling of boreholes for both human and animal consumption in the rural areas. The country has a large and rapidly increasing livestock population -- over 40 million herd of cattle and sheep. In the Central Southern and Southern Sudan, there are large stretches of Savannah and mountain scrub for grazing. Grazing land is estimated by the Range and Pasture Department of the Ministry of Agriculture, Food, and Natural Resources to be over 61% of the total land area. Forest resources, once abundant in the Southern and Central Southern parts are threatened by agricultural expansion. The variation in vegetational types and natural habitats in the Sudan has produced a wide range of wildlife resources. Rare species such as the Nubian ibex, the white onyx, and more common species like the yellow-backed duiker, crocodiles, etc., exist in the Sudan. The lakes and rivers carry a varied fisheries stock (as does the Red Sea), most of which is underutilized at present.

CHAPTER TWO

Environmental Problems in the Sudan

The Sudan's environmental problems can be listed in very broad terms and in order of priority as:

- Desertification
- Environmental health impact of irrigation and other water resources development projects
- Excessive use of pesticides and fertilizers
- Aquatic weed problem
- Wildlife depletion
- Degradation of Red Sea ecology
- Other problems such as pests (locusts, Nile rats, etc.), pollution from industrial wastes, urban sanitation, etc.

Desertification

This is far and away the single most problematic resource degradation problem in the country, and poses a severe threat to the agricultural lands and the irrigation schemes on which the country's economy depends. It has been estimated that within the 17-year period between 1958 and 1975, the desert advanced almost 100 km. It is currently expanding south at the alarming rate of 5-6 kms. annually.

At the onset of global desertification and, in particular, the Sahelian drought, various theories were propounded for desert encroachment.

Among these are: long-term climatic change, periodic droughts, or the destructive consequences of man's activities. The majority of the Sudan's desertification problems have arisen from the third cause. More specifically, the major culprit has been unsound agricultural practices -- such as overcultivation in marginal areas. This causes rapid desertification because, in the dry years following a year of rainfall, the ploughed soil disintegrates -- the fine clays and silt are carried away in dust storms and the sand moves into dunes. The immediate effect of this type of soil erosion is the loss of productive land, but of course the medium- to long-term effect is desertification. Another type of soil erosion which leads to desertification results from either man-made or spontaneous combustion fires (arising from extreme climatic conditions) on the grasslands. Such fires are often set by pastoral nomads to improve the quality of grass for grazing.

A second major cause of desertification is overgrazing. This has become an acute problem in parts of the Sudan because of the unprecedented increase in livestock population. Closely associated with this is the lowering of water tables due to increased water use for livestock.

A third cause is deforestation arising from the cutting down of trees and other vegetation to provide fuel, building materials (for both humans and as animal enclosures), and as feed.

This desertification, from whatever causes, continues to produce a rapid loss of productive agricultural and range land and, with it, declining food production and economic productivity.

Environmental Health Impact of Water Resources Projects

Modern agricultural practices in areas like the Sudan create favorable ecological conditions for the increase in, and transmission of, disease-bearing organisms. If reservoirs or natural or artificial water courses are located in areas which facilitate easy access by human beings, these water-borne diseases become endemic. Irrigation, especially, is causing an unprecedented increase in various kinds of waterborne diseases. The two most prominent diseases are malaria and schistosomiasis (bilharzia). The incidence of bilharzia, virtually unknown in the Gezira before irrigation, has increased sharply over the years after the establishment of irrigation. Surveys in the Gezira in the late 1970's show a general bilharzia infection rate of between 60-70%. The prevalence rate of malaria in children in the Gezira increased from 2% in 1962 to almost 20% in 1974, according to Ministry of Health statistics. Malaria is the major health problem in the country now.

Excessive Use of Pesticides and Fertilizers

In the Sudan, pesticides are used for three main purposes: crop protection, public health, and protection of animals. From 1949, when pesticide use began in the Sudan, until the present, a great range of chemical pesticides have been used to combat pests like the cotton white fly, the anopheles mosquito, the tse-tse fly, etc. At the same time, there has been an increase in the use of fertilizers concomitant with agricultural expansion and diversification of crops. The benefits of these expensive imports were obvious and immediate. The harmful effects less so. Today the side-effects are acutely felt, especially on the big schemes -- e.g., the Gezira, Rahad, etc. On these schemes, there is a high pesticides residue in crops, animals, and humans. In some cases, high residues of DDT have been detected in mother's milk. Soil fertility has declined, with large concentrations of salts accumulating in the soil, running off into the irrigation canals. Pests, such as the anopheles mosquito and cotton white fly are becoming increasingly resis-

tant to the escalating spraying. Consequently, output per feddan on the Gezira scheme is now declining sharply year by year despite equally sharp increases in use of fertilizer and insecticide spray (for example, on much of the Gezira, pesticides application has increased from 3 sprayings per season in the early 1960's to 12 sprayings in 1980).

Aquatic Weed Problem

This problem is acute on the White Nile, where water hyacinth plants are multiplying at an alarming rate. Some of the irrigation canals are also infested with two types of aquatic weeds -- the immersed (and canal bank weeds) or the submersed weed. Both types are characterized by rapid growth during the cropping season. All aquatic weeds interfere with irrigation pumps as well as navigation. The most serious adverse effect of the aquatic weed is that it decreases the oxygen content of the water, with dire consequences for aquatic life. In the irrigation canals, the aquatic weeds contribute to excessive or undesirable water loss. Hence, there is very strict supervision to prevent the water hyacinth from entering the Blue Nile from the White Nile and infesting the irrigation canals. The White Nile is the only water course affected because the Sudd provides the ideal germinating conditions for water hyacinth shoots.

Wildlife Depletion

The major threat to the Sudan's wildlife resources is posed by intensive poaching, mainly from the neighboring African states of Ethiopia and the Central African Republic. Within the Sudan, however, the number of licensed firearms owned by local people has increased, with a consequential increase in illegal hunting. Other causes of wildlife depletion are the displacement or disturbance of the habitat (e.g., the clearance of forests) and the encroachment of mechanized farming. An example of the latter was the threat posed (happily resolved) to the Dinder National Wildlife Park by the proposed routing of the Rahad Irrigation Canal. Naturally, the problems

associated with overgrazing, overcultivation, and forest fires have a detrimental effect on the Sudan's wildlife resources.

Degradation of Red Sea Ecology

The Red Sea does not only have a unique ecology, but it is also one of the regional seas of which very little is known. It has a low species diversity and, possibly, even a fragile ecosystem as it contains some of the world's warmest and most saline sea water. In addition to the high salinity, there are the Red Sea brine pools which lie at the bottom of the sea and may be associated with the African-Asian tectonic divide.

The Red Sea also contains the most northerly colony of coral reefs in the world which, at the moment, is threatened by starfish along the Sudan's coast and uncontrolled exploitation of coral reefs. There is some speculation as to the potential environmental impact of a proposed Saudi-Sudanese plan to mine the metalliferous muds in the Red Sea. A further environmental hazard is created by the heavy oil tanker traffic, and more importantly, oil exploration and exploitation along the coast.

Other Problems

Among the major pest problems in this category are the green and white flies and the Nile rat. The former two pose risks of asthma, onchocerciasis, etc. These are present all along the Nile, the white fly breeding in lakes and brackish water (especially in irrigated paddies) and the green fly thriving in rapidly flowing waters.

Industrial pollution is also becoming a major problem. Although the Sudan's industrial activities are minimal compared with most other countries', the effects of industrial pollution are beginning to be felt in the newly industrialized areas, such as Khartoum-North. The major cause of pollution are the agro-industries and food processing plants which cause water pollution as well as problems of disposal of agro-industrial waste. Examples

of these are the sugar cane processing plants, the Kenana sugar factory, et al. Water pollution associated with the textiles industry also causes grave risks. The cement factories create air pollution.

Water supply and water quality are another problem in this group of problems. The various irrigation schemes have all generated their brand of water pollution problems, as described above. In addition, the availability of water for agriculture and other uses is a very important issue in the Sudan, and account for the government's attempts to increase the yield of Nile waters (Jonglei Canal) and to utilize all of its entitlements under the 1959 Nile Waters Agreement with Egypt. Nevertheless, the available water supply is severely reduced by evapotranspiration and the reduction in the storage capacity of dams due to the high river siltation rate.

Population as an Environmental Factor

Inevitably, a factor underlying most, if not all, environmental stress in the Sudan is the rate of growth and distribution of human population. The Sudan's population is increasing at the rate of 2.7% annually, but urban population growth was about double that figure. The major population centers are closely associated with the developed regions of the country in Khartoum, the Gezira, Kassala and the Blue Nile Provinces. The Nile Corridor is the most densely populated area, while in the rest of the country the densities tend to thin out to less than 2 and 4 persons per square km.

This unbalanced distribution of urban as well as the rural settlements shows the inverse relationship between resource availability, extent of exploitation and degradation. Consequently, areas around the urban settlements along the River and in the semiarid parts of the country have deteriorated very rapidly. Urban sanitation problems in rapidly expanding cities like Khartoum and Omdurman are becoming acute and could well become very serious if no action is taken soon. Perhaps less clearly defined as

an environmental health problem is nutritional deficiency arising from inadequate production of food in relation to population. Many of the factors referred to above contribute to this deficiency which, in a circular fashion, compound environmental impacts.

Conclusion on the Character of Environmental Problems

The conclusion to be drawn from the foregoing is that the majority of the Sudan's environmental problems, as in many other developing countries, are associated with the development process itself -- agricultural land use, water supply, industry, health and population dynamics. The most serious problems appear to be compounded by the fact that both a decline (desertification) and an increase (irrigation) in agricultural activity tend to result in an environmental problem of one kind or another.

CHAPTER THREE

Overview of Government Structure & Legal System

A constitution was promulgated on 8th May, 1973 by a 207-member People's Assembly. This constitution established the Sudanese Socialist Union (SSU) as the sole political organization in the country. Executive power is vested in the President of the Democratic Republic of the Sudan, and Legislative and Judicial powers are vested in the People's Assembly and the Supreme Court, respectively. The most important principles of the Constitution provide for socialism as the basis of the economy, Islamic law and custom as the main sources of legislation and the supremacy of the rule of law. The Supreme Court is the custodian of this constitution and the rights and freedoms conferred therein.

The Sudanese state is formally defined in Article I as a unitary republic, but over the last few years, attempts have been made to decentralize public administration under the mandate in Article 6 of the Constitution. In Article 8, the Constitution provides for the continuation of the 1972 Southern Provinces Regional Self Government Act. In 1971, at the end of the Civil War which polarized the North and South for 17 years, the Addis Ababa Agreement was signed, granting the South a considerable degree of autonomy. The three Southern Provinces were merged into one region -- the Southern Region, with headquarters in Juba. The executive organ of this regional administration is the High Executive Council for the Southern Region. There is also a Regional Assembly in Juba. The High Executive Council is responsible for all matters of relevance to the Region, except national defence and foreign affairs, which are still vested in the central government. The operative legislation setting out the powers and authorities of the Executive Council are the combined effect of the Distribution of Legal Powers between the Central Ministries and the Ministries of the Southern Region of the Sudan Act, 1977 and the Southern

Provinces Regional Self-Government Act, 1972. The objective behind these laws was to model administration in the Southern Region on that of the central government (with parallel or counterpart ministries at the regional level), and in conformity with the provisions of the National Constitution. However, a comparison of these three documents reveals various anomalies and, sometimes, even contradictory provisions. For example, Art. 184 of the National Constitution recognizes the People's Local Government Council as the basis for Regional self-government in the Southern Provinces and yet the 1972 Act fails to mention them. It can also be argued that by vesting executive powers in the High Executive Council, a parliamentary system of Government is created in the Southern region, contrary to the Presidential system of government declared in the Constitution. These gaps are understandable, as the Regional self-government was passed PRIOR to the adoption of the present constitution. Since then, some of the necessary amendments to the laws have been made.

In spite of these discrepancies, the positive aspects of the Southern Region's self-government experiment have been such that the GOS is determined to extend the experiment, establish more regions, and devolve more power to the provinces.

This process of devolution commenced in 1971 with the passing of the People's Local Government Act. Under this Act, the provinces have primary responsibility as well as legislative and executive powers for matters such as education, agriculture, housing, and public health. The provinces were increased to 18 in 1977 and now include: Bahr-El Ghazal; Blue Nile; East Equatoria; Gezira; Jonglei; Kassala; Khartoum; Lakes; Nile; Northern; Northern and Southern Darfur and Kordofan; Red Sea; Upper Nile; West Equatoria and White Nile. The 1971 Act also establishes People's Executive Councils headed by Provincial Commissioners, who are appointed by the President. These Executive Councils are the apex of a pyramid made up of People's rural government, town councils, village, nomad, residential area, market area, or industrial area councils.

The next phase of the decentralization process, which is under debate now, is to reorganize these provinces into autonomous regions like the Southern Region. The Regional Government Act, 1980 was passed recently and the Northern Sudan is divided in five regions -- Northern, Middle, Eastern, Kordofan and Darfur.

Our interest in this dynamic policy lies in its impact on the development or management of a region's natural resources and on its environment. In a country as vast as the Sudan, some degree of decentralization is, perhaps, inevitable if government is to function effectively, but are there adequate provisions in the proposed legislation to safeguard the rational exploitation of regional or provincial resources? And, perhaps most importantly, what constraints are necessary to ensure that regional natural resources and environmental policy conform to certain nationally (or maybe even internationally) recognized standards? If the new law is the indicator, then the mandate of the regional authorities (e.g., control of pests and plant diseases, development, use and protection of forest products and pastures, land use) is too broad to be meaningful unless it is subject to a caveat that these functions should conform to national forestry, land use, etc. policy. These issues were the major concern of the senior officials who were interviewed, some of whom testified before the Council of Ministers during hearings to determine the impact of the new law on the present central administration.

Legislative power is jointly vested in the Peoples Assembly and the President under Article 118. At the regional level, the appropriate law-making body is the High Executive Council in the Southern Region and the proposed Peoples Assembly in the new regions to be formed shortly. Law enforcement is entrusted to the Attorney-General.

Customary law still plays a major role in the lives, and legal relationships affecting land ownership, land use, grazing rights, rights to water, etc., in certain parts of the country and certainly among the nomads.*

*The Ford Foundation has sponsored a series of studies conducted by the University of Khartoum's Faculty of Law on the impact of current development activities on the customary law relationships of a selected number of tribes in various parts of the Sudan.

CHAPTER FOUR

Role of Law

Although the Constitution recognizes Islamic Law and Customary Law as the main source of legislation in the Sudan, one should add a third set of laws, Statutory Law. It is recognized that it is beyond the scope of this review to delve into the jurisprudential theories and definitions of these types of rules, but nevertheless, for the sake of clarity, an attempt will be made to give brief descriptions of these three. Statutory law is a combination of English common and statutory law, some Egyptian law, and some assimilated Sudanese customary or Islamic law. The majority of enacted environmental and natural resources law, such as fisheries, game and wildlife, forestry legislation, etc. fall under statutory law. Customary law encompasses those indigenous rules which govern the rights and duties of indigenous peoples in their personal relationships and transactions and in their use of natural resources, especially land and water. Hence, customary laws are as numerous as there are tribes. Islamic law is more homogenous and covers those rules (derived from Islamic ideology) governing personal relationships and transactions, land ownership, and land use, which are administered by the Sharia Court. The parallel existence of these types of laws create a position at one and the same time of conflict and harmonization of laws, which is common in many African countries. Where conflicts arise, legislation is passed.

An example of such conflict resolution provision in Sudanese legislation can be found in the land tenure system which includes public land owned by the state, privately owned land, and tribal or communal land. The 1970 Unregistered Land Act vests all land which, from the date of commencement of that Act, is unregistered (under the 1925 Land Settlement and Registration Ordinance) in the Government of Sudan. This nominal ownership by the state extends to all but 6 million feddan (which are registered as privately owned) of the Sudan's total land surface. The Act further states that all "bona fide" uses of land by communities will be recognized. The term bona fide refers to those traditional forms of land tenure (grazing, watering, and similar rights to land and water use) that have been acquired under custom or recognized under Islamic law. Estimates of these communal lands account for about 40% of the land under nominal state ownership.

Attitudes to the three types of law vary. For example, although customary law usually has less sophisticated means of implementation and/or enforcement, as compared with statutory law provisions such as regulations, licenses, fines, etc.; it has a higher rate of compliance than statutory law. Surveys done by the University of Khartoum Law Faculty show that 60% of all disputes in the Sudan are settled by customary law.

Statutory law is considered alien by the majority. Attitudes to it parallel a nonchalant and sometimes even negative approach to government property -- it can be treated with more disrespect than one's own property. Poaching in some of the national parks is an example. Combined with this inherent disregard for these laws are a lack of manpower and other resources for, and tedious methods of, enforcement. Where these laws call for citizen participation (e.g., in the case of forestry, wildlife laws) in the majority of cases here is either little or no incentive to encourage the citizen to help with information on infractions, or else the government procedure is so tedious as to be completely discouraging. Lastly, some of the statutory laws are out-

dated and completely out of step with economic, social, and political developments.

These three types of laws have a major role to play in regulating use of natural resources. While customary and Islamic law norms (such as those regulating grazing rights and patterns, the drilling of boreholes, etc.) enjoy a high degree of adherence and compliance, statutory law is least respected. Hence, although statutory law covers by far the bulk of environmental and national resources laws, both the content and the inadequacies in the machinery for enforcement render it the least effectual of the three.

CHAPTER FIVE

The Sudan's Natural Resources & Environmental Policy

There is only an oblique reference to environmental policy in the 1973 Constitution. Under Article 37, all natural resources are declared to be the property of the State, which is entrusted with ensuring the "appropriate exploitation" of these resources. One might make attempts to define "appropriate exploitation" in broad terms in order to incorporate the notion of conservation and/or sustainable development into the exploitation of natural resources. Nevertheless, it is necessary to inquire into the actual interpretation of this concept of "appropriate exploitation" and whether there is a need to incorporate specific environmental and natural resources management policy into the Constitution.

As indication of the interpretation to be placed on Article 3 of the Constitution is to be found in the current six-year Development Plan. One of the key methods for attaining the overall objective of the Plan (accelerated and balanced growth in the nation's economy) is the conservation of the country's natural resources. A large proportion of the strategies for agricultural expansion relate to natural resource conservation so it is worth focusing on it for a moment. The key concepts in this context are "vertical" and "horizontal" expansion. The former involves the process whereby optimum use is made of existing agricultural projects. This, were it to be achieved,

would entail a rehabilitation of the Gezira Scheme for example, stringent controls over the use of pesticides and fertilizers, etc. The latter is geared toward exploiting the as yet untapped resources by increasing mechanized farming techniques and by modernizing the traditional farming sector. One important goal of this method is the reclamation of arable lands, which implies an intention to tackle some of the desertification problems.

For the industrial sector, the Plan makes little reference to the development of the country's mineral resources -- in fact, the only reference is to the allocation of funds for geological surveys and mineral explorations in the Red Sea.

The foregoing are very extensive policies indeed, and require a higher level of specificity, if they are to be meaningful in some of the sectors of interest to this study. This level of specificity can be deduced from various actions, activities, or regulation of the competent government organizations or agencies. Examples of these are: the establishment of central and provincial forest reserves; the establishment of a National Environmental Committee in the National Council for Research; the establishment of a MAB National Committee to develop awareness of environmental issues and to organize research activities; the establishment, and the GOS's support of, DECARP (the Desert Encroachment Control and Rehabilitation Programme) to draw up projects to combat desertification; the institution of various irrigation schemes to obtain maximum productivity from the land. Even the Jonglei Canal Project, despite its possible environmentally adverse affects can be cited as an example of the Sudanese Government's environmental policy because elaborate measures were taken to analyze possible environmental effects and also because the objectives of the project include the prevention of massive water loss in the Sudd region and an increase in the yield of Nile Waters in order to provide water for irrigation and other life supporting purposes. And, recently environmental health legislation has been passed.

CHAPTER SIX

Role of Government Institutions with Responsibility for Environmental and Natural Resources Management

The key ministries and other governmental bodies can be listed, in order of priority, as the Ministry of Agriculture, Food, and Natural Resources; the Ministry of Irrigation; the Ministry of Health; the Ministry of Industry; and the National Environmental Committee of the National Council for Research. In the following sections, each department's policies will be described and the role of the counterpart divisions in the Southern Regional Administration will also be discussed. A few examples of programs that they are implementing will be given, followed by a description of problems which they face in implementing these policies or programs.

THE MINISTRY OF AGRICULTURE, FOOD AND NATURAL RESOURCES

As is to be expected, the Ministry of Agriculture, Food, and Natural Resources (MOA) plays a pivotal role in the implementation of the major provisions of the Six Year Development Plan. The present structural set-up of the Ministry is the result of attempts in the early seventies to consolidate the activities and programs of agricultural land use, natural resources and environment-related departments within the Government Administration in the Sudan. The Ministry is currently divided into 3 major divisions in addition to a Directorate-General for Planning. This latter section coordinates planning, and establishes priorities of the other three sections. The bulk of its work is discharged by an ad hoc council consisting of all the Undersecretaries of the other three sections (the General Administration for Agricultural Services; Animal Resources; and Natural Resources). Because of the importance of the Natural Resources Administration for this report, special attention will be focused on its work.

The Natural Resource Administration is divided into:

- 1) The Soil Conservation, Land Use, and Water Programming Administration
- 2) The Forestry Administration
- 3) The Wildlife Administration
- 4) The Range and Pasture Administration
- 5) The Coordinator for DECARP

The Land Use, Soil Conservation and Water Programming Administration

This Administration originated in 1946 as the Soil Conservation Section, with a mandate to conduct soil surveys and analyses and to program surface water supplies to the rural areas. In 1956, the Department of Land Use and Rural Water Development was created, and it assumed the functions of the Soil Conservation Section. In 1966, some of its responsibilities were passed on to the Rural Water Department created under the Rural Water Development Corporation Act. Under the 1974 reorganisation of the Ministry of Agriculture, the present Administration was created. It currently has the following subdivisions:

- Water Use Section
- Lab Section
- Pilot Projects Section
- Social Affairs Section
- Remote Sensing Section

The Administration's activities and programs include small-scale integrated rural development schemes such as soil conservation pilot schemes in the Southern Funge (the savannah, high rainfall area of the central Sudan), and a study on nomadism and its relationship to environmental management in the Sudan.

By reason of the nature of the service which this Administration attempts to provide, it has more of an opportunity to collaborate with more government agencies than most. Yet for the same reason, its work is hampered by the need for such collaboration. The major difficulties it faces in discharging its duties arise from the lack of a definitive land use policy, the lack of coordination among relevant government departments, uncertainties over the effect which the new policy of decentralisation is going to have on the Administration's area of competence within the newly created regions and lastly, the perennial problem of lack of funds to carry out projects.

There is no doubt that the most serious natural resources issue in the Sudan is the serious conflict of land use. Land use practices associated with extensive cropping (including water supply) are encroaching on other uses of land such as forestry, wildlife conservation and range and pastures. However, it is not so much the actual dedication for use which conflicts as the impacts or side-effects of one use upon another. The urgent need for a definitive land use planning policy cannot be overemphasized. Yet the numerous attempts to produce one in the last 25 years have failed. One reason for this failure may be the fact that the pre-requisite for the formulation of a land use policy, a national land and water resources survey has not been completed. The size of the country alone makes a survey difficult, and necessitates a major mobilisation of human and financial resources. The Administration's strategy has been to proceed in a piecemeal fashion to conduct regional surveys with foreign financial assistance, rather than to tackle the task in toto. To date, 15% of soils have been surveyed. Plans are underway to conduct surveys of groundwater and surface water (apart from the Nile) resources and to update the 1958 vegetation map.

One reason for the failure to prepare a national land use plan is the obstacle posed by professional and technical biases within the relevant Admini-

strations. One of the fundamental requirements for the preparation of a land use plan is the ability of decision-makers with multi-disciplinary background (geologists, soil research experts, geographers, foresters, etc.) to adopt an integrated approach to land use questions. This objective has never been achieved in the Sudan. In fact the present structure of the Ministry of Agriculture is the result of an exercise in natural resources and land-use coordination - and represents an embodiment of the most long-lasting coordination attempt so far. However, the Sudan is still without land use legislation. A draft law prepared by this Administration has not yet been passed.

This last point is closely related to the lack of coordination within the government structure. This problem is acutely felt within all the Government departments and was repeatedly referred to, as the main stumbling block to policy implementation. One of the most valuable results of a national land use policy is that it would provide the framework, and increase pressure for, coordination.

A second major obstacle to achieving a national land use plan is uncertainty over the likely effect of decentralization. Again, this is closely aligned to the lack of a national policy. In the absence of this national policy, which will provide the framework for which local governments are to exercise their powers, the decentralization program will appear to be doomed to failure even before it comes into effect.

The environmental problem which perhaps best illustrates the interplay of an absence of land use policy and the effects of political decentralization is the excessive drilling of boreholes for livestock as well as human consumption. This is a highly sensitive political question as there is considerable pressure on local authorities to provide watering holes for cattle. This, for reasons of political power, etc., they invariably do, without regard to the other, less destructive uses to which the land can be put.

Such problems appear to occur in virtually every government department which has responsibility for environmental and natural resources policy. A third "extraneous" factor, lack of funds, is also of course pervasive but is of less significance than the lack of a land use policy and the strain of decentralist politics.

The Forests Administration

The major objective of this Administration is to ensure the full utilization and continuity of Sudan's forest resources, which is identified as one of the goals of the six year development plan. The aim of this policy is to create two main types of forests - productive and protective. Productive forests are used to serve national and local needs (under the Central Forests and Provincial Forests Acts respectively) such as telegraphic poles, fuelwood, etc. Protective forests exist to protect certain marginal areas and to provide shelter belts for delicate soil or catchment areas. Thus, the Administration is engaged in reforestation and afforestation projects, the conduct of training programmes in conjunction with the Forest Research Institute, the manufacturing of forest products, survey of wood resources - expansion of firewood and charcoal, and shelter belts and tree plantation programmes.

The major problem which the Administration faces in discharging its responsibilities can be described as unorganised forest exploitation and include:

- (a) Horizontal expansion of agriculture. This would in itself cause no problem if agricultural practices are scientific, treating soil as capital. However, the current practice is to tap the land resources for "quick and economical increase in production" without requirement of rehabilitating the used soil.

- (b) Tree felling for fuel, especially to provide the major cities with fuel.
- (c) Uncontrolled grazing which not only results in denudation but affects the natural regenerative capacity of forests because sprouts and seeds are eaten up before they reach maturity.

In addition to these specific problems are those of land use planning and administrative decentralisation, the effects of which are acutely felt in the forestry sector as well.

The Administration has proposed many solutions aimed at ensuring a peaceful and even harmonious co-existence with agricultural activities. In fact they have persistently pointed out the mutually beneficial effects of placing forest areas near cultivated land to provide tree shelter. These attempts have been thwarted by the agriculturalists who claim that tree shelters interfere with irrigation, interfere with plant protection because the trees hamper aerial pesticide spraying, tree shelters take up valuable agricultural land and finally harbor dangerous pests and insects. In light of these attitudes, the Administration's strategy is to mount an educational drive to inculcate in inhabitants of forest/agricultural areas, the fact that the co-existence of agriculture and forestry is scientifically, ecologically, and economically viable.

The Wildlife Administration

The Administration's main policies are the protection of wildlife and the creation and maintenance of national parks, game reserves and zoological gardens. They administer the three national parks - the Nimule, Southern and Dinder National Parks (efforts are underway to establish a fourth, the Radome Park) and the 15 game reserves.

The main problems which jeopardize the effective implementation of these plans are deforestation, wild fires, (whether natural fires or intentionally set) and poaching. This Administration's activities are also adversely affected by the three major problems outlined in the section on the Land Use Administration.

The Range and Pasture Administration

The Administration's major responsibility involves the management and conservation of rangeland and pastures for livestock grazing. The majority of personnel work in the provinces, to ensure close working relationships with the local, district and provincial authorities. This responsibility requires the Administration to carry out three main activities: 1) the preparation of fire lines to prevent fires from spreading at an uncontrolled rate and threatening the entire pastures in certain areas - new methods are being tried (such as the use of chemicals, etc.) to replace the costly, labour-intensive and time-consuming traditional methods; 2) the conduct of research by technical staff to carry out rehabilitation of lost pastures by reseedling, etc.; 3) building pasture enclosures to protect valuable rangeland and pasture areas. All these activities are carried out under the supervision of the Governor of the relevant province and the Administration's technical staff in the field.

The basic problems faced by the Administration are 1) overgrazing; 2) threats posed by seasonal fires; 3) problems of policy coordination between the division and the local authorities. These are in addition to the three common ones referred to earlier, although in this case, special mention will have to be made of the conflict of land use problems again. The main problem here is a conflict between rainfed agriculture and livestock raising. Estimates and calculations show that the present livestock population of 40m herd is almost 10 million herd in excess of the carrying capacity of the total land area for grazing. This problem has been further exacerbated by the Government of Sudan's policy, which places high priority on the provision of veterinary services and disease control/prevention. Hence, the livestock population continues to increase without any parallel expansion of rangeland and range management services. In addition, the GOS's integrated rural development policies place unprecedented demands on the

use of rural areas. The Administration has endeavoured to carry out the policy in the six-year plan, to integrate livestock management and crop cultivation and experiment with rotational planting of legumes which would be suitable for fattening livestock. No success stories are yet available.

The overgrazing problem is closely related to the indiscriminate drilling of boreholes. The latter is the responsibility of the Rural Water Development Corporation, which is outside the scope, and hence reach, of authority of the Ministry of Agriculture. The Administration has demonstrated that the drilling of one borehole exposes a 30-40 mile radius of land around that watering point for livestock grazing. A practice which effectively prevents the drilling of such boreholes at locations of less than that distance apart would reduce overgrazing quite considerably. However, the local authorities find the political pressure imposed by the nomads, the traditional cattle grazers, too great to resist so these unsound practices continue.

Finally, although legislation has been passed establishing a land tenure system there is no similar provision regarding the various uses of land. Some customary laws provide for grazing rights, etc., but this is by no means uniform, and is even more complicated because in the majority of cases, the users of the land are nomads. A solution that has been proposed by Hunting Technical Services in Phase IV of the Savannah Development Project (and been endorsed by the Range and Pasture Administration) is the use of tribal district (order) as a unit for development - so that all land use within that district will be obliged to conform to the peculiar laws of that district. This will certainly minimise the occurrence of conflicts.

National Desertification Control Coordinating and Monitoring Unit

This is the latest addition to the MOA and illustrates the GOS's determination to control the alarming rate of desert encroachment. As it is merely a

coordinating unit, it has very few programs of its own. Its major activity has been to review the twelve major project proposals prepared by DECARP for submission to external funding agencies. The four projects which the unit has selected as priority areas are 1) Restocking of the gum arabic belt; 2) Project on aquifers in North Eastern Africa, Egypt, Sudan, Libya and Chad; 3) Range management and livestock raising in the Sudan. The fourth project is designed to strengthen this unit. In addition, there are such continuing activities as the Savanna Development project.

Not surprisingly, a major problem facing the unit is money. However, no less inhibiting is the problem of coordination. There is a considerable overlap between the unit's work and each of the Administrations mentioned above. The unit has been assigned a part-time assistant posted in each Administration and it is gradually beginning to gain a reliable network of trained and well-informed officials in the relevant branches of the Ministry. Nevertheless the unit feels that one major issue that is overlooked is the socio-economic aspect of the land use policies which result in desertification. In particular, the unit considers that its work will be advanced quite dramatically if the participation of nomads in some of the projects is encouraged. Although this has not been accomplished yet, there is considerable support for this among the technical staff concerned because it holds promise for an understanding of some of the problems.

In addition to these main Administrations there are various semi-autonomous parastatal organizations responsible for production or marketing of agricultural goods. As of 1979 the major ones are the Gezira Board, the Rahad Corporation, Mechanised Farming Corporation, the Agricultural Research Corporation, the Agricultural Production Corporation, the Animal Production Corporation, and the Livestock and Meat Marketing Corporation. Of these, the first two deserve special mention.

The Sudan Gezira Board

This operates the Gezira and Managil irrigation schemes, and is responsible for the Sudan's main cotton producing area. The Scheme is in effect a partnership between the Government, the tenants, and the Board. The Board's organisational structure is the basic model for other irrigation schemes in the Sudan. The Scheme is currently labouring under a host of ecological, environmental and economic malaises.* The situation is particularly critical not only for the inhabitants of its 370 square miles but for the Sudan as a whole, as the Scheme alone provides almost one half of Sudan's foreign exchange earnings. Today output per feddan (1.03 acres) is declining steeply year by year despite rapidly growing inputs of fertilizer and insecticide spray.

Mechanized Farming Corporation

This corporation, originally established to oversee the clearing of land for mechanized farming has now become the equivalent of the irrigation schemes' Boards for rainfed agriculture. It now supervises all activities in this field from conducting land surveys, to organising credit, to running the state farms. Like the Gezira Board, the Corporation is running a program which is fraught with environmental problems and land use conflicts. There are many experts in the Sudan who attribute soil erosion and other environmental problems to mechanized farming - appropriately termed "suitcase farming" because it opens out large plots of land (about 6m acres) for farming with little regard to proper planning or rationalization of land use, effects on the topography, and allows farmers to move from plot to plot without requiring them to engage in any activities which will rehabilitate the soil. In fact, it encourages monocropping which leads to decline in soil fertility,

* The World Bank has recently made a big cash allocation designed to revitalize this scheme.

MINISTRY OF IRRIGATION

In 1980 the Ministry had six divisions:

1. Nile Water Department
2. Dams Department
3. Irrigation Affairs Department
4. Projects Department covering new development schemes
5. Hydromechanical Department
6. Planning Department

The Ministry of Irrigation also provides Sudan's four members of the Egypto-Sudanese Permanent Joint Technical Commission on Nile waters, PJTC, (see below) under the International Agreements Over the Use of Nile Waters.

Housed in the same offices as the Ministry of Irrigation is the Executive Organ of the Jonglei Canal Project. This body works jointly with the PJTC on the execution of the Jonglei Canal Project. The Ministry is, as it were, the client of the project, and has representatives in the Executive Organ.

The work of the Ministry of Irrigation is critical to the survival of the Sudan. Historically, this Ministry rather than the Foreign Ministry, has dominated the "hydro politics" of the Sudanese Nile, both nationally and in the Sudan's relations with its neighbouring riparian States. The Ministry's standing among other government agencies arose from the technical nature of hydrological negotiations. Indeed, it grew to the point where it came to be considered the senior Ministry, with status above that of the Ministry of Foreign Affairs. This advantageous position has not, however, conferred upon the Ministry a standing sufficient to ensure its capacity to coordinate the different arms of the government involved in irrigation and related activities.

Inadequacy of coordination is perhaps best exemplified in the management of dams. Taking the Roseires Dam on the Blue Nile as an example (an excellent case study, incidentally, of the problems produced by lack of maintenance and coordination)

it seems clear that, despite this Ministry's "lead responsibility" for dams, it did not have sufficient authority when the Roseires Dam was under construction to create an integrated dam commission or corporation designed to manage the dam on a multipurpose basis. Hence the continuing muddle which has resulted in the dam running well below capacity in electrical generation because of failure to clear debris and silt from the reservoir. Suspension of electrical generation for a short period - about one week would be necessary - in July, at the height of the floods, would facilitate the reduction of the bank of silt by flushing through the dam.

The Roseires Dam was conceived of as a multi-purpose dam for irrigation of the upper part of the Rahad Scheme, for electricity generation, and also for river management (checking more of the Blue Nile flood than could be managed by the Senar dam which is now largely silted up). Hence, Roseires contributes to river control not only for Rahad but also the Gezira Scheme. In practice, however, the dam has never been used for irrigation, though there are plans afoot to raise it by ten metres and take a major irrigation canal from the west side of the greatly extended Roseires lake. Problems of multi-purpose management stem from the fact that four ministries are involved: the Ministries of Irrigation, Agriculture, Electricity and Industry. Another important government agency is the Ministry of Planning, which must allocate funding to any other ministerial projects.

When questioned about the continuing emphasis on new projects rather than improving the performance of existing investment, the Ministry's officials stressed that available studies indicated that all possible conservation and management schemes would be necessary if adequate water supplies were to be available to Sudan and Egypt in 1990s.

With regard to future schemes, major plans are being developed for the damming of the Sobat's waters. Ministry officials stressed that the existing Technical Committee for the Study of the Nile Basin (until recently based at Entebbe) was intended by the Sudanese at least to become a Nile waters commission involving all of the riparian states. However, regional politics have so far ruled out such collaboration.

MINISTRY OF HEALTH

This Ministry is the primary agency for implementing health policy, the salient features of which are the improvement of preventive and social medicine, the promotion of social medical services (including health education) and the encouragement of public participation in the promotion of health.

The main divisions of the Ministry are:

- the Social and Rural Health Division
- the Planning and Development Division
- the Health Statistics and Research Division
- the Medical Supplies Division
- the Laboratory and Medical Research Division
- the International Health and Training Division
- Administration and Finance Division

The six-year Plan places considerable emphasis on environmental health and outlines the allocation of funds for the establishment of environmental health centres at the local level. Malaria and bilharzia control units have been set up within the MOH and these have drawn up elaborate programs for the eradication of these two common environmental health diseases. These units work closely with the Medical Research Council of the National Council for Research. Both groups are experimenting with a new approach which is designed to encourage more public participation in the improvement of health services. Their programs no longer rely solely on the provision of drugs but involve health education, etc.

There is also a Sanitary Engineering Department of the MOH which supervises environmental health-related tasks such as sewage and waste disposal.

Other governmental agencies whose activities and responsibilities relate to environmental and natural resources matters are the Ministries of Industry, National Planning, Energy and Mining, and Education, and the UNESCO MAB National Committee. Because of their relatively minor roles, these will not be described.

While this discussion on government institutions cannot be as extensive as it could, some conclusions can be drawn. Although the institutional structure is basically sound, the influence and role of the relevant institutions is diffused, mainly because of lack of coordination both at the policy and decision-making levels within the central and local government administration; and partly because of minimal communication between the local and central government administration. Lack of trained manpower may also be cited as a contributing factor.

THE NATIONAL COUNCIL FOR RESEARCH'S NATIONAL COMMITTEE FOR ENVIRONMENT

This is the only example of action being taken to coordinate environmental activities in the Sudan. The National Council for Research (NCR) was established by Presidential decree in 1970 and originally had sub-councils divided into Agriculture, Animal Resources, Industrial, Scientific, Medical, and Economic and Social Research. The focus of its activities is on scientific research. This Council cooperated with non-governmental agencies in the Sudan to prepare the National Report on the State of the Environment in Sudan to the 1972 Stockholm Conference. Since its inception, the Council has conducted research on: the water shortage problem in the Sudan, solar energy and related environmental problems, socioeconomic

and environmental studies of the Rahad scheme, study of wastewater disposal in the domestic setting, etc. In 1977 the Council created a National Committee for the Environment. The functions of this Committee are to:

- 1) advise the government on methods to be adopted to alleviate the environmental effects of development;
- 2) advise the government and policy makers on the country's environmental problems;
- 3) cooperate with the Institute of Environmental Studies at the University of Khartoum to provide training programs in the environmental field;
- 4) coordinate UNEP's and other international bodies' programs in the Sudan.

The membership of this Committee includes representatives from the Ministries of Health, Agriculture, Industries, Local Government, the Sudan's MAB Committee, the Southern Region's Minister of Agriculture, and interested private NGOs. In other circumstances this listing would have provided a sound basis for coordination of all environmental activities but in reality the Committee's impact on the implementation of uniform environmental policy is limited because most of these agencies do not have any in-house procedures for coordinating internal policy, representation on the Environmental Committee is top heavy and Committee meetings are few and far between (twice yearly).

The Southern Region

Because of the special situation of the Southern Region a special focus on it is necessary. The region lags far behind the North in every sense of the word, although it is a potentially wealthy region with a potentially viable economy. The region began its development in 1972 with a very rudimentary institutional infra-

structure and while considerable autonomy has been devolved to it by the Central Government it still depends on budgetary support from the North, until such time that it is able to generate adequate revenues from the development of its own resources.

The South is governed by the High Executive Council for the Southern Region (HECSR), whose president is vice-president of the Republic and whose members are regional ministers for departments of the regional government. To a large extent, these regional ministers correspond with the Central Government Ministries in Khartoum. The Regional Ministry for Agriculture and Natural Resources is responsible for environmental matters generally. In addition to the regional MOA, there are regional Ministries for Commerce; Industries and Mining; Administration, Coordination and Legal Affairs; Finance, Planning and Economy; Animal Wealth and Tourism; Education; Health and Social Welfare; and Cooperatives and Rural Development.

Each regional Ministry is headed by a Minister who is a member of the HECSR, but the functional head is the Director-General of the Ministry. Coordination, both among these regional Ministries and between them and the Central Government in Khartoum is supposed to be directed by the Planning Ministry, but this coordination is hampered by the inadequate transportation and communication system.

The main strategy in the Southern Region's policy is the development of agriculture, forestry, and health and education. In principle, the decentralisation policy should contribute to an acceleration of this development process but in practice this has not been attained yet because the South commenced the complex challenge of tackling its development with too many handicaps and very limited resources, particularly skilled manpower. Even now, eight years after the establishment of the Southern Regional Administration, the search for trained manpower to administer vital development projects is lacking.

CHAPTER SEVEN

Basic Environmental and Natural Resource Laws and Sectoral Regulation

The Sudan has not promulgated an organic or comprehensive environmental and natural resources legislation. Regulatory measures for environmental management have been effected on a piece-meal, sectoral basis, as needs arose. Hence one of the earliest environmental legislation - the Forests Ordinance was enacted in 1932. One of the newest Acts is the Environmental Health Act, 1975. As usual, legislative activity has not always kept abreast with developments and consequently, there are many sectors where legislation has been lacking for years but has not been forthcoming. In the following discussions, only the major legislative provisions in the identified sectors will be discussed. For the sake of brevity, minor provisions will merely be referenced.

A. SECTORAL REGULATION

Environmental Health

The major provisions appear in the Public Health Act and the Environmental Health Act, both passed in 1975. After a definition section in Chapter 1, the rest of the Environmental Health Act deals with institutional responsibilities, water and air pollution. By far the most noteworthy provision appears in s.4, which imposes a duty on local councils to preserve and improve environmental health, defined, rather inadequately, as "health condition of a human being, an animal or a plant and all that is related to human life in the surrounding environment." This of course imposes an obligation to protect the well-being of fauna and flora as well - a rather extensive obligation which may unduly tax the manpower resources of the local authorities. These councils are also required to make adequate provision for the installation of public sewers,

the disposal of rainwater and untreated wastes, the collection and treatment of wastes, etc., and to take preventive measures against the spread of epidemic diseases. The Act imposes considerable obligation on the People's Council, and yet the only guidance they are given comes in s.5, which states that they may issue regulations or instructions for the implementation of their duties, acting upon the recommendations of the Minister of Health and the Public Health Board, which is a creation of the new Public Health Act. Under s.5 of the Public Health Act, one of the major functions of the Public Health Board is described as the establishment of environmental health standards and the provision of technical advice to the local Government Councils.

While these two Acts are important first steps for promoting environmental health they by no means give the subject exhaustive treatment. In light of the environmental health problems described above and the perennial problems associated with administration in the Sudan (lack of coordination, lack of definitive national policies to guide local authorities) these laws may pose more problems for the already-stressed local authorities than they solve.

Water Supply, Water Use and Water Quality

Legislative texts dealing with this subject are plentiful and include:

- 1) The Public Ferries Ordinance, 1939
- 2) The Nile Pumps Control Ordinance, 1939
- 3) The Nile Pumps Control (General Regulations), 1951
- 4) The Nile Pumps Control (Stand-by) Regulations, 1953
- 5) The Nile Pumps Control (General Amendment No. 2) Regulations, 1968
- 6) The Nile Pumps Use Control (Tenancies) Regulations, 1969

- 7) The River Transport Ordinance, 1950
- 8) The Freshwater Fisheries Ordinance, 1954
- 9) The Water Hyacinth Control Act, 1960
- 10) The Gezira Scheme Act, 1960
- 11) The Central Electricity and Water Corporation Act, 1966
- 12) The Rural Water and Development Corporation Act, 1967
- 13) The Public Health Act, 1975
- 14) The Environmental Health Act, 1975

One reason for this abundance of regulation, especially with regard to use of Nile waters, is the need for strict monitoring of the use of the Sudan's allocation of Nile waters under the 1959 Agreement between Egypt and the Sudan. The Sudanese Ministry of Irrigation has estimated that the Sudan's entitlements under this agreement must be increased if the Sudan is to continue its program of agricultural expansion.

The Central Electricity and Water Corporation is entrusted with responsibility for Water Supply (for domestic, industrial and hydroelectric power) under the 1966 Act by that name. This responsibility is limited to surface water resources only. Groundwater supply is the responsibility of the Rural Water and Development Corporation, while the Nile Water Use Control Board has authority to regulate use of Nile waters for agricultural purposes. The Gezira Scheme Act imposes an obligation on the Gezira Scheme Board to construct and maintain the Scheme's canals.

The 1951 regulations made under the Nile Pumps Control Ordinance lay down stringent conditions for the issuance of water pumping and water-routing licenses. The requirements that have to be satisfied include the public health aspects, and the procedure involves no fewer than the District

Public Health Boards, the Provincial and District Committee and the Irrigation Director. Similar, although less stringent licensing requirements are established by the Rural Water and Development Corporation Act of 1967 for groundwater and surface water resources.

Provisions on water pollution appeared as early as the 1939 Nile Pumps Control Ordinance. Although this Ordinance did not set out any clearly defined water quality criteria the combined effect of the regulations issued thereunder (which required the Public Health Boards of the District and Provincial Authorities to be represented on the Nile Water Use Control Board and the Rural Water and Development Corporation) and the then (1939) Public Health Ordinance provisions, were designed to ensure that water resources development projects were consistent with public health requirements. The most comprehensive treatment of water pollution now appears in the Environmental Health Act, in Chapter III, ss. 8-12. S.8 prohibits the discharge, dumping or other disposal of substances into sources of water "in a manner harmful to human or animal health or prejudicial to other water uses." Under s.9 district health authorities are required to monitor public and private drinking water sources, and to carry out periodical medical examinations of persons working in contact with drinking water sources and systems. The district health officials are also required to make provision for the treatment of water resources so that they can be utilized. S.10 imposes an obligation on institutions responsible for the storage and supply of drinking water to comply with regulations from time to time laid down by the Minister. S.11 makes provision for the district health officials to take precautionary and remedial measures for the prevention of spread of epidemics through drinking water. Finally, s.12 lays down conditions under which the health authorities may authorise the discharge of treated wastes into public water courses.

In this very brief overview of the major legislative provisions for water supply, use and quality, a few observations can be made. Firstly, there appears to be a proliferation of government institutions with responsibility for water resources questions. These range from the Ministries of Agriculture and Irrigation, the Gezira Board, the Central Electricity Corporation and Rural Water Development Corporation, and the Public Health Board at the national level to the Provincial and District Committees at the local level. Secondly, in spite of the existence of these laws there is no definitive declaration of water quality criteria. These observations are very pertinent in light of the various environmental and institutional problems outlined above. Besides, very few regulations have been made to give badly-needed guidelines to the local authorities.

Soil Conservation

There is no specific legislation on soil conservation in the Sudan although references are made to the subject in the following laws:

- 1) The Rural Water and Development Corporation Act 1967
- 2) The Allotment of Lands for Development of the Mechanized Farming Corporation Order, under the Mechanized Farming Corporation Act
- 3) Parts of the National Parks, Sanctuaries and Reserves Regulations 1939, issued under the Preservation of Wild Animals Ordinance, 1918
- 4) The Gezira Scheme Act, 1960

As an example, the 1967 Rural Water and Development Corporation Act concentrates mainly on the definition of the organisational structure and functions of the Corporation, one of which is the protection of "resources, pastures, agricultural lands, soil and Sudan tree wealth" from deterioration. Soil conservation is provided for only by implication in the other Acts such as the Gezira Scheme Act, which empowers the Board to conduct agricultural research. Information on the exact implementation of these provisions with

regard to soil conservation activities is scant and, as mentioned earlier, the Soil Conservation, Land Use and Water Programming Administration of the Ministry of Agriculture is concentrating its activities on conducting soil surveys to provide a better information base from which a soil conservation strategy can be prepared.

Land Tenure and Land Use Planning

Ownership and other rights in land are governed partly by written law and partly by customary law and tradition, although the GOS owns most of rangeland, forests and cultivated land. The major uses of land in Sudan are for agriculture (grazing and cultivation), and forestry. While there is no legislation specifically dealing with land use, legislation relating to land are:

- 1) The Unregistered Land Act, 1970
- 2) The Acquisition Act, 1970
- 3) Taxation of Land and Date Trees Ordinance 1925, and regulations
- 4) The Town and Village Planning Act, 1961
- 5) Road Traffic Ordinance, 1922

The 1925 Land Settlement and Registration Act provides for the registration of ownership and rights to pasture, forest produce and cultivating occupation. Any land subject to this Act but not claimed will be presumed to be the property of the GOS. All land which is not registered by the commencement of 1970 is deemed to be the property of the GOS and is deemed to have been registered as such. Another direct reference to land use appears in the Rural Water and Development Corporation Act mentioned above and the Mechanized Farming Public Corporation (Establishment) Regulations, 1975, which calls for a "plan for proper exploitation of natural resources" within the planned area.

Our earlier discussions have reiterated the far-reaching and negative impact that the lack of a land use plan presents to all levels of administration in a country with such multiple land use requirements.

In fact, the formulation of such a plan will create the framework within which legislation in almost all of the sectors being discussed in this section can be prepared.

Forestry

As mentioned earlier, the forest reserve system is the GOS's main forest protection policy. The two major Forestry Acts which deal with this policy are:

- 1) The Central Forests Act, 1932
- 2) The Provincial Forests Act, 1932

Both of these laws were formulated before independence and have obviously been overtaken by current events, a changed situation marked by the threat of deforestation and consequently, the need for more management-oriented legislation which makes adequate provision for multi-purpose forestry. Both acts provide for the creation of forest reserves. In view of these considerations and the inappropriateness of these laws, a Draft Forest Act has been prepared. This draft law makes provision for a more progressive notion of forest protection. Although it still provides for the establishment of reserves, the purposes of these reserves include not only production but protection, recreation, grazing and farming as well. This draft has not yet been introduced as a Bill and reports claim that this is awaiting the outcome of the regionalization program.

Game, Wildlife and Protected Areas

There is one basic legislative text which regulates activities relating to wildlife, game protection and national parks. This is the Preservation of Wild Animals Ordinance, 1935 as amended and regulations made under it, such as:

- a) The Game Regulations 1935 as amended
- b) The National Parks, Sanctuaries and Reserves Regulations, 1939, as amended.

This Act establishes three main classes of protected wild animals and specifies conditions under which hunting may take place. Other provisions empower the Director of the (then) Game Preservation Department (now the Wildlife Administration) to issue regulations to implement the Ordinance, to issue game regulations and to establish national parks and game sanctuaries. The two regulations mentioned above established the conditions for the issuance of game licenses and permits and for the establishment of the 3 national parks and 15 game reserves. The National Parks, Sanctuaries and Game Reserves Regulations prohibit the use of firearms, and any agricultural, forestry or mining activities in these reserves. Responsibility for enforcement is entrusted to the Minister of Interior, who is entitled, under these Regulations as well as the Delegation of Powers Orders, 1960, to delegate some of his powers to the Director of the Wildlife Administration.

Other directly relevant legislation are The Central Forest Ordinance 1932 and the Provincial Forest Ordinance 1932. The Central Forest Act authorises the Chief Conservator of Forests to specify activities which can be legally undertaken in these areas. At the provincial level forest officers are to be appointed by the Governor of the province to manage these reserves.

There are a series of other legislation which indirectly affect the management of wildlife such as the Arms Ammunition and Explosives Ordinance, 1933, the Plant Diseases Ordinance, etc.

The problems faced by the Wildlife Administration in enforcing these laws have been outlined above. In addition, in spite of amendments designed to up-date provisions and to give effect to post-1935 developments the law does not make a definitive statement of wildlife and national parks policy. Further, although amendments have been timely, they are not exhaustive (for example, no regulations exist for the implementation of CITES (Convention for the Regulation of Trade in Endangered Species) and a need is now felt for a consolidated legislative text. A draft law was prepared for the GOS by FAO but this has not

been passed yet.

Fisheries

Relevant legislation include the Marine Fisheries Ordinance, 1937 and the Freshwater Fisheries Ordinance, 1954. These establish the machinery for the development of fisheries resources in the Sudan. Attempts have been made during the course of the forty odd years since the policy was established to issue regulations to keep abreast with developments in the fisheries industries. The most recent regulations were made in 1977. Nevertheless there is an urgent need for an updating of the legislation to take account of current developments in international fisheries issues (such as fisheries within a country's exclusive executive zone) as well as the GOS's strategies for fisheries resources. The 6 year plan calls for the completion of fish resources surveys. Once this has been achieved a comprehensive fisheries resources conservation law will be required, as will a national and local network of competent fisheries administrative authorities.

Marine Resources and Coastal Zone Management

Information collected so far on the Sudan's marine and coastal zone management is scanty. There is no information on coastal zone development along the Red Sea coast, although it can be projected that there will be pollution problems associated with port and harbour activities in Port Sudan, and the new port at Suakin, when it opens.

Legislation identified so far deal with the establishment of harbours and a merchant navy and the ratification of International Conventions. These are:

- 1) The Convention on the Continental Shelf Ratification Act, 1970.
- 2) The Convention on the Inter-Governmental Maritime Consultative Organisation Ratification Act 1970.
- 3) The General Regulation and Control of Merchant Shipping Act, 1971.
- 4) The Harbours and Shipping Ordinance, 1916.

Nevertheless, legislation is required to regulate coastal zone management, and to encourage oceanographic research (recently an Institute of Oceanography has been established) and to protect marine areas from pollution. This may be done within the framework of UNEP's Regional Seas Programme Red Sea Project, which is expected to draw up an Action Plan for the Red Sea in the near future.

Pesticides, Chemicals and Dangerous Substances

Since the introduction of pesticides chemicals in the Sudan a debate has been going on as to which government department should have authority to regulate the use of pesticides, insecticides, etc. in the Sudan. The choice has been between the Public Health Board or the Ministry of Agriculture. Legislation was drafted by the research division of the Ministry of Agriculture in the late 1950's but to date this has not been adopted yet. Hence, regulation for the control of the use of pesticides appear in laws which deal with agriculture, and even that only by implication (an example is the Gezira Scheme Act, 1960, S.4 (H) "the conduct of bulk pest control activities").

Legislation to control dangerous substances (such as radioactive substances, chemical pollution from industries) include:

- 1) The Sulphur Ordinance, 1932
- 2) The Food Control Act, 1973
- 3) Freshwater Fisheries Ordinance, 1954
- 4) The Preservation of Wild Animals Ordinance

Air

Although this is not a major problem, legislation has been promulgated to regulate it. Chapter IV of the Environmental Health Act, 1975 deals mainly with air pollution arising from industrial activities and consequently, prescribes siting requirements and restrictions for industries, chimney heights, etc. It also provides regulation for the incineration of wastes, etc.

S.15 empowers the district health authorities to take action to prevent the emission of gas, smoke, wastes, dust, etc. from factories, furnaces and vehicles that are likely to cause harm to human health.

B. Other Methods of Enforcing Policy and Law - Environmental Impact Analysis

The foregoing discussions have indicated a direct correlation between development strategies/projects and the environmental and natural resources issues outlined in Section 2: the Six-Year plan states that one of the methods for achieving the objective of accelerated and balanced growth in the Sudanese economy is the conservation of natural resources. Although this expression has not been defined in any document which further expands on this development policy, it can be reasonably argued that "conservation" means more than just preservation. It implies sustainable development of the country's natural resources. Nevertheless, there is strong evidence that some of the development projects bring about a rapid degradation of the country's natural resource base.

Some projects in the Sudan are specifically designed to redress environmental and resource degradation ills. Examples of projects which fall under this category are the shelter-belts and tree plantation projects, control of river erosion project, the water hyacinth control project etc. However, these are by far the minority of cases. At this point in our review, an inquiry into procedures designed to address the environmental impact of development projects is necessary. What legal mechanisms exist to compel developers to conduct environmental impact analysis of projects? Our research has revealed no legislation requiring any formalised, systematic environmental impact analysis of projects. Admittedly, some of the legislation (both old and new) require the potential developers to inform the competent Government authorities of environmental or potentially adverse effects of their proposed projects. An example is Article 4(3) of the Nile Pumps Control (General) Regulations 1951, which inter alia requires an applicant for a pumping license to satisfy the District Commissioner that "(b) there are no objections to the Scheme which make it agriculturally or administratively undesirable...(g) that the Public

Health Authority has no objection in principle to the Scheme." The weaknesses of this particular regulation are immediately obvious. Nebulous phrases like "agricultural desirability" and weak provisions which require the Public Health Authority's approval "in principle" will not, by any stretch of the imagination ensure that certain desirable environmental quality criteria are met. In fact, the experience of the Nile pumps schemes shows that their environmental effects, such as waterlogging and salinity, the numerous environmental health problems, rapid siltation, etc., have not been avoided, neither are they being adequately controlled. The same is true of many projects in other sectors.

What is needed is an environmental impact assessment policy, which imposes an obligation on developers (whether in the public or private sector) to provide adequate information on the potential impact of the proposed project on the natural environment. This policy need not establish as elaborate a procedure as exists in some parts of the developed world, but the minimum it could provide for will be the maximum review process that can be carried out by the technical and manpower resources of the Sudan. It certainly could set out to establish certain relevant and easily attainable environmental quality standards for the Sudan. It should then establish the suitable procedure which ensures that new development projects (and, over a certain moratorium period, existing ones) satisfy these criteria. This may be the only solution to the problem of rehabilitating and revitalising ongoing projects and ensuring that new ones do not, by reason of their environmentally adverse impacts, thwart the ultimate objective of sustainable development.

Conclusion

Although it may appear, from the number of laws described in this chapter, that there is ample legislation on environmental and natural resources management in the Sudan, it is necessary to stress that, with very few exceptions, the relevance of these laws is peripheral, incidental or by implication only. They

are described here in order to highlight the main characteristic of the status of the Sudan's environmental legislation: many laws are outdated and attempts to revise these laws have been piece-meal and, in most cases, have met with little success.

CHAPTER EIGHT

International Agreements Over the Use of Nile Waters

The Nile basin is of particular interest to any study of the legal, regulatory and institutional aspects of environmental and natural resource management in that the control and sharing of the river's waters has been the subject of international agreements and management for longer than any other Third World natural resource. The subject is rendered even more interesting by the fact that no other major river valley is shared by so many autonomous states and no other downstream state is so utterly dependent for survival upon collaborative management of a natural resource as is Egypt on the Nile.

The Fashoda incident of 1898, in which the French attempted to link with Emperor Menelek of Ethiopia (and possibly the Kalifa of Sudan) to wrest political influence over the Upper Nile in Sudan from the British, was the first attempt - in modern times at least - to influence the natural flow of the Nile in a political threat to Egypt.

By 1920, the Egyptians were resenting British management of Egypt's external relations in the form of Sir Murdoch-Macdonald's scheme to dam the Blue Nile at Sennar and the White Nile at Jebel Auliya. This was seen as a plot to hold Egypt in thrall by direct control of vital waterworks outside Egypt's borders while stimulating a cotton producer (Sudan's Gezira scheme) which would reduce the value of Egypt's major exports.

In that same year, and in an attempt to reassure both Egyptian and Sudanese sentiment, Britain convened a Nile Projects Commission with representatives from India, the United States and the UK, which pointed towards the 20th century tradition of allocating water rights between Egypt and Sudan, based

upon estimated future needs. The first formal Nile waters agreement was struck in 1929. It defined Egypt's "acquired rights" as 48,000 cubic Kilometres and Sudan at 4,000, and - to Sudan's obvious disadvantage - established as a principle the primacy of existing land usage and water needs, versus potential usage and needs. Such a lop-sided and inequitable agreement could not long endure, however. The matter came up for renegotiation with Egypt's decision to seek funding for the high dam at Aswan. After protracted negotiations over a new formula for dividing Nile waters (1954-58) the Sudanese repudiated the 1929 agreement by raising the Sennar dam to increase the water supply for Gezira.

A change to a military government in Sudan and Soviet commitment to support the Aswan High dam, precipitated a new agreement on Nile waters, signed in 1959. This agreement was much more advantageous to Sudan. Based on an estimated minimum annual Nile discharge at Aswan of 84,000 cu km, Egypt was to receive 55,000 cu km and Sudan 18,500 (a 7,500 cu km gain from the Aswan dam). This represented 14,500 cu km more than Sudan's 1929 share and over twice what Egypt offered when the talks started in 1954. As Sudan was not yet able to absorb that much water, an annual "water loan" of 1,500 cu km was arranged to go to Egypt until 1977 (the remaining 10,000 cu km being written off to evaporation and seepage at the Aswan reservoir). An even more important concession to Sudan was that any increase due to the yield of the river was to be shared 50-50 between the two countries, the same agreement to be applied to future Upper Nile projects, the cost of which was to be borne equally.

It was during these negotiations that a Permanent Joint Technical Commission (PJTC) was agreed. This would inspect each country's territories,

gather hydrological data, supervise studies and implementation of future Upper Nile hydraulic works. In the event of a shortage of water stored upstream, the PJTC would also determine allocation between the two countries. Finally, it would study and prepare common negotiating positions vis a vis any other riparian states. A final part of the 1959 package was Egypt's agreement to pay to the Sudan 50 million pounds in compensation for the displacement of some 50,000 Nubians of the Wadi Halfa district and for the flooding of about 20,000 feddans of their land.

Since 1959 this agreement has been faithfully applied. The PJTC has also regularly met, whatever the political climate between the two countries, and both countries have, without exception, received their designated share of water. An important defect of the 1959 agreement was that no reference was made to water quality. This may become an increasing problem for Egypt, as the Sudan (eg in the case of the Rahad scheme) expands its irrigated acreage with greater run-offs of leached salts and chemical residues. (It is relevant, though, to note here that over half of the world's 170 international rivers have no use-agreements among the riparian states, and very few of those who do, specify water quality standards.)

It is the conclusion of most experts that, at least among African and Middle East nations, the 1959 Nile agreement serves - with the exception of this lack of a water quality provision - as a model for international river management. Apart from Egypt and Sudan, other riparian states were involved to some degree in the 1959 agreement. Uganda, Kenya and Tanzania reserved their rights to a future (and hypothetical) disposition of the water of the equatorial lakes and sources of the White Nile. Since 1967, all three countries have participated in the hydro-meteorological survey of the

equatorial catchment launched by WMO. (They were joined in 1972 by Burundi and Rwanda, though Zaire has remained aloof.) New agreements will clearly need to be negotiated, however, if and when Egypt or Sudan propose to use Lake Victoria as a major over-year storage facility, which would of course flood habitable areas along its shores. Ethiopia is at present bound by no agreement over the Nile. So far the government has done nothing provocative, but it has fairly ambitious water plans under consideration, which would certainly affect the Sudan's Blue Nile.

Surges of development in the Nile basin have inevitably followed regional political development. Sudan's settlement of its equatorial guerilla war in 1972 was the basis for the new development thrust of the Jonglei canal scheme to by-pass the Sudd - a scheme in which Egypt, now turning its attention away from military preparations in the North towards further agricultural expansion, was anxious to share. A revised Egyptian-Sudanese accord on the Jonglei canal was signed in 1974. As indicated above, its content followed the signs of the 1959 agreement in terms of sharing. The Jonglei project is otherwise noteworthy as an early focus of environmental concern. In 1954 a British team reported from the Sudd on the overall impact of a proposed canal between Jonglei and the Sobat-White Nile confluence. This, and subsequent studies, led to a major realignment of the canal, following the recognition that the original canal alignment would result in major disturbances for seven hundred thousand people and nearly one million cattle. Clearly, it was inevitable that this canal would continue to be a focal point of regional politics. What is relevant to this section of our report, however, is that international relations between Egypt and Sudan have remained stable throughout the intervening period.

This may not continue in the future for environmental reasons on top of obvious political hazards. There is mounting evidence that water quality is becoming an increasingly important factor for Egypt. The high evaporation rates at Aswan have led to 10% increases in salinity. With drain-back from irrigation down-stream of Aswan, salinity is now a third higher in the delta than at Aswan. These are not alarming levels at present, but agricultural intensification in Sudan and Egypt cannot fail to raise the level. Greater use of equatorial lakes and operation of the Jonglei scheme will make the White Nile, with its higher natural salinity than the Blue Nile, more important in the down-stream discharge.

Institutional and political pressures experienced in meeting problems of salinity (and algae) are likely to be exacerbated by pollution from chemicals run-off due to heavy use of pesticides, herbicides, chemical fertilizers and copper sulphates (used to kill snails that host bilharzia). Problems with regular run-offs are also exacerbated by "crash programmes" as for example in 1975 when herbicides were used on 50,000 km of canals and drains to kill heavy concentrations of Nile hyacinths. This program took place in Egypt over 100 miles from the Sudanese main Nile: the fact that it has affected Sudan upstream (because such intensification must limit what Sudan can allow to run-off if the delta region is not to become disastrously polluted) serves simply to illustrate the problems of water quality management that may be expected to add to flood and diversion management questions which have been the focus of PJTC activities thus far.

As national policy makers in the Sudan (and Egypt) continue to draw up and seek funding for nationally-oriented projects with heavy water

water demands, some authorities think that the Nile will be substantially overcommitted (see e.g. Waterbury, 1979). If Egypt and the Sudan find that enormous proposed capital outlays and ecological disruptions only postpone a water shortage by about 15 years, then perhaps they should be encouraged to look at their opportunity costs now.

One may conclude this section with the comment that a major moment of decision appears to be unavoidable. The meeting of the PJTC in June 1977 started new rounds of discussion on Nilotic supply. It seems that Sudan and Egypt may have to scrap some of their projected agricultural plans. It also seems clear that the determination of who scraps what and when, will acquire third party mediation: perhaps by the rich Arab states of the Gulf region, who have strong political and economic stakes in both countries. At present it seems as though both countries are purposely claiming ignorance of their opportunity costs. The past history of Nile water negotiation shows that great significance is attached to actual needs for existing channels and paddies. We may thus be witnessing one further chapter in the tragedy of a commons, as the past basis for future water agreements becomes the motive behind the clearly indentifiable thrust for new schemes (in both Sudan and Egypt) instead of seeking investment to make existing irrigated agriculture work better and more productively.

CHAPTER NINE

Emerging NGO and Academic Involvement in Environmental and Natural Resources Management

Some environmental activities are going on at the non-governmental level which deserve special mention here. The first involves the work of the Institute of Environmental Studies of the University of Khartoum. The Institute, the first of its kind in Africa, was set up almost two years ago with funding from the Ford Foundation. Its training program is offered to graduate students with the objective of training them for jobs within the Government of Sudan administration. The program offers a two-year master's degree course which includes subjects ranging from principles of environmental science through environmental economics, environmental and resource law, and land and coastal zone management, urban and regional management, etc. The majority of its student body are civil servants who have taken a leave of absence from work and are expected to return to the civil service to fill the need that was constantly referred to for "trained people". The first group of locally trained environmental professionals will be graduating in mid-1981.

In addition, there are certain faculties and departments at the University of Khartoum whose activities and programs are of direct relevance for the environmental and natural resources problems in the Sudan. The faculties of Agriculture, Medicine, Science and Law are examples, as are the departments of Forestry, Fisheries and Geography. The Department of Geography, in particular, is engaged in work involving rural development issues, the development and management of arid land, agricultural geography, agricultural location, etc.

Another organisation is the Sudan Society for the Protection of the Environment. This is a non-governmental organisation (NGO) which was formed in 1975, with the major objectives of 1) disseminating information on environmental problems in the country and 2) exerting some influence on the Government of Sudan's decision-making. Its membership includes university lecturers, students, and government officials who are concerned about problems such as misuse of natural resources, especially in the mechanized farming sector, and desertification. The Society was instrumental in calling attention to the adverse impact of the proposed Rahad Scheme on the Dinder National Park. This prompted a reassessment of the Scheme. Although the final decision to relocate the Scheme further away from the park was based on financial and not environmental considerations their action in averting attention to some potential environmental effects of the Scheme must be noted. The Society has been fairly active in the education or public information fields. It has published articles in newspapers, taken part in television shows and is very active in the World Environment Day (5th June) programs.

CHAPTER TEN

Conclusions and Recommendations

Of all the positive aspects of environmental management which emerged from our research on, and visit to, the Sudan, the most noteworthy is the high level of awareness among government officials of the Sudan's environmental problems, and the policy, legal and institutional modifications that are necessary to improve the overall management structure. Many of the criticisms levelled at the system were very constructive - examples were given of ways in which the various natural resources management units (forestry, wildlife, range and pasture, etc.) could be reorganised to provide a more responsive institutional system. Other positive indications relate to the work of the Sudan's Desert Encroachment Control and Rehabilitation Programme, DECARP; the opportunity for environmental training that is offered by the Institute for Environmental Studies; and the emerging NGO (notably the Sudan Society for the Protection of the Environment, SSPE) involvement in environmental issues. In the last two organisations one sees the beginnings of very competent institutions which will be able to tackle some of the Sudan's numerous environmental problems.

In addition, the Sudan is a country of enormous potential. The fertile, rainfed lands in the South are ideal for crop cultivation as well as livestock rearing. The dry, parched soils in the northern parts of the country are nevertheless very fertile and, thanks to the flow of Nile waters, can be put to productive agricultural uses through irrigation. Consequently, in a land that is almost 50% desert (29% desert and 19% semi-desert) agriculture accounts for more than 80% of its foreign exchange earnings. In realisation of the vast potential for food production in this part of the world the oil-rich

Arab countries have been pouring money in what has been claimed to be the future "bread basket of the Arab world". The Western countries are also contributing their share, with the result that in Khartoum and the neighboring areas there is a bustle of economic activity.

However, the reality is different from one's first impressions of the country. The weaknesses of the entire system, and especially the environmental management structure has unfolded in the preceding chapter. The vital irrigation projects are fraught with environmental problems, and there is little doubt about the severity of the country's natural resources management problem. There are four major deficiencies in the environmental and natural resources management system in the Sudan.

The major problem is a severe lack of coordination within the governmental structure. The problem of coordination in the Ministry of Agriculture has been outlined earlier. These problems are exacerbated by the fact that the Ministry's priorities for funding puts the natural resources sections of the Ministry's work (as opposed to agricultural services such as crops, fertilizers, etc.) close to the bottom of the list. Hence, resources are very often unavailable to provide the meaningful management system that is required. The same problem exists with water resources management. For example, there are three Ministries and one public corporation concerned with the management of the Roseires dam alone (Irrigation, Agriculture, and Industry, and the Public Electricity and Water Corporation). There is also a Nile Water Control Board in the Ministry of Agriculture and a Nile Water Department in the Ministry of Irrigation. Similar problems exist in many other Ministries.

The second major problem relates to the conflict of land use. This problem is compounded by a lack of adequate information on the country's natural resources. The Ministry of Agriculture itself has only very rough ideas of total area of forests, fertile land, etc. The size of the country alone makes a detailed survey difficult. Efforts are now being made to prepare regional surveys.

Another major issue and source of difficulty for environmental management is the power of the local authorities. This situation has arisen because of the difficulties inherent in having a centralised administration in a country as vast as the Sudan. Plans are now underway for the devolution of powers from the central government to the provinces, but it is becoming clear that the decentralisation policy may complicate things further. The general consensus is that there is an urgent need to strengthen the national institutions; promulgate a definitive natural resources and land use policy before implementing the decentralisation policy, which it was suggested should require all the regional/provincial authorities to exercise their powers within the general framework of this national policy. In the absence of this most of the local authorities are bound to follow their own devices and allow practices which will put severe strain on the country's resources.

The last shortcoming of the system relates to the laws. As pointed out in the main text, the majority of environment-related laws are outdated and enforcement is very weak. Not much interest is shown in environmental law in any of the government institutions. There are very few lawyers who devote attention to environmental law. In fact the only interest in effective environmental and natural resources law is at the University of Khartoum's Institute of Environmental Studies where a one semester course is taught. It is hoped

that the environmentalists trained by this Institute will begin to impress upon government officials the important role of law in the environmental management system.

Our recommendations will focus on the problems outlined above. In addition, these recommendations will be limited to activities that can be undertaken at the central government level. A great deal of research remains to be done if one is to understand the complexities of the constraints on the operations of local provincial and regional authorities. Before itemising our proposals, one general point has to be made. We have identified many very competent institutions - both governmental and non-governmental. Our recommendations will require a considerable amount of research and decision-making. It will be most desirable if these local experts and institutions participate in the execution of most of the work to be undertaken in these proposals. Such an approach will take advantage of the sophisticated knowledge of the country, its politics, and culture which these institutions and individuals have. Examples of institutions which immediately come to mind as potential collaborators are the Institute of Environmental Studies, the Department of Geography of the University of Khartoum, and possibly, even the Sudan Society for the Protection of the Environment.

The first recommendation relates to the establishment of an integrated environment and natural resources management policy. Although the activities listed in the chapter on the Government of Sudan's environmental policy suggest a policy of aggressive management of the environment, and while some of the Government of Sudan's programs attest to this, it is clear that the entire management structure suffers from a lack of policy framework within which programs and actions can be designed and implemented. The GOS should establish

this type of policy (either in the next Development Plan or in any other national document which the GOS may consider appropriate). The value of such a definitive statement lies in providing the central government, regional and provincial authorities with guidelines and a policy framework for their activities and programs, and for the development of regional resources. The land use question reappears in this context. An important component of this policy formulation should be a review of the land and water use question and the early adoption of the Plan (or a modified version of it) which has already been formulated.

There ought to be a more thorough review of the institutional structure for environment and natural resources management within the Government of Sudan. This review should focus on identifying and putting into effect more innovative uses of existing institutions, in particular the NCR's National Committee for the Environment. Such a review will tackle the problem of overlapping responsibility and gaps in institutional coverage. It will extend beyond the central government administration to provincial and regional level institutional coverage and needs. The desired objective will be to suggest ways for improved coordination of government activities and programs.

A great deal of work will have to be done in the legal field in order to formulate a comprehensive environmental and natural resources management legislation. These laws are required to give effect to the environmental policy, to establish environmental quality standards and to institutionalize the environmental impact assessment procedure. Of course, this is a monumental task which can only be accomplished over a period of time. Once the country's policy for environmental management is established and well-entrenched, and the efforts have been made to streamline the institutional set up, the priority areas for legislative reform in this field should be immediately

apparent and a time frame can be relatively easily established for the formulation of some of these legislative goals.

There are many sectors where policy, laws and institutions that will ensure effective management are lacking. The most noteworthy sector in this regard is coastal zone management (and marine pollution control). In view of the special characteristics of the Red Sea, and the rapid developments that are taking place along the Sudan's Red Sea coast, the early formulation of a policy for proper management of this resource is imperative. As mentioned in the main text, there is a dearth of information on the subject. In 1975, a Saudi-Sudanese Joint Commission for the Development of the Red Sea Resources was established. The Commission's main objective is the development of the non-living resources in the area defined as the common zone. The Commission is aware of the potential threat that such activities will pose on the Red Sea's ecology, yet not much technical research has been conducted. The Sudan does not have the technology, expertise, nor financial capabilities to carry out the necessary research. There may be other threats which are as yet unknown or unidentified. Therefore, we would propose that a thorough study should be undertaken of coastal zone management in the country in order to examine and propose answers for the following questions: what is the current institutional set up for such management and how can it be improved?; what is the impact of coastal development (ports, fishing, etc.) on Red Sea ecology?; what level of management is being achieved?; in view of the fact that the Red Sea is a single ecosystem which requires an integrated management system, how can such integrated management be achieved?; what are the possibilities that exist for cooperation among Red Sea Coastal States?

Although it has been mentioned earlier that the GOS is receiving donor assistance to revitalise the Gezira Scheme, it is clear that more work remains to be done. It will be worthwhile for the GOS to undertake an economic AND environmental assessment of some of the large agricultural projects - the Gezira and the Rahad for example, to ascertain those projects' weaknesses and to determine what modifications (or even drastic operational changes) are necessary to provide economic and environmental rehabilitation of these vital projects.

There is a considerable amount which foreign donors can contribute to the recommendations outlined above. In particular, international assistance will be particularly beneficial if it is directed at strengthening the work of institutions such as the National Council for Research and the DECARP, which have concrete plans for solving some of the Sudan's environmental management problems.

The problems outlined in this review are but a few of the complex and varied problems which beset the Sudan. Although they are not as pressing as some other problems (such as declining foreign exchange earnings) their impact on the success rate of projects which are designed to solve some of the more pressing problems are so crucial that it is worth devoting considerable time and resources to their solution. In fact the benefits to be derived from the development process will be greatly diminished if these environmental and natural resources issues are not tackled early enough.

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LEGAL AND INSTITUTIONAL ASPECTS OF ENVIRONMENTAL AND NATURAL RESOURCES
MANAGEMENT IN THE SUDAN

Appendix I

List of Laws

1. The Diseases of Animals Ordinance, 1902
2. The Plant Diseases Ordinance, 1915
3. The Harbours and Shipping Ordinance, 1916
4. The Land Settlement and Registration Act, 1925
5. The Taxation of Land and Date Trees Ordinance, 1925
6. The Arms, Ammunition and Explosives Ordinance, 1932
7. The Central Forests Ordinance, 1932
8. The Provincial Forest Ordinance, 1932
9. The Sulphur Ordinance, 1932
10. The Game Regulations, 1935
11. The Preservation of Wild Animals Ordinance, 1935 as amended and regulations made thereunder.
12. The Marine Fisheries Ordinance, 1937
13. The Nile Pumps Control Ordinance, 1939
14. National Parks, Sanctuaries and Reserves Regulations, 1939
15. The Royalties Ordinance, 1939
16. The Road Traffic Ordinance, 1942
17. The Date Shoots Requisition Ordinance, 1944
18. The River Transport Ordinance, 1950
19. The Nile Pumps Control (General Regulations) 1951
20. The Freshwater Fisheries Ordinance, 1952
21. The Nile Pumps Control (Stand-by) Regulations, 1953
22. The Hides and Skins Ordinance, 1954
23. Petroleum Resources Development Act, 1958
24. Petroleum Resources Development Regulations, 1959
25. The Gezira Scheme Act, 1960
26. The Water Hyacinth Control Act, 1960
27. The General Regulation and Control of Merchant Shipping Act, 1961
28. The Town and Village Planning Act, 1961
29. The Central Electricity and Water Corporation Act, 1966
30. The Rural Water and Development Corporation Act, 1967
31. The Nile Pumps Control (General Amendment No. 2) Regulations, 1968
32. The Allotment of Lands for Development of the Mechanised Farming Corporation Order, under the Mechanized Farming Corporation Act, 1969
33. The Nile Pumps Control (Tenancies) Regulations, 1969
34. The Acquisition Act, 1970
35. Convention on the Continental Shelf (Ratification) Act, 1970
36. The Convention on the (IMCO) (Ratification) Act, 1970
37. The Unregistered Land Act, 1970
38. The Peoples Local Government Act, 1971, as amended
39. The Mines and Quarries Act, 1972
40. Southern Provinces Regional Self-Government Act, 1972
41. The Development and Promotion of Industrial Investment Act, 1972
42. Wildlife and National Parks Act, 1973
43. The Food Control Act, 1973
44. The National Council for Research Act, 1973

45. The Environmental Health Act, 1975
46. The Public Health Act, 1975
47. Mechanized Farming Public Corporation (Establishment) Regulations, 1975
48. The Distribution of Power Between the Central Ministries and the
Ministries of the Southern Region of the Sudan Act, 1977, as amended

Appendix II

LIST OF PERSONS CONTACTED

- A. MINISTRY OF AGRICULTURE, FOOD AND NATURAL RESOURCES
1. Undersecretary for Natural Resources
Dr. Abdel Aziz Bayoumi
 2. Director-General for Planning and Administration
Dr. Tawfiq Hashim Ahmed
 3. Land Use, Soil Conservation and Water Programming Department
Dr. Hassan Mohamedin, Director
Dr. Mawiya Mustafa
 4. Range Management and Pasture Department
Dr. Ali Deraj, Director
Dr. Suleiman Abdalla, Range Management Specialist
Mr. Mohamed Fadl el Mula, Head of Natural Range Management Sector
 5. Forestry Department
Dr. Kamal Hassan Badi, Director
Dr. Zakaria A. Saad, Head, Afforestation and Shelterbelts Section
 6. Wildlife Department
Dr. Abu Sineina, Director
Dr. Mahgoub el Bedawi, Head of Game Preservation Section
 7. Desert Encroachment Control and Rehabilitation Programme
(DECARP) Coordinating Unit
Dr. Farouk Ahmed, Coordinator
- B. MINISTRY OF IRRIGATION
1. The Undersecretary
Dr. Grassim O. Hassan
 2. Dr. Abbas Haddayda, Consultant and Irrigation Advisor
 3. Dr. Kamal Ali, Nile Water Department and Member of the
Permanent Joint Technical Commission
- C. MINISTRY OF HEALTH
1. Dr. Zuhair Noor, Malaria Control Unit
- D. NATIONAL COUNCIL FOR RESEARCH
1. Dr. Saad Abbadi
Secretary General
 2. Dr. Mohamed O.H. El Karori
Director, Agricultural Research Council

3. Dr. M.A. Amin
Director, Medical Research Council
4. Dr. Wadie Yawni Magar, Director
External Relations and Scientific Editor

E. NATIONAL DOCUMENT CENTER

1. Mr. Tofiq al Rahim Manour, Reference Librarian
2. Ms. Cecile Wesley

F. ATTORNEY-GENERAL'S DEPARTMENT

1. The Undersecretary
Mr. Tijani Osman
2. Mr. El Fatih
Contracts and International Agreements Department

G. UNIVERSITY OF KHARTOUM

1. Deputy Vice Chancellor
Professor Faisal Tag el Din
2. Department of Geography
Dr. Mustafa Khogali, Acting Head
Dr. Yacoub Abdalla Mohamed
Dr. Mohammed el Hadi Abu Sin
3. Faculty of Law
Ms. Dina Sheikh el Din
Dr. Akolder Tier
4. Institute of Environmental Studies
Dr. M.D. el Khalifa, Chairman
Professor Joe Whitney (Advisor, University of Toronto)
Dr. Tag el Seed (Aquatic Biology) and Director

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1. Mr. Anwar Abdu
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2. Dr. Kamal Agabawi
Former Minister of Agriculture
3. Dr. Omer el Agra
IIED Fellow
Lecturer, Faculty of Architecture, University of Khartoum
4. Dr. Tijani Alaam, Chairman
Sudan Society for the Protection of the Environment
5. Ford Foundation
Mr. Norman Singer, Assistant Representative
Piero Bronzi, Agricultural Programme Officer
John Gerhart, Representative for the Middle East and North Africa
6. Dr. Yahia Abdel Mageed
Former Minister of Irrigation
7. Khalil Osman
President, Gulf International
8. USAID Mission
Mr. Arthur Mudge, Mission Director