Sudan Government
Ministry of
Environment
And Tourism

HCENR

UNDP

CBD

IUCN

The Sudan's National Biodiversity Strategy and Action Plan

National Biodiversity Strategy and Action Plan Project

May 2000

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FOREWORD

The Convention on Biological Diversity (CBD) signed by Sudan in June 1992 and ratified in October 1995, addresses at global level the entire spectrum of biological diversity, the sustainable use thereof and the fair and equitable sharing of the benefits accruing from that use.

Sudan's National Biodiversity Strategy and Action Plan (NBSAP) finalized early May, 2000 envisages future sustainable national development plans to take into consideration the conservation of diversity, national heritage and indigenous knowledge. To a great extent this is in line with the country's ideological and political thinking over the past decade. The Ten Year Comprehensive National Strategy (CNS) 1992/2002, the Khartoum Treaty of 1997, Fashoda of 1998 and the 1998 Constitution all recognize and value the ethnic, cultural and resource diversity in the country.

It is hoped that national strategies such as that of Biodiversity, Environmental Conservation, Combating of Desertification, Water, Agriculture, Forestry and Wildlife will form the matrix for subsequent medium and long term national development strategies and plans. It is hoped that both the legislature and executive will foster such planning.

The wide consultative and participative process adopted by the Higher Council for Environment and National Resources (HCENR) in conducting the base studies and assessment, the synthesis of results and the various fora for the discussion thereof, the involvement of state authorities, professionals, researchers and NGOs is very much commendable. Also are the efforts of reviewers and the task force, which summarized it all. The support of GEF, UNDP and IUCN – East Africa Regional Office is appreciated.

ABBREVIATIONS AND ACRONYMS

ACSAD	Arab Centre for the Studies of Arid Zones and Drylands
ADB	African Development Bank
ALESCO	Arab League Educational, Cultural and Scientific Organization
AOAD	Arab Organization for Agricultural Development (LAS)
ARC	Agricultural Research Corporation
ARRC	Animal Resources Research Corporation
BADEA	Arab Bank for Economic Development in Africa
BNF	Bio-Nitrogen Fertilization
CBD	Convention on Biological Diversity
CGIAR	Consultative Group for International Agricultural Research
CIFOR	Centre for International Forestry Research
CITES	Convention on International Trade in Endangered Species Wild Flora and Fauna
CNS	Sudan's Comprehensive National Strategy for Developme 1992 – 2002
COMMESA	Common Market for Eastern and Southern Africa
CSD	UN's Commission on Sustainable Development
ENRRI	The Environment and Natural Resource Research Institute
FAO	Food & Agriculture Organization of the United Nations
FNC	Forests National Corporation
GATT	General Agreements on Tariffs And Trade
GDP	Gross Domestic Product
GEF	Global Environmental Facility

GMOs	Genetically Modified Organisms
HCENR	Higher Council for Environment and Natural Resources
ICGEB	International Centre of Genetic Engineering and Biotechnology
ICRAF	International Centre for Research in Agro-Forestry
IDB	Islamic Development Bank
IFAD	International Fund for Agricultural Development
IFF	Intergovernmental Forum on Forests
IGAD	Inter-Governmental Authority on Development
IMF	International Monetary Fund
IPCC	Intergovernmental Panel on Climate Change
IPF	Intergovernmental Panel on Forests
IPGRI	International Plant Genetic Resources Institute
IUCN	International Union for the Conservation of Nature
IUFRO	International Union of Forestry Research Organization
LAS	League of Arab States
MAF	Ministry of Agriculture & Forestry
MCAB	Monoclonal antibodies
MEAT	Ministry of Environment And Tourism
MFNE	Ministry of Finance and National Economy
NGOs	Non-Governmental Organizations
OAU	Organization of African Unity
PCR	Polymerase Chain Reaction
RPA	Range and Pasture Administration (MAF)

SECS	Sudanese Environment Conservation Society
SNBSAP	Sudan's National Biodiversity Strategy And Action Plan
SSCP	Single Stranded Conformational Polymorphism Analysis
UNCCD	United Nations Convention to Combat Desertification
UNCED	United Nations Conference for Environment and Development
UNCTAD	United Nations Conference on Trade And Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCC	United Nations Framework Convention on Climate Change
WAO	Wild Animals Ordinance
WB	World Bank
WCGA	Wildlife Conservation General Administration
WFP	World Food Programme
WHO	World Health Organization
WRC	Wildlife Research Centre
WTO	World Trade Organization

UNITS OF MEASURE

Hectare (ha)	= 100 m × 100 m = 2.38 feddans
Feddan (fed)	= 60 × 70 m = 0.42 ha
Square Kilometer (sq.km)	= 1000 × 1000 m.
Milliard cubic meters (md.c.m.) for water	= 1000 million cubic meters
Cubic meter c.m. (for water and fuelwood)	= 1.0 × 1.0 × 1.0

Glossary of Arabic Words/terms

Mahal	Dry years
Haddam	River bank erosion
Sudd	Papyrus swamps in Sudan
Dar	Tribal grazing lands

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EXECUTIVE SUMMARY

Sudan's National Biodiversity Strategy and Action Plan (NBSAP) was finalized mid May 2000. The plan envisages future sustainable development plans to take into consideration the conservation of the natural environment and its constituent biological, ethnic and cultural diversity. As such this concept is very much in line with the country's ideological and political thinking over the preceding decade. The Ten Year Comprehensive National Strategy (CNS) 1992-2002, the Khartoum Treaty of 1997 and Fashoda Treaty of 1998 together with the 1998 Constitution, all recognize and value the ethnic, cultural and resource diversity in the country. NBSAP as such, also comes in fulfillment of Sudan's obligations towards and aspirations to benefit from the Convention on Biological Diversity (CBD). Sudan signed the latter in June 1992 and ratified it in October 1995.

Sudan's NBSAP is presented in three parts: Part I which highlights basic background information and the synthesis of the results of biodiversity assessment, specially conducted for the purpose of developing the strategy. Part II which points out major threats, opportunities and constraints to biodiversity in Sudan. Part III which encompasses strategy, actions, implementation modalities and proposed projects.

Part I is made up of two chapters on background and a synthesis of the results of biodiversity assessment, status and trends.

Part II briefly illustrates some of the major threats, opportunities and constraints pertaining to biodiversity in Sudan.

In Part III the strategy aspires to attain a number of set objectives. The latter are based on several guiding principles that emanate from current political, socio-economic and constitutional happenings. The objectives cover aspects pertaining to biodiversity such as conservation, promotion of awareness, creation of enabling environment for and effecting sustainable utilization, complying with and benefiting from regional and other conventions /agreements Sudan is party to, together with essential legislative actions. A number of opportunities conducive to the realization of the strategy and possible impediment constraints are enumerated. Twelve projects (summarized in table 8) are proposed to achieve the objectives of the strategy. Funding for the projects is envisaged from Sudan Government with substantial contribution from the donor, development partners and international community. An implementation modality and a time frame together with monitoring and evaluation schedules are proposed at the end of the strategy.

The strategy stresses on the need for building a critical mass that can contribute essentially to the sustainable development and conservation of biodiversity.

To fulfill this objective, the strategy proposes several projects that emphasize conservation of biodiversity while building capacity and taking legal measures to preserve the indigenous knowledge and resources of flora and fauna.

The HCENR adopted a wide consultative and participatory approach in preparing NBSAP. The approach was followed throughout; from conducting the base studies and assessment, through the synthesis of results, organization of various fora for the discussion thereof, involvement of federal and state authorities, professionals, researchers and NGOs. The process culminated in summoning a task force to put the NBSAP together. The draft was presented to two renowned reviewers and was finally presented to a well-attended workshop. The task force incorporated the comments of reviewers and the outcome of the final workshop into the document. The NBSAP PC and IUCN-EARO team of the project reviewed and abridged the document to produce to the final version.

PART I

BACKGROUND TO BIOLOGICAL RESOURCES IN SUDAN

1. PHYSICAL, SOCIAL AND ECONOMIC FEATURES OF SUDAN

1.1 Introduction

The Sudan is a vast country extending gradually from the desert in the north, with hot dry climate and almost no vegetative cover, to the African Sahel Zone in the center, with light and dense Savanna, and to the sub-tropical region in the south with heavier rains and dense tree cover. This endows the country with various environments and different agricultural systems.

The Sudan is an Afro-Arab country well-placed geographically, median among the Arab countries in North Africa, the Arab countries across the Red Sea and the countries of east, central and west Africa. In this respect, the country serves not only as a bridge facilitating trade and human movement, but also as a melting pot of African and Arab cultures. The country by size and diversity is Africa in miniature with complex cultural, ethnic and religious entities. With 2.5 million square kilometers (sq. km.) in area, Sudan is the largest Arab and African country. It enjoys extensive arable land, estimated at some 85 million hectares (ha) (1ha = 2.38 feddans), that can mostly be rain cultivated with rainfall varying from about 50 millimeters (mm) in the extreme north to more than 1500 mm in the extreme south. Thanks to the extensive rains, most of central and all southern Sudan are largely covered with forests and grasslands, estimated at some 66 million ha. The Nile River with its various tributaries crosses the country from the south to the north with an annual flow of some 84 milliard cubic meters (md.c.m.), Sudan's share of which is 18.5 md.c.m. at Aswan. The country is also well endowed with underground water, which has hardly been tapped, in addition to numerous seasonal rivers outside the Nile Valley, which need to be controlled and regulated to maximize their utilization. These natural resources have allowed the build-up of a national herd of livestock, estimated at some 116 million head of cattle, sheep, goats and camels, as well as several million wild animals. The Nile Valley and the Red Sea are also rich in fish and aquatic life constituting a tourist attraction in addition to their role in food security. The country is becoming well known for its rich mineral resources, which include oil, gold, iron, lead, chrome, asbestos...etc. Indeed a 1600 kilometers of pipeline, Bashair Sea Port, Khartoum Refinery and other installations have been completed and the export of crude oil began on 30th August 1999. That of refined products is to commence early May 2000.

1.2. Ecological Zones

Harrison and Jackson (1958) have ably described the vegetation of the Sudan. Harrison and Jackson (1958) classified the vegetation ecologically into five major divisions. The Vegetation of the Sudan could be divided into the following zones:

Table (1): Ecological zones of Sudan.

Major division	Sub-division	App. Area square km.
I- Desert	-	726000
II- Semi-desert	*Acacia tortillis* – Maerua *crassifolia* desert scrub	187000
	Semi-desert grassland on clay	104000
	Semi-desert grassland on sand	86000
	Acacia mellifera - *Commiphora* desert scrub	86000
	*Acacia glauc*ophylla - Acacia *etbaica* scrub	31000
III- Woodland Savanna	low rainfall on clay soils	
	Acacia mellifera thornland	96000
	On dark cracking clays	52000
	On soils formed in situ with *Commiphora* and *Bascia*	
	Acacia seyal – Balanites savanna woodland	119000
	anogeissus – Combretum savanna woodland	49000
	On sand	
	Acacia seyal savanna woodland	65000
	Combretum cordofanum-Albizzia	86000
	Terminalia- Sclerocarya- Anogeissus-Prosopis	65000
	Special areas	
	Toposa area	36000
	Hill catenas	70000
	Baggara catena	18000
	Ragaba catena	34000
	High rainfall	
	Anogeissus-Khaya-Isoberlinia savanna woodland	311000
	Woodland savanna recently derived from rain forest	36000
IV. Flood region	*Cyperus papyrus* swamps of the "*sudd*" and "*toich*" area with *Hyphaene thebaica, Borassus aethiopum, Acacia seyal, A. siberiana* and *Balanites aegyptiaca* among the tree species.	25000
V. Montane vegetation	The montane areas include the Dongotona and Didinga Hills, the Immatong Mountains, the Red Sea Hills and Jebel Marra.	6500

1.3. Population

The total population of Sudan is estimated at 30 millions (1998). The annual rate of the increase in population is one of the highest in the Arab Region (about 2.7%), but the geographic density is one of the lightest; 12 persons per square kilometer, on average, varying from one state to another. The demographic constitution of the population is leaning towards the young generations offering adequate labor force. The latter (the age bracket between 10 and 64) totals about 16.6 millions, of whom about 7.9 millions are resident in the northern states. Among those 6.6 million are employed, leaving some 1.3 million unemployed, an unemployment rate of 16.6%.

Sudan was a leader among African and Arab countries in establishing education facilities which date back to the end of the 19th century. Primary education is well spread (up to 8th grade) and shall be universal by the year 2002. There are some 42 universities and higher education institutions, most of which have been established after 1990. Currently, only 20% of the students are enrolled for technical education. Plans, however, are underway to increase this ratio up to 60% to match the demand triggered by the enormous investments in industry, mining, communications and modern technology.

1.4. Water Resources
1.4.1. Rainfall

Summer is the main rainy season, extending from May to October, with precipitation ranging between less than 50 mm in the extreme north to more than 1500 mm in the extreme south. The rainfall, however, is characterized by significant variations in distribution as well as in timing and location thereby magnifying the risks of localized crop failure. To avert this risk, mechanized rainfed production schemes have been spread all over central Sudan. Apart from agriculture, the rains replenish the underground reserve and provide the scattered wadis and water points with annual quantities to support the enormous wealth of livestock and wildlife.

1.4.2. Nile water

Sudan is a meeting point of river tributaries that emanate from the Ethiopian plateau and the region of the Great Lakes. The Blue Nile with its tributaries, Dinder and Rahad, flows from the east annually providing some 54 md.c.m. The Atbara tributary adds another 12 md.c.m. On the other hand Bahr El Jebel commences from Lake Victoria with permanent rains, but the greater part of the runoff is lost in the *Sudd* area inside the Sudan. The Sobat River, which joins the White Nile at Malakal, flows from the Ethiopian plateau and is fed from tributaries inside and outside the Sudan. Almost all the water flow of Bahr El Ghazal River (estimated at 14 md.c.m.) to join the White Nile at Lake No.

The big variation in the Blue Nile and River Atbara flow between the high river during the flood season and the low river during the months from March to

May, has necessitated the construction of dams to store water for irrigation and for the generation of hydroelectric power. At present, there are three dams: Sennar (1 md.c.m.), Roseires (3.4 md.cm.) and Khashm El Girba (1.3 md.c.m). However, the accumulated silt in the dam lakes has reduced the storage capacity by 25% in Roseires dam and by 40% in both Sennar and Khashm El Girba dams. Thus, heightening the Roseries dam to increase the storage capacity to 7.3 md.c.m. and constructing Siteit Dam across upper Atbara River to install additional storage capacity for irrigation projects are being seriously considered by the Sudan Government.

Sudan is now utilizing about 14.6 md.c.m. of its share of the Nile water for irrigation, of which 9.5 md.c.m. are from the Blue Nile, 1.7 md.c.m. from River Atbara, 1.8 md.c.m. from the White Nile and 1.6 md.c.m. from the River Nile. The heightening of Roseries Dam and the construction of the new dams will enable the country to utilize a reasonable portion of its share.

1.4.3. Seasonal surface non-Nile waters

These include El Gash seasonal river which has an annual runoff of 600 million cubic meters (m.c.m.) and Khor Baraka with 500 m.c.m., in addition to about 40 smaller riverlets or wadis scattered all over the central plain, providing about 6.7 md.c.m., which was collected through soil dams and hafirs to be sustainably utilized.

1.4.4. Underground water

The water bearing rock strata comprise the Nubian Sandstone, the Um Rwaba Series and the basement complex which cover, respectively, 28.1%, 20.5% and 9.1% of the total area of the Sudan. The preliminary surveys are continuing to determine the underground water quantities to be sustainably utilized. Research is on-going to verify the actual amounts to be used for domestic purposes and irrigation.

1.5. Infrastructure

The development of the infrastructure is highly important for the Sudan because of its extensive area and diverse environment and agricultural systems. Thus, the railway lines draw their importance as lifelines connecting south, west and north Sudan to the main port on the Red Sea coast. The railway in the Sudan is the oldest on the continent and the longest, extending for 4570 kilometers (km) and together with the branch lines constitute some 5500 km.

The total length of the permanent roads in the country is estimated at 50000 km, of which 1700 km are tarmacked and work is underway on a number of intra-state highways.

Sudan Sea Line, which is government-owned, has a number of vessels for the transport of commodities and passengers around the world. Apart from Port Sudan; the main port, other ports are being rehabilitated and developed such as Suakin, Ausif and Bashair from which petroleum products are exported. The communication sector has developed significantly thanks to the introduction of modern technology.

1.6. Economy

The livelihood of the population and the source of internal and external trade is based on primary commodities. Over 80% of Sudan's employment takes place in the agricultural sub-sector of the economy and the contribution of this sub-sector has been the highest for the last four decades, at least. Again, 97% of Sudan export trade is in the form of low value primary commodities or agro-based industrial production. Sudan's principal exports are cotton lint, groundnuts, sesame seed, gum Arabic, sorghum grain, livestock, hides and skins together with cotton seed cake and meat.

Agro-based industrial production includes such goods as flour, sugar, biscuits & sweets, tomato paste, animal feed concentrates, vegetable oil, starch & glucose, spinning & weaving and leather work.

Forest products go directly to the household and to small enterprises. The household gets its energy requirements and building materials. The small enterprises receive energy in the form of wood for brick making and furniture timber. The non-wood forestry products are numerous and have mainly food and handicraft values. The most important non-wood product is the gum Arabic, which has an export value and fetches a handsome income of foreign currency.

Livestock export has accelerated in recent years as a result of demand in the Arab region. Its contribution to the GDP is increasing. It has reached about 23% in 1998.

From the above description it is evident that biodiversity is the source of Sudan's present wealth and the driving force of its economic activity. Although Sudan has started producing and exporting petroleum, it will continue to depend on commodity production for some time to come.

This situation means that Sudan has to very carefully conserve the sources of its present wealth in plants and animals. At the same time, and while developing and exporting its oil wealth, Sudan has to avoid and control the pollution hazards associated with the industry both in the hinterland where production takes place and the Red Sea coast where the export terminals are located.

1.7. Social Setup

Sudan population, at present, is estimated at 30 million. The growth rate is about 3.0% and the doubling time is 20-30 years. Population density is low but the distribution is not even. About one third of population is found on less than 7% of the land area and many parts of the country not occupied.

In many of the inhabited parts it appears that population has approached the carrying capacity of the environment under the prevailing agricultural and animal production technology. The recurrent conflicts between cultivators and herders, particularly in the arid zone, is an indicator of both degradation of resources as well as the growth of the human and livestock populations.

At the present the population of Sudan lives off land resources and their biodiversity. This takes the form of rainfed and irrigated agriculture, wood and non-wood forest products and livestock production. The agricultural sector contribution to GDP is about 40%, which is high compared to other developing countries. This is clear indication of the role of biodiversity in the livelihood of the population. There is growing sense of commitment to the conservation of resources at various levels of the society. The experiences of drought and desertification and displacement have taught the ordinary citizen that his livelihood is vulnerable if he continues to adopt his present survival strategies, which are becoming environmentally unfriendly. Changes have been made in the management of rural resources in order to cope with the new situation.

1.8. Legal and Institutional Aspects

There are several laws, acts or ordinances that deal with the environment, either for protection or conservation. What characterizes the current environmental legislation in Sudan is that it is sector based. Thus we have environmental legislation dealing with land tenure health, forestry, wildlife, fisheries, agriculture, livestock, public health, etc. The sectoral legislation is closely connected to the structure of the government ministries, departments and parastatal corporations.

The legislation has mainly regulatory powers of harvesting some resources and powers of penalty for violation. The essence is both protection and conservation. The sector legislation is in some respects a reflection of the terms of reference of the different ministries and their internal structures.

It may be said that sector-based environmental legislation has been satisfactory for a long time, perhaps up to the early 1980s. The widely observed environment degradation, which arises from the use of resources, has given grave concern and raised the question of the necessity of integrating the work or programs of the different ministries to achieve much needed conservation through integration of planning and development activities in the fields of agriculture, range, forestry, rural water development and veterinary services.

The Higher Council for Environment and National Resources (HCENR) came into existence in 1990. The establishment of the council was in response to the country's internal environmental challenges and in fulfillment of Sudan's international post UNCED commitments.

The council's main role is coordination between the different ministries, which have protection roles of Sudan's resources, the manner of their development and their sustainable use. The council is under the minister of Environment and Tourism. The creation of the ministry is the response of Sudan Government to commitments arising from the UNCED.

The present need in terms of legislation is to advance the protection of resources phase into a phase of conservation and sustainable use. An initial step has been made in this regard by the promulgation in March 2000 of the Environmental Policy Act. The new act is now in force. The new law empowers the council with additional coordinating roles, requires that environmental impact assessment be part of the planning of big development projects and stipulates that environmental awareness becomes incorporated into the general and higher education curricula.

There is still room for further improvements in the institutional structures of the federal system of government. The most urgently needed is the clarification of the roles of the different levels of the government system with respect to responsibilities for planning of development. These levels are the central or federal, state government, provinces and local government units. Precise roles for these levels are yet to be developed and implemented.

Experience showed that each level claims full jurisdiction over the resources. The conflict was very clear in the case of forest resources as these, at present, represent, an invaluable source of the much-needed revenue at state level.

There also remains the question of the existing sectoral environmental legislation. Two issues need attention 1) should that legislation remain federal as it had originated? or 2) should it be amended and passed down to the states in accordance with the obligations given to them by the federal structure?.

2. THE STATUS AND TRENDS OF BIODIVERSITY IN SUDAN

Even though Sudan is rich in its diversity of ecosystems, habitats, species and genetic resources, no coordinated, comprehensive surveys or assessments have been carried out. Most surveys and studies on biodiversity components were fragmented and were tailored for limited academic or research and scientific purposes. Data collected or information gathered have most of the time been site-specific, local and at the particular institutional levels. However, indicators and observations show that there is a declining trend and diversity loss in many components. The BSAP assessment was carried out by multi-disciplinary teams. The BSAP project has taken the initiative of updating the information on biodiversity.

The recent biodiversity countrywide assessment undertaken by NBSAP project even though not very comprehensive, it constituted a benchmark and a base of information for the different ecosystems, habitats and species.

The effort made was to update the information on the different biodiversity components but future monitoring and filling in of the gaps in knowledge is imperative.

2.1. Agriculture

Let us not forget the indigenous fruits and vegetables, such as kursan and okra, which have saved us from starvation in times of drought. We must conserve and utilize the existing biodiversity that are the riches of Sudan.

In the Sudan, many plant species are grown to meet the demands for food, shelter, clothing, medicine and fodder. Some of these species have been grown in the country for a very long time, while some are recent introductions. Both cultivated and wild types of some species are known in the Sudan, while for other species only cultivated varieties are present. Diversity is observed within both cultivated and wild types constituting a wealth of genetic resources that need to be well conserved. This is true for both field and horticultural crop species in Sudan as described in the following.

2.1.1. Field crops

The list of field crops grown in Sudan is a long one. It includes cereals, oil crops, grain legumes, fiber crops, forage crops and others.

a. Cereals

The cereal crops grown in the Sudan are sorghum, pearl millet, wheat, maize, rice, finger millet and barley. Several authorities consider Sudan as a center of origin for sorghum (*Sorghum bicolor)*. The Sudan flora includes all the three wild sorghums believed to be the progenitors of cultivated sorghum (viz. *S. aethiopicum, S. verticilliflorum,* and *S. arundinaceum)*. It is the home of *S. sudanense* (Sudan grass) which attained international importance for forage.

Through centuries, Sudanese farmers have developed and conserved diversified varieties of sorghum well adapted to the conditions where they evolved. At present, such variability is observable in different regions of the country. In Darfur, for example, the grain sorghums grown are classified by farmers into three groups: the short season early maturing ones referred to as "Najad", and two late season groups, one is used for brewing and known as "Mareig", and another used as flour and known as "Fasikh". A list containing 118 farmers' varieties was reported indicating types of sorghum grown in south Kordofan (Kadugli area) only. Such list can be taken as a good example of the diversity of this crop in just a very small part of the country. These landraces are being replaced by new high yielding varieties developed and released by the Agricultural Research Corporation (ARC).

(i) Pearl millet

(*Pennisetum glaucum)* is another important cereal food crop in Sudan especially in the western parts of the country. Western Sudan is believed by some to be a center of origin for this crop. About 18 wild species of *Pennisetum* are found in the country. Genetic resources of this crop in Sudan include a variety of landraces grown by farmers mainly in Darfur and Kordofan states. In Kordofan for example local pearl millet varieties are classified into seven groups according to seed and head characters, mainly.

(ii) Wheat

(*Triticum aestivum)* constitutes an important food crop in Sudan. In the past, it was only produced in the northern region, which is considered as the traditional production area of wheat in Sudan. Old landraces of this crop in the northern region were eroded and what is cultivated now as local (*Beladi*) is either a mixture of unknown old and new cultivars or an old exotic called "Hindi 62". An old landrace of wheat known as Abu Ali having specific characteristic morphological features is currently seen as a rare off-type in wheat fields. Another traditional area of wheat production in Sudan is Jebel Marra area in Western Darfur State. A number of improved wheat cultivars have been released for production in northern, central, eastern and western Sudan.

(iii) Maize

(*Zea mays*) is another cereal crop introduced to Sudan and produced in different regions on a limited scale for local consumption. The grown cultivars of this crop are mainly variable local landraces as is the situation in the northern, central, western and southern parts of the country. Some improved varieties were introduced from Egypt, Syria, CIMMYT and South Africa for commercial production.

(iv) Rice

(*Oryza sativa*) although grown on a limited scale in Southern Darfur, Bahr El Ghazal and White Nile states, wild rice varieties are known to be found in water-logged swampy areas mostly in the "*Sudd*" region of southern Sudan. It is well known that wild red seeded rice is found in Radom area in Southern Darfur State.

(v) Barley

(*Hordeum vulgare)* is cultivated in some few pockets in Northern and Darfur states. Wild species were found in small pockets in the upper terraces of Jebel Marra.

(vi) Finger millet

(*Eleusine corocana* Gaertn*)* is cultivated mainly in Western Equatoria State. Due to its cultivation there for a long time, many adapted local cultivars have evolved. Some wild species are also known in Sudan like *E.indica* and *E.flagellitera*. The former is believed to be the progenitor of the cultivated species.

b. Oil crops

The most important oil crops grown in Sudan are sesame and groundnut. In the recent past, the country witnessed an expansion in the areas under sunflower. Large amounts of oil are extracted from cottonseeds.

(i) Sesame

(*Sesamum indicum* L.) is grown in Sudan under rain-fed conditions by subsistence, and semi-commercial farmers. Selection by subsistence farmers resulted in many landraces adapted to different ecological areas. Three wild relatives of sesame were recognized in Sudan viz. *S.alatum*, *S.latifolium radiatum* and *S.anguistifolium*. The existing wide variability in the cultivated landraces and the wild species make Sudan an important area of sesame genetic diversity. New improved cultivars of sesame are being released for production especially in the central and eastern Sudan.

(ii) Groundnut

(*Arachis hypogea* L.*)* is another important oil crop grown in central, eastern and western regions of Sudan. It is believed to have been introduced to western Sudan by West African immigrants about two to three hundred years ago. Farmers' varieties previously grown in that area were of the runner type locally known as "*Abu Hibilat*". Unfortunately, such type is thought to have disappeared and it is difficult to collect it. The earliest forms of groundnut introduced in Sudan belonged to the sub-species *hypogaea*. Small-seeded runner types were established on the sandy soils of western Sudan and the bunch types were grown along the Blue Nile on heavy clays. These two groups of groundnut formed the landraces in Sudan. As a part of improvement program, new varieties belonging to the subspecies *fastigiata* were introduced.

(iii) Sunflower

(*Helianthus annuus* L.) is an oil crop that has started to occupy large area of production in Sudan since late 1980s. The varieties grown are hybrid varieties whose seeds are annually imported.

(iv) Niger

(*Guizotia abyssinica* Cass.) is a member of the family *Compositae*, and is an important oilseed crop in Ethiopia and parts of India. It was introduced to the Ingessana area from Ethiopia where it is grown on a limited scale. Andrews

(1956) recorded three of the known five wild species of the genus in the Sudan.

(v) Safflower

(*Crathmus tinctorius* L.) has been cultivated in the Nile valley for about 4000 years. It was introduced to the Northern State at a very early date, but has been on very limited scale. A collection from this area (N852) is the ancestor of the best varieties now being grown in U.S.A.

Only one species of *Crathmus*; namely, *C. persicus* (*C. leucaulos*) was recorded as occurring wild in the Red Sea Hills by Andrews (1956).

(vi) Castor

(*Ricinus communis* L.) is a potential source of vegetable oil in Sudan.

c. Grain legumes

The grain legumes constitute important food crops in Sudan. Several species are grown in Sudan including winter-adapted species and summer-adapted ones. The main winter-adapted crops include faba bean, haricot bean, chick-pea, lentils, lupin, and pea. The summer-adapted species include cowpea, pigeon pea and hyacinth bean. Some other legumes are grown on a very limited scale, of which the bambara groundnut is the most important.

(i) Faba bean

(*Vicia faba* L.) is the major winter-adapted cultivated legume grown in Sudan. It is grown in the Northern and Darfur states. The Northern and River Nile states produce 90% of the total production. The varieties grown are primarily landraces named after the localities of production like Aliab, Zeidab, and Agabat. In Darfur, faba bean is produced mainly on the upper terraces of Jebel Marra and the northern parts of the region where the climatic conditions are suitable for its production. Varieties grown there are mainly local cultivars introduced from the northern states. ARC including selections from the local "Beladi" type released a number of improved cultivars. The local cultivars are highly adapted and are strong competitors yield-wise to the released varieties.

(ii) Haricot bean

(*Phaseolus vulgaris* L.) is grown mainly in the River and Nile states. It is grown also on the lower terraces of Jebel Mara and in Northern Darfur State. Cultivars grown are generally landraces known as "*Beladi*". The ARC has released three improved cultivars for farmers.

(iii) Chick pea

(*Cicer arietinum* L.) is mainly produced in the River Nile State. It is also cultivated on the upper terraces of Jebel Marra and the northern parts of Northern Darfur State, and in El Hawata area of Gedarif State. Cultivars grown by farmers are landraces known as "*Beladi*". Although a number of improved cultivars were released to farmers, they still grow their local landraces.

(iv) Lentil

(*Lens culinaris* Medic.) is grown mainly in the River and Nile states (Rubatab area). Farmers grow a variety called Selaim. The ARC released three

improved varieties for farmers. Lentil is also grown in Darfur states, on the upper terraces of Jebel Marra area and the northern parts of Northern Darfur State.

(v) Lupin

(*Lupinus albus*) is a crop of minor economic importance grown in the Northern and River Nile states. The cultivated material is absolutely local landraces. As other winter-adapted legume, lupin is grown in Jebel Marra area and in the northern parts of Northern Darfur State.

Among other winter-adapted grain legumes grown in the northern states and Northern Darfur State is the pea (*Pisum sativum* L.)

(vi) Cowpea

(*Vigna uniguiculata* (L) Walp.) is among the most important summer adapted food grain legumes. It is believed to have been introduced from West Africa to the western parts of Sudan. This has resulted in a considerable diversity of cowpea types especially in Kordofan states. In Darfur states, it is usually grown inter-cropped with cereals using mainly two local varieties known as "*Hineteer*" and "*Gambaro*".

(vii) Pigeon pea

(*Cajanus cajan* (L) Millsp.) is another important summer-adapted grain legume grown in appreciable areas in northern and central Sudan. It is also grown on small scale in Darfur states. The cultivars grown are local landraces

(viii) Hyacinth bean

(*Lablab niger* (Medick)) is grown on extensive areas in the River Nile, Northern and Darfur states mainly for fodder, although some is harvested for bean.

(ix) Bambara groundnut

(*Voandzeia subterranea* L. Thouras) is a minor leguminous crop in western Sudan. It is grown mainly in Northern Kordofan, and Western and Southern Darfur states. It is believed to have been introduced there by immigrants from West Africa. Cultivars grown are mixtures of several different lines originating from the original early introductions.

d. Fiber crops

Several plant species are used in Sudan as fibre producing plants. More than 30 species, indigenous to Sudan, are used for fibre production. Most of them grow wild, and the most widely used is perhaps the Dom palm (*Hyphaene thebaica*). The most important fibre crop grown in Sudan is cotton, while kenaf and sisal are potential crops worthy of mention.

(i) Cotton

(*Gossypium* sp. L) growing and spinning in Sudan seems to date back to a period before the Christian era. True wild cotton species were reported in Sudan, namely, *Gossypium somalense* and *G. anomalum,* both are lintless and perennial. There are also some local cultivars of *G. arboreum* that could be collected in various parts of Blue Nile, Equatoria, Darfur and Kordofan states. *G. herbaceum* var. *africanum* also existed in those same areas.