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Economic Benefits of Biodiversity in Sudan[1]

Contents

[1] Sudan (2001). Sudan Country Study on Biodiversity, Ministry of Environment and Tourism, April 2001, 272 pp.

Introduction

The natural resources of Sudan continue, as they done for centuries, to provide livelihood and the base of Sudan economic activity in the form of rain cultivation, Gum Arabic collection, livestock production, bio-mass energy and building material. Sudan economists refer to this activity as the traditional sector. The modern sector comprises both the mechanized rain fed agricultural and in the irrigated production of the clay plains bordering the river system and irrigated by gravity-flow from the Nile system. A substantial proportion of GNP is derived from traditional sector production.

The pressure on land resources accumulated over the generations has continued unabated. The first reason is due to high rates of the growth of human and animal populations. The second cause is the inability of the economy to provide other production alternatives. Degradation of Sudan resources has reached crisis proportions and fighting desertification is now high on the national agenda.

1. Economic History

In 1821 the Khedive of Egypt conquered Sudan, ostensibly to annex the territory to the Ottoman Empire. The invasion opened Sudan resources to the international capitalist market. The desired primary commodities for export were Gum Arabic, sesame seed, ivory, ostrich feather, senna and tamarind. These were exchanged for manufactured goods.

To tap the rich resources of the tropical vegetation of southern Sudan, the Khedive sent two expeditions in 1839 and 1841 up the Nile to traverse the Sudd swamps. These expeditions and the introduction of the steamboat on the Nile opened the way for spates of European explorers, savants, adventurers and traders. By 1882, a total of 71 Europeans (34 British, 13 French, 10 Germans, 4 Italians, 3 Portuguese, 2 Americans, 2 Austrians and a Hungarian) travelled up the Nile in the quest for the source of the river and the mapping of its basin (Johnson 1906).

The reports and diaries on these journeys contributed very useful botanical information. The most important is perhaps that of G.A. Schweinfurth who travelled in the eastern Sudan and Bahr el Ghazal between 1868-71 and T. von Kotschy who travelled in western Sudan 1857-68. Their accounts were systematic and economic botanical studies.

By the mid-1850s Khartoum was a bustling city, teeming with European consuls, merchants and their local agents. A Chamber of Commerce was established in 1862. In the same year the volume of Gum Arabic trade from Kordofan was 50 thousand quintals worth 40 thousand pounds sterling.

The British imperial interest in Sudan was lured, on the political side, by the desire to protect the route to India, the jewel of the empire, and on the economic side to beat the American cotton cartel, under whose mercy the Lancashire textile mills fell. Cotton was produced in Sudan under the Khedive rule by flush irrigation in the inland river deltas of Eastern Sudan.

A German savant visiting Sudan in 1843 entertained the idea of growing cotton by irrigation in the vast fertile clay expanses bordering the Blue Nile were cleared of their vegetation and became a vast cotton estate. The large-scale operation was dictated by economic considerations to assure its success. The total rotational area began with 300,000 but reached two million by 1859. The removal of the semi-desert scrub and tree vegetation dictated in 1928 the introduction Eucalyptus and Prosopis tree species as planted species to produce wood fuel.

The economy of scale was again introduced during the Second World War in the clay plains of East Central Sudan to produce under rain food grain and oil seed to feed the Allied troops in the Middle East. The wide-level disc plough and the seed-drill, copied from the Canadian prairie experience, was a great success and the state-controlled operation was quickly privatized and millions of feddans of forests and woodland were given away. The mechanized crop production schemes became part of Sudan modern economic sector, utilizing monetized inputs, similar to cotton production. The area expanded rapidly into the Blue Nile and Southern Kordofan clay plains.

The economy of scale has continued to be a model for Sudan development despite its two obvious disadvantages: mono crop culture and deforestation. The academic community from the economic, the agricultural and the environmental points of view questioned the wisdom of the economy of scale.

Economists were weary of a whole economy based on cotton export and called for diversification of commodity production. The agricultural viewpoint also favored diversification, which it believed was possible through the variety of agricultural environments. Commodity diversification could be achieved through agro-ecological specialization: intensifying the irrigated crop rotation, devoting the low savanna on clay to food grains and oil seeds, the high rainfall savanna to short-staple cotton and the tropical equatorial red loam soil to plantation crops.

Unfortunately Sudan had a history of interrupted economic development plans mainly as a result of political instability. Commodity diversification and utilization of the agro-ecological potential did not progress beyond the drawing board. The lack of continuity in economic planning resulted in fiscal deficits, which brought Sudan economy under the IMF umbrella of structural adjustment since 1978. In simple terms the prescription meant more exports of primary commodities which effectively brought more pressure on land resources. The traditional pressure on land as a means of survival and subsistence has been increased many folds, over a very short period of time. The net result was the acceleration of an already deteriorating environment.

The structural adjustment economic policies and the need for more food grain production had far-reaching environmental implications. The export commodities of sorghum, oil seed, gum Arabic and livestock are derived from the horizontal expansion of the present activities of the traditional rain fed agricultural sector. Millions of feddans of natural forests and rangeland are lost each year. The horizontal expansion for the production of these primary commodities led to strip-mining of the natural resources of grazing and forest in particular.

2. Economic Development Planning

The Gezira development experiment set a very good economic and management example for the economy of scale as a model for Sudan social and economic development. Between 1960-1970 economic development planners have identified and dealt with two Sudan economic sectors: the modern and traditional. The former received capital investment, mostly in the central irrigated and eastern rain fed clay plains, to increase its growth and productivity. The latter, the traditional economic sector received investment in the form of services rather than capital for expansion or modernization. It had been assumed, for at least the decade of the ten-year plan 1960-1970 that the traditional sector grows annually at the comfortable economic rate of 3.3% without recourse to input, similar to the modern sector.

The importance of the traditional sector was recognized in 1975. It had been realized that it does contribute to GNP, provides employment for 80% of Sudan work force and that its neglect had led to regional growth disparities and imbalances. These have social and political costs. Unfortunately investment and development in this sector did not appeal to the international, bilateral or private financial institutions.

Between 1973—1978 investment credit was available from Arab countries, international, bilateral and private sources. The greater portion of this financial inflow was handled by the public sector. Shortage of energy and transportation difficulties frustrated the planned development. Very poor results were made and some projects did not make a start. The Sudanese currency had to be devalued. Sudan economy was simply unable to absorb or cope with the flow of investment. It lacked the infrastructure, energy, transportation, communication and manpower. The migration of Sudanese academics, professionals and skilled labor to the Arab countries had begun at about the same time.

Sudan economy had been under various IMF Structural Adjustment Programmes for the past two decades. Political instability has undermined these treatments and no tangible results were made. No expansion in irrigated agriculture took place in two decades. The unexpected result of the situation was the emergence of the traditional sector as a strong supporter of Sudan economy. Livestock exports have become a major commodity in the past few years. This sector did not receive direct investment, rehabilitation or subsidies. It is unduly and heavily tapped.

In 1992 Sudan economy went into full swing liberalization. All commodity subsidies were removed together with import controls and pricing. The only two regulations, which remain are controls over wages and foreign currency transaction. Sales of public sector enterprises commenced.

Rain fed crop production now covers some 50 million feddans. Natural forests are heavily harvested. The annual replanting is very modest compared to the areas harvested. It is in the order of 80,000 feddans annually. Livestock exports accelerated. The environmental debit of continuous expansion of the traditional sector production is huge.

3. The Debt Burden

Sudan has accumulated a respectable record of foreign debt. The majority occurred during the years 1973-1979. Up to 1989, there were many rounds of debt scheduling and rescheduling. Borrowing more or less ceased since 1983. These paved the way for limited borrowing to rehabilitate the irrigated sector enterprises. The traditional sector did not receive rehabilitation funding. Its output is export commodities that would offset the investment.

After 1992 Sudan resumed actively debt repayment. These did not attract the desired flow of investment or fresh loans. Sudan relationship with IMF is under constant review. Debt repayment has so far been made from Sudan natural resources base this debt may be looked upon as an environmental debt.

4. Drought Displacement

The aftermath of the 1984 famine disaster in North Kordofan, North Darfur and the Red Sea has not been fully evaluated. The political change over in 1985 has unfortunately delayed that. The euphoria over the return of political pluralism shifted the national agenda to the protection of democracy.

The UN agencies and the international NGOs shouldered the provision of emergency relief. They by virtue of their presence in the field have acquired experience on the effects of drought far better than Sudan government units. NGOs and the UN agencies have also contributed training of their national staff in emergency preparedness and handling.

5. War Displacement

Some sixteen camps of the war-displaced persons exist around Khartoum State alone. The total population is some 1.6 million. The NGO community and Unicef provide the basic services such as clean water supply, sanitation, primary health care, maternity and child health and nutritional support. Other displaced camps also exist in other big cities. The future of these camps is not known. It has not yet been contemplated.

6. Desertification

The National Drought and Desertification Unit (NDDU) has recently released figures on the extent of desertification. Using the geographical information system with six indicators (rainfall, vegetation, geomorphology, land use, water sources and population) the new data update Sudan ecological zones which have been fixed previously by climatic and vegetation data. The data further give the areas affected and assign desertification classes within each ecological zone between 10-18°N, as part of the requirements ofthe Convention to Combat Desertification.

Some 32.9% of total area is affected by desertification. In addition, the new data show from combination of rainfall and a normalized index of vegetation differences, that the Nubian sandstone,

Qoz soil and alluvial deposits are most vulnerable to desertification. One third of Sudan or a total of 0.42 million km^2 north of latitude 10^0 is affected.

7. Direct Economic Flow

7.1 Forests and Woodland Resources

In Sudan reserved forests alone cover an estimated area of about 20.million feddans (50,000km^2).These woodland resources constitute a major source of economic benefits to the household sector and the small enterprises and industries such as brick making, bakeries and furniture industries. The household sector generates benefit from wood and non-wood products. The small industries only require wood for energy.

Table 1. 1993—Estimated household demand for wood in m^3

Category	Type of demand					Total
	Charcoal	Firewood	Cosmetic	Construction	Furniture	
1993 Demand						
Urban	4,117,717	1,088,823	111,943	271,171	117,130	5,706,784
Rural	2,036,624	4,542,948	98,083	762,054	123,892	7,563,601
Total	6,154,341	5,631,771	210,026	1,033,225	241,022	13,270,385
Forecasted demand by 2015						
Urban	5,465,699	1,262,282	252,780	384,445	158,212	752,348
Rural	2,703,336	5,266,678	221,484	1,080,382	167,348	9,439,228
Total	8,069.036	6,528,960	474,264	1,464,827	325,560	16,962,642

The reserved forest resources generate sizeable annual revenue to the national budget from sales and taxes. The forestry department produces all the sleepers needed by Sudan railways. They produced the fuel of the Sudan river steamer fleet before the arrival of the petroleum products. There were in the 1930s some ninety wood stations along the White Nile.

An interesting use of wood in Sudan is the women utilization of the smoke Acacia seyal wood as a skin cosmetic. The smoke the skin with a yellowish color and leaves a long lasting and pleasant smell. The demand for this type of wood, being institutionally determined, is price and income inelastic. As such this wood has a wide commercial distribution in Sudan.

The 1993 forest products' survey quantified and forecasted demand into the year 2015. The tables below present rural-urban profiles of wood consumption in 1993 by the households and establishments for different purposes together with consumption forecast into the year 2015.

Table 2. Summarizes estimated urban and rural wood demand.

Table 2. Estimated wood demand (m^3)

Category	Type of Demand	Total

	Charcoal	Firewood	Construction	Furniture	
1993 Demand					
Urban	58,900	63,706	3,924	1,606	128,136
Rural	13,816	40,651	1,681	262	56,410
Total	72,716	104,357	5,605	1,868	184,546
Estimated Demand by 2015					
Urban	94,317	104,440	4,819	1,863	205,439
Rural	22,124	6,664	2,065	303	91,136
Total	116,441	171,084	6,884	2,166	296,575

It is clear from the above figures that in 1993 the households sector consumed 13.3 million m^3 of round timber for different purposes. This figure will be more than doubled by the year 2015. A high rural households consumption share of 57% of total consumption indicates that for the majority of the rural population in Sudan alternative sources of basic household subsistence items (fuel, housing, fencing, and furniture material) are unavailable or unaffordable and that people rely almost entirely on procuring them locally. The share of cosmetic wood in total consumption of 0.6% is very close to the share of furniture of 1.8%. This is an amazing demand pressure on the tree Acacia seval.

The relatively small enterprise and establishments wood consumption of 0.19 million m^3 of indicates that the households sector, particularly in the rural areas, is the main consumer of wood The rural consumption is raw wood and is used for energy and housing The forecasted high demand for wood by the year 2015 does imply forests conservation and management in order for the supply of wood to grow by the same pace of the demand for it.

7.2 Non Wood Products

Non-wood forest products in Sudan have numerous human uses ranging from medicine, food, soft drinks, weaving, furniture, and decoration to cosmetics. In spite of their wide use and their economic benefits to both producers and consumers, data pertaining to production and consumption of non-wood products, with the exception of gum Arabic, is not found in any official records. Gum Arabic over shadowed other non-wood products because it is a very important export commodity. Its annual trade is in-the range of 45 million $US.

The 1 993 forest products survey data presents modest estimates of the production of eighteen non-wood forest products in Sudan. This is in recognition of the growing economic value of these products. They are becoming more and more scarce to their main users, the rural people. To the urban-based populations some of these products are delicacies.

7.3 Livestock

Second to Ethiopia, Sudan has the largest livestock population in Africa. Sudan livestock population comprises of cattle, sheep, goats and camels. Equines are normally not included in census because there is no internal or external trade in them. The table below gives current official estimated livestock

population the period 1995-1997. The figures are largely derived from old census data by extrapolation and field reports (Table 3). The livestock population is shown below in thousand heads.

Table 3. Livestock population in Sudan

Type of livestock	1995	1996	1997	Growth Rate %
Cattle	30,077	31,666	33,102	5.0
Sheep	37,146	37,202	39,835	3.6
Goats	33,319	35,215	36,037	4.1
Camels	2,903	2,915	2,935	0.6
Total	103,445	106,998	111,910	4.1

In 1997 total livestock population was estimated to be 112 million heads, growing at a rate of 4%. The estimate consists of cattle (29.6%), sheep (35.6%), goats (32.2%) and camels (2.6%). The inputs for livestock production are provision of water and vaccination against disease. The cost is paid by the herders. The grazing is free as it is based on the institution of communal land use. Herders pay animal tax to the local authorities.

Over 70% of Sudan population, about 25.6 million, who live in the rural areas directly depend in one way or another on livestock for their daily livelihoods. The remaining 30% urban population benefit indirectly through the multiplier effect.

The figures in the tables below should be taken as indication of the magnitude of milk and meat production. They are by no means correct figures. They are official estimates only and cover what the authorities know from what they reach in a very vast country. Almost every rural household raises the goat. It provides poor households with milk that is not reflected in government books. The figures for meat consumption under estimated actual meat consumption because animal slaughtering away form veterinary inspection and licensing is a common practice in Sudan.

Table 4. Milk production (thousand tons)

Livestock	1995	1996	1997	Growth Rate %
Cattle	4,276	4,370	4,560	4.3
Sheep	440	392	415	5.9
Goat	1,239	1,024	1,026	0.2
Total	5,955	5,786	6,001	3.7

Table 5. Meat production in thousand tons

Type of Meat	1995	1996	1997	Growth Rate%
Beef	171	226	474	88.6
Lamb	144	177	187	14.9
Sheep meat	85	104	109	14.1
Camel meat	218	23	26	22.2
Total	418	530	796	45.2

Apart from the provision of milk and meat goats and sheep are the semi-liquid assets of the poor. These are assets that are easily liquidated into cash to buy non-food consumer items. This is the case in the semi-desert and desert communities. Goats are sheep are liquidated in years of poor cereal production. At the present meat and milk industry is small-scale. Therefore the estimated annual average production of 4.4 million tons of cow milk and 0.3 million tons of beef are in many respects wasted. Both products are sold to the urban consumer. Their prices are lower than the economic value of the biological resources used in producing them. Milk and meat are considered a zero-price input and in this way the producer subsidies Sudan national consumption of milk and meat. Unless such a market failure is corrected. Sudan biodiversity (animals and plants) will continue to deteriorate.

In addition to milk and meat production Sudan livestock produces an annual average of 24.1 million pieces of animal skins of which 12.4%, 42.1%, 45%, and 0.5% are cattle, sheep, goat and camel skin respectively (Table 6).

Table 6. Skin production (thousand pieces) 1995-1997

Type of skin	1995	1996	1997	Growth Rate %
Cattle	1,482	3,604	3,852	80.0
Sheep	9,794	9,968	10,694	4.6
Goats	10,427	10,946	11,186	3.6
Camels	77	109	738	39.6
Total	21,780	24,627	25,870	9.4

The annual average production of 24.1 million pieces of skin represents the non-food economic contribution of livestock to the trade, industrial, and export sectors of the economy. In addition we need to add the value sizeable annual government revenue through the animal tax and zakat systems.
It should he noted that the annual average rate of skin production of 9.4% exceeds the annual average livestock population growth rate of 4.1%. This suggests that livestock population in Sudan decreases at an annual average rate of 5%. Consequently, taking 1997 as a base, if such a rate of animal slaughtering continues livestock population in Sudan will be reduced to half by the year 2010. This is an alarming situation. It calls for immediate correction measure.

Livestock exports whether as live animals or meat have accelerated in the past few years. This is a reflection of the fact that other primary commodities, form both the agricultural and irrigated and rain fed production sectors, for export are in short supply. The high cost of production has discouraged producers. Livestock exports now constitute 23% of Sudan total export earnings.

7.4 Field Crops

Table 7 below summarizes the total areas planted in both the irrigated and rain fed sectors with main field crops for the period 1995-1997.

Table 7. Areas cultivated with field crops (thousand feddans) for 1995-1997

Year	1995	1996	1997	Annual Change %
Cotton	438	589	755	36.2
Groundnuts	2,113	2,580	2,918	19
Sesame	3,206	3,556	5,571	36.9
Sorghum	15,953	12,312	19,773	12
Millet	7,707	5,758	8,492	5.1
Wheat	662	709	809	11
Total	30,079	25,504	38,396	13.8

In 1997 Sudan crop production used a total area of land of about 38.4 million feddans. Half of the total area (51.5%) went for sorghum production, the main staple food. Land for crop production expands at an annual rate of 13.8%. Total crop production amounted to 6.8 million tons growing by rate of 4.5% from the previous. The corresponding increase in the expansion of cultivated area was 13.8%.

The value of the exported commodities is shown below. The fluctuations in the value can be attributed to changes in macro-economic policies. Cotton area was reduced to encourage wheat production and sorghum exports were curtailed as a measure of food security. Export of raw hides and skins was discouraged to promote leather industry and thereby add value to this commodity. Gum Arabic suffered marketing policy problems for three years in succession (Table 8).

Table 8. The export value of Sudan commodity exports

Commodity	Value (Million $US)		
	1995	1996	1997
Cotton bales	123.5	128.2	105.7
Groundnuts metric tons	2.7	1.3	7.1
Sesame metric tons	80.4	141.1	117.3
Gum Arabic metric tons	51.4	29.5	27.0
Sorghum metric	43.9	2.6	No exports
Livestock heads	83.9	81.4	78.2
Hides and skins	20.5	28.7	82.8
Cake meal metric tons	8.4	10.2	15.4
Total	414.2	423	373.5

7.5 Horticultural Crops

More than twenty vegetables are seen in the market. The productivity of vegetables is high. Some 0.33 million hectares produce 2.6 million tons of various types of vegetables. Because of their small-scale production, variety and wide trade distribution, they improve income distribution. Horticulture production also supplies the food industry with raw materials and thereby creates more urban jobs. By virtue of their wide trade distribution and relatively low prices, especially vegetables, they improve the general nutritional standards and offer diet supplementation to the poor.

In recent vegetable and fruit export started to contribute to Sudan balance of payments through growing export revenue.

7.6 Agro-based Industries

The agro-based industrial sector of Sudan is a mirror image of Sudan agricultural biodiversity. The production of this sector supports import's substitution. It also has the potential for expansion. The present agro-based industries include furniture, soft drinks, concentrates, and canned vegetables. Sudan has been self-sufficient from sugar produced locally and surpluses have been exported (Table 9).

Over and above its direct and immediate contribution to national consumption, Sudan agro-based industries multiply its economic role through other economic benefits. These include reduction of external imbalances, urban unemployment and broadening the tax base.

Table 9. Sudan agro-based industrial production 1995-1997

Production	Production Unit	1995	1996	1997	Change %
Flour	Thousand tons	50	254	381	331
Sugar		428	459	505	9
Biscuits		5	13	20	150
Sweets		9	26	40	172
Tomato paste		0.2	1.3	2.1	475
Fodder		12	43	48	150
Starch and glucose		5	6	7	20
Cigarette		1.1	1.7	2.6	68
Vegetable oils		50	100	116	66
Spinning and weaving	Thousand yards	5695	3739	3631	-18
Skins	Thousand pieces	4523	5275	8109	40
Leather and shoes	Million pairs	0.7	5.5	6.3	414

7.7 Sudan Export Trade

Sudan primary commodity production has fetched an annual average export trade revenue of about $403.6 millions. The above figures show that while Sudan volumes of agricultural exports, except cotton, grow at high rates, export revenues grew at a relatively lower rate. In some cases such as Gum Arabic and livestock growth was negative. The overall agricultural export revenue is growing at a negative rate of 4.9%.

The discrepancy between exports and revenues growth rates is a cause for concern. The natural capital Sudan possesses, in exchange for revenues according to the international market forces. The accrued export revenue on the face of it does not seem to recover the full cost of the export commodities. Their value in the international price does not include a maintenance or depreciation cost. These costs are

borne by Sudan in the form an unknown dollar value, which could be termed Sudan environmental resources debt.

When Sudan steps into global trade arena the situation will become harder. The environmental debt will multiply at a fast rate. It will degrade Sudan environmental resource base, at least, at about the same rate of revenue growth.
