

An Assessment of Natural Resources with emphasis on agriculture and food security

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1. Introduction:

By the year 2025, 83 percent of the expected global population of 8.5 billion will be living in developing countries. Yet the capacity of available resources and technologies to satisfy the demands of this growing population for food and other agricultural commodities remains uncertain. Agriculture has to meet this challenge mainly by increasing production on land already in use and by avoiding further encroachment on land that is only marginally suitable for cultivation.

Major adjustments are needed in agricultural, environmental and macroeconomic policy at both national and international level in developed as well as developing countries to create the conditions for sustainable agriculture and rural development (SARD). The major objective of SARD is to increase food production in a sustainable way and enhance food security. This will involve education initiatives, utilization of economic incentives and the development of appropriate and new technologies, thus ensuring stable supplies of nutritionally adequate food, access to those supplies by vulnerable groups, and production for markets, employment and income generation to alleviate poverty, and natural resource management and environmental protection¹.

Statistics on Africa tell us that poverty alleviation should rank at the top of its priorities, since the majority of the population of the continent suffers from low living standards. The vicious circle of poverty leading to environment deterioration and is vice versa regarded as the main obstacle hindering economic growth i.e. the cause and effect relationship between poverty in one hand and environment deterioration and natural resources depletion in the other hand.

This fact sharply reflected in relation to food security. Africa is the only continent suffering from food deficit; and poverty among its population is significant and expected to increase, though it is the most thinly populated continent (249 persons/1000 hectares approximately half the international average - 442 person/1000 hectares).

Compared to the late sixties in 1995 malnutrition was doubled in 1995 (from 100 mill. in the sixties to 200 mill. in 1995). Since 1950 nearly 500 mill. hectares of land were subjected to soil erosion, 65% of which is agricultural land. During less than two decades (from the eighties to 1995) Africa lost 49 mill. hectares of forests. Now 14 African countries experience shortage in water and by 2025 other countries are expected to join the water-deficit ones. African countries do not carry only the burden of foreign debt but also an increasing environmental debt i.e. the cost of diseases cure is greater than the cost of preventive measures. What is applicable to Africa is applicable to Sudan to this or that extend.

2. Promoting Sustainable Agriculture and Rural Development:

¹ United Nations Convention to Combat Desertification (UNCCD), 1994

Like most developing countries Sudanese economy depends largely on agriculture. 70 % of the economic active population of the country work in agriculture. 90% of them live in rural areas. Thus we could safely say rural development necessitates agricultural development i.e. sustainable agricultural development means defacto rural development.

To achieve this goal the priority must be on maintaining and improving the capacity of the higher potential agricultural lands to support an expanding population. However, conserving and rehabilitating the natural resources on lower potential lands in order to maintain sustainable man/land ratios is also necessary. The main tolls of SARD are policy and agrarian reform, participation, income diversification, land conservation and improved management of inputs.

The success of SARD will depend largely on the support and participation of rural people, national Governments, the private sector and international cooperation, including technical and scientific cooperation.

Among other, the following are the main factors that impede agricultural development: drought and desertification, soil degradation, deforestation, unplanned expansion of rain-fed and irrigated crop production at the expense of range land, lower potential lands and biological diversity. SARD could be achieved only by solving the problems obstructing its realization.

3. Drought and Destertification:

The text of the United Nations Convention to combat desertification defines: "Desertification" means land degradation in arid, semi arid and dry sub humid areas resulting from various factor, including climatic variation and human activities.

"Combating desertification" includes activities which are part of the integrated development of land in arid, semi arid and dry sub humid areas for sustainable development which are aimed at:

- a. prevention and /or reduction of land degradation.
- b. rehabilitation of partly degraded land and
- c. reclamation of desertified land

The main objectives of the convention are the following two:

- i. to combat desertification and mitigate the effects of drought in countries experiencing serious drought and/or desertification particularly in Africa, through effective action at all levels, supported by international cooperation and partnership arrangements in the frame work of an integrated approach which is consistent with Agenda 21 with a view to contributing to the achievement of sustainable development in affected areas.
- ii. achieving this objective will involve long term integrated strategies that focus simultaneously in affected areas on improved productivity of land and the rehabilitation; conservation and sustainable management of land and water resources leading to improved living condition in particular at the community level.

The convention though not neglecting other affected developing countries gives priority to affected African countries in the light of the particular situation prevailing in that region. Commitments and obligations of Sudan are not spelt out explicitly but could be under-stood as that of African countries. The commitments and obligations of African country parties are:

1. in accordance with their respective capabilities, African country parties under take to:

- a. adopt the combating of desertification and/or the mitigation of the effects of drought as a central strategy in their efforts to eradicate poverty.
 - b. promote regional cooperation and integration, in a spirit of solidarity and partnership based of solidarity and partnership based on mutual interest in programmes and activities to combat desertification and/or mitigate the effects of drought.
 - c. rationalize and strengthen existing institutions concerned with desertification and drought and involve other existing institutions as appropriate in order to make them more effective and to ensure more efficient use of resources.
 - d. promote the exchange of information on appropriate technology, knowledge, know how and practices between and among them and
 - e. develop contingency plans for mitigating the effects of drought in areas degraded by desertification and/or drought.
2. pursuant to the general and specific obligations set out in articles 4 and 5 of the convention, affected African country parties aim to:
- a. make appropriate financial allocations from their national budgets consistent with national conditions and capabilities and reflecting the new priority Africa has accorded to the phenomenon of desertification and/or drought.
 - b. sustain and strengthen reforms currently in progress toward greater decentralization and resource tenure as well as reinforce participation of local populations and communities and
 - c. identify and mobilize new and additional national financial resources and expand as a matter of priority existing national capabilities and facilities to mobilize domestic financial resources².

3.1 The Magnitude of Drought and Desertification in Sudan:

Sudan is located between longitudes 22 and 38 and between latitudes 3 30 and 22 N. The country is recently divided into 26 states, 16 E in the North and remaining 10 in the South (Table 1) the population of Sudan

Table 1: Population of Sudan Per Region (North Sudan)

	Total area (million km)	%	Population (million)	%
Sudan	2.50	100	25.4	100
Northern Sudan	1.78	72	19.5	77
Southern Sudan	0.72	28	5.9	23

Source: 1993 census

The drought cycle has stricken the Sudanese Sahelian countries since late 1960s and the early 70s and from that time until now Sudan is suffering the long lasting imprints of the drought disastrous effects, desert encroachment and desertification impacts. The country is divided into 7 ecological zones with rainfall varying from zero mm in the northern desert to 1300 mm in the high rainfall Savannah (Table 2)

² Note: Article (4) deals with the commitments and obligations of African country parties; article 5 is about the commitments and obligations of developed country parties.

Table 2: Rainfall and Ecological Zones of the Sudan

Ecological zones	Rainfall in mm	Area km	%
Desert	0-75	718.07	30.7
Semi desert	75-300	486.40	20.8
Low rainfall Savannah on sand	300-400	680.90	29.1
Low rainfall Savannah on clay	400-800	340.40	14.6
High rainfall Savannah	800-1300	81.08	3.5
Flood region	800-1000	24.32	1.0
Mountain region	800-1000	6.40	0.3

Source: M.N. Harrson and T. K. Jackson, 1958,
Ecological classification of vegetation of the Sudan

The desert and semi desert represent 51.5% out of the total area if we add to that the low rainfall Savannah zone the figure will jump to more than 80% (80.6%). This indicates that the problem of desertification and desert encroachment is a serious problem in the Sudan. Table 3 shows the different zones and rainfall ranges³.

Table 3 Approximate Area Statistics of Rainfall Range for zones between (lat. 10-18 N) 1961-1990

Rainfall Range	Area km	% zone	% total	latitude
0-10	25805	2.05	1.04	14-18
10-100	280946	22.30	11.27	
Subtotal	306751	24.37	12.31	
100-200	240733	19.12	9.66	13-14
200-300	173097	13.74	6.95	
Subtotal	413830	32.86	16.61	
300-400	120858	9.59	4.85	12-13
400-500	119848	9.51	4.81	
500-600	145305	11.55	5.83	
600-700	94046	7.47	3.77	
700-800	33647	2.67	1.35	
Subtotal	513707	40.77	20.61	
800-900	8220	0.65	0.33	10-12
900-1000	7345	0.58	0.29	
1000-1100	6007	0.48	0.24	
1100-1200	2428	0.19	0.10	
1200-1300	14 73	0.12	0.06	
Subtotal	25473	2.02	1.02	
Total	1258758	100	50.5	10-18N

Source: NDDU, 1990.

3.2 What Has Been Done to Combat Desertification:

In part II general provisions of the text of the United Nation Convention to combat desertification the affected developing country parties are expected to:

1. implement their obligation individually or jointly either through existing or prospective bilateral or multilateral arrangements or a combination;
2. adopt an integrated approach addressing the physical, biological and socio - economic aspects of the processes of desertification and drought;
3. integrate strategies for poverty eradication into efforts to combat desertification and mitigate the effects of drought;

³**Note:** When we compare Table (2) with Table (3) we notice the difference in affected areas. This is resulting from the total areas calculated. Table 2 shows the total area 2337570 km while table 3 gives the total areas equal to 2492360 km. The problem of the irreliability of most data available is very common. Still both estimates indicate that desertification is a very serious problem in the Sudan

4. determine institutional mechanisms if appropriate keeping in mind the need to avoid duplication.

The question is to which extent did Sudan fulfil its obligations?. Concerning desertification what has been done is very little. NDDU surveyed the affected areas in N. Sudan (13 out of the total 16 states). That means all states of N. Sudan with exception of S. Darfur, S. Kordofan and Blue Nile. The total area affected by desertification amounts to 1,259,751 km, 50.5% of the country's total area. The results of the surveys are summarized in Table (4).

**Table 4: Seminars on Drought and Desertification
Causes of the Problem and the Priorities of Suggested Solutions:**

State	Cause of the Problem	Suggested Solutions
Red Sea	local population activities. Climatic changes. Weakness of the infrastructure.	Better water management. Dispersion of seeds in valleys, wadis and other suitable places to improved the vegetation cover. Land reclamation. Extension services. To increase awareness about the problem.
Gezira	moving sand d lack of awareness of the size of the problem	Replanting the vegetation and tree cover. Fixation of the moving sands. Increasing the awareness. Energy substitutes
Khartoum	Drought absence of laws governing the protection and conservation of natural resources no irrigation schemes in the areas affected by desertification.	Conservation and improvement of natural pastures establishment of irrigated scheme applying new technologies planting wind bearers.
North	Estimation lack of finance fertile land only on the river banks no substitute for miskeet trees was planted.	Reclamation of degraded land due the desert encroachment protection of fertile lands from desert.
Gedarif	Deterioration of the vegetation cover absence of laws protecting the conservation of environment no coordination between research institutions and the decision makers.	Adopting rotations in agriculture combating soil degradation development of forests pastures wild life in a sustainable manners capacity building.
White Nile	Climatic changes misuse of resources	Fixation of moving dunes recovery of the vegetation cover development of land use provision of extension services improvement of livestock production availing water and conserving to habitat conserving wild life and biodiversity.
Sennar	Absence of monitoring and evaluation of projects laws and regulation for forest production and conservation are not respected expansion of mechanized agriculture.	Environmental awareness reforestation water harvesting investment maps laws and regulation.
N. Darfur	Drought civil strife, economic inflation inappropriate state interventions.	Awareness, rationalization of energy consumption and reforestation rehabilitation of the drought affected areas.
N. Korodofan	Drought agricultural expansion in fragile regions felling of trees over grazing pasture fires.	Rehabilitation programmes in degraded areas extensive extension programmes energy substitute grazing planning root participation.
W. Darfur	Irrational uses of resources lack of environmental awareness.	Water harvesting projects developing and improving of farming systems.
W. Kordofan	over stocking and overgrazing excessive use of timber in house building.	Re-planning rain fed agricultural production and forming suptrn protection and conservation of natural resource i.e. reserving forests afforestation and reforestation of popular forests reclamation of grand lands.
River Nile	moving dunes deterioration of agricultural production and decrease of productivity degradation of natural pasture and their grazing capacities loss of vegetation and tree cover desertification is not given the appropriate weight absence of awareness formal and popular.	Wind belt wile basin studies awareness (environmental rehabilitation of pasture availing energy substitutes feed production livestock protection and conservation through availing of water for animals and human beings.
Kassala	wrong state policies misuse of resources poverty and ignorance moving dunes.	Regenerating the vegetation cover rationalizing water utilization awareness increasing productivity of crops.

Source: Ministry of Agriculture and Forestry Combating Desertification and Drought unit, Khartoum, 1998.

3.3 The Impact of Drought and Desertification:

Drought and desertification have their impacts on soil, bio-diversity, forests and food security.

3.3.1. Soil Degradation:

One of the top priorities of rural development in a sustainable manner is to improve farm productivity. It is because only through improving productivity, as well as increasing diversification ensuring that risks to the ecosystem are minimized that we could ensure food security and increase rural income. This is especially a must in fragile ecologies. One of the obstacles that could hinder realization such a programme is the soil degradation spreading in our country.

In the Sudan 5 types of soil degradation are identified. These are namely: wind erosion, water erosion, in flood plain areas, depletion of soil fertility, salinity and alkalinity.

3.3.1.1 Wind Erosion:

Wind erosion is prevalent north of latitude 14 N and in Kordofan sand, extending south to latitude 10 N. The effect of wind erosion is more apparent between latitudes 12-14N where advancing desert sand threatens the grazing land. Due to the destruction of the natural vegetation cover by trees cutting, overgrazing and fires, about 20% of the area between 12-14 N has changed into shifting sands (mainly around towns and villages). As a result desert sand is moving south of latitude 16 N at encroachment rate estimated by 5 km / year. Wind erosion is also serious problem and causes a lot of soil damage in the sandy levees in the flood plain of the Nile, where moving sand dunes are formed.

3.3.1.2 Water Erosion:

Water erosion effect on soil degradation is regarded as serious in Equatoria, Jabbel Mara, Nuba Mountains and the areas, south east of Gedarif town. Excessive erosion in Equatoria is due to the destruction of the vegetation cover by fires under condition of high intensive rains. Also over cutting and overgrazing is prevalent and cultivation of crops is practiced on sloping land without proper soil conservation measures. Water erosion is problematic in the southern parts of sandy soil in Kordofan and Darfur regions where mono-culture cultivation of certain crops is prevailing. Unfortunately this type of farming is practiced without giving any consideration to its negative impact on soil. Clearance of vegetation cover for mechanized farming aggravated the situation since it started what is known as sheet and gully erosion especially in the area southeast of Gedarif.

3.3.1.3 Flooding:

Flooding is regarded as the most serious factor of soil degradation in marshy regions of Upper Nile and NE of Bahr el Gabal. About 20% of this region becomes marshy during the rainy season (June - September), while the remaining area becomes excessively wet. The problem is caused by the adopted way of rainwater collection as well as river flooding. Add to that the water drains very slowly due to flat relief. Flooding is a problem in flood plain areas along rivers. Though it hinders cropping during flood seasons but create suitable conditions for growing crops after floods. Also riverbank erosion is a problem in some parts (*haddam*) while in other parts are covered by sand during floods.

3.3.1.4 Depletion of Fertility:

Soil in Sudan is generally poor of minerals. its fertility is seriously and very rapidly depleted all over the country. This fertility depletion is more evident in areas under rain fed cropping. The

mechanized schemes are depleted in particular especially in Kassala, S. Kordofan and Blue Nile areas. Fertility depletion in these areas is estimated to be very high where average yields dropped to < 50%.

The main factors causing soil fertility depletion, could be summarized in:

- very rare fertilizers and other inputs application;
- no proper cropping rotation is developed (most farmers) cultivate the same crop in the same area for years (mono-culture farming);
- reduction of fallow period in the last two decades due to high food demands of the increasing population.

3.3.1.5 Salinity and Alkalinity:

Salinity and alkalinity do not represent a problem in the Sudan. The Gezira and White Nile schemes do not suffer from salinity and alkalinity. If they are any traces of them it is due to factors and process under natural conditions. As it is known, irrigation reduces alkalinity and not even secondary salinity is traced even under poor draining conditions. The slow movement of water (0.2-0.5 m/h) is sufficient to leach the soil so that no salinity occurs.

Only irrigated areas in the Nile flood plain (Dongola area) are to a small degree affected by salinity. This is mainly limited to sub-crescent basin areas where salts are accumulated during soil formation. Even here the soils affected by salinity could be reclaimed easily (washing).

3.3.2. Biological Diversity:

The convention on Biological Diversity signed by 150 government leaders at the 1992 Rio Earth Summit is dedicated to:

- promoting sustainable development
- recognition that bio diversity is about more than plants animals and micro organisms and their ecosystems-it is about people and our need for food security, medicines fresh air and water, shelter and a clean and healthy environment in which to live.

"The wide variety of vegetation types in the Sudan is reflected in its fauna. Out of the 13 mammalian orders in Africa 12 occur in the Sudan. A total of 91 genera and 224 species and subspecies of mammals other than bats, and 931 bird species have been recorded in the Sudan (Hassaballa, et al, 1985). However the World Resource Institute (1988) indicated that out of 266 species of mammals in the Sudan there are 19 known as globally threatened species (WRI, 1988).

It should be pointed out that there are no recent regular surveys of fauna and flora of the Sudan and it is generally believed that they have been subjected to serious destruction. However the magnitude of deterioration of flora and fauna have not been subjected to systematic studies or surveys and are presented only and speculations.

The insect faunas of the Sudan are very diversified. It is estimated that at least 100 species of insect pests in the Sudan. Equally diversified is the fish fauna the most significant of which are that of the Nile. The Nile is geologically old and has a distinctive "Nilotic" fauna. The Nile fish fauna consist of relatively few species (24 families and 106 species), compared for example to the Niger's 160 species the Congo's 700 species or the Amazon's 1300 species⁴.

⁴Abdel Ati H.A; Nimir M,B. and Moghraby A, Environmental Degradation and Conflicts in Sudan: an overview, Novembers 1993, IFAA.

The areal census of livestock and wild life in the Sudan (1977) indicated that wildlife in Northern Sudan does not constitute an exploitable resource of any significance. In fact it is believed to be disappearing at an alarming rate. Abundance and distribution of several species has been 6 times reduced during the last few decades (Nimir, 1983, p. 175). Several species are extinct and many others are threatened with extinction and are now restricted to few locations. In southern Sudan, the richest of the country's regions in bio diversity and natural game reserve, the effect of modernization and war conditions have also drastically reduced wild life some species to extinction. Jong-Boon listed the following as the main factors behind the reduction of the wild life population:

1. The destruction of habitats from such causes as uncontrolled burning, felling and clearance of forests for charcoal production; expansion of settlements and changes brought about by natural factors such as drought and desert encroachment.
2. The opening up of remote areas for the construction of roads thereby giving better access to hunters and encouraging poachers and interrupting wild life migration paths and possibly isolating small pockets of game whose numbers may be below the survival value for the species.
3. The expansion of settlements and the increase in human populations leading to a greater need for meat and therefore more hunting.
4. Commercial poaching often in or near National Parks and Wild Life Reserves, caused by the high market value of game meat, skin and horn.
5. tribal hunting of a wasteful kind in which whole herds of animals are destroyed with modern automatic weapons.
6. Improvement in hunting equipment such as fire arms and means of transport.
7. Epidemic disease e.g. Rinder pest.
8. Public apathy towards wildlife⁵.

Table 5: Vegetation and Livestock Distribution according to Ecological Zones

Ecological Zone	Latitude	As % of the total Area	Main Veg. Cover	Livestock
Desert	North of 16° N	30.7	Scattered Plants Khors & Wadis	cattle in irrigated areas, desert sheep and camels & sheep in the rainy season
Semi desert	14°-15° N	20.8	Grasses, shrubs and short trees	camels, sheep in the rainy season
Low rain fall Savanah	10°-14° N	47.2	Plants, acacia trees	cattle, sheep & goats
High rain fall Savanah	South of 10° N	47.2	Tropical Forests	small number in the any seem
flood Region	South of 10° N	1.3	Various Plants	cattle in drought years
Mountane region	West, East and south Sudan	1.3	Scattered plants forests in some shapes	cattle in drought year, sheep & goats

Sources: Ali Darag, A paper Presented to the conference of land use in the Sudan, 1999

In spite of this richness, the Sudan could be regarded as deterioration bio-diversity is about people and our need for food security, medicines, fresh air and water, shelter, and a clean and healthy environment in which to live.

The convention of biological Diversity has validated the following three key concepts, that are shaping global action today:

⁵Ibid.

4. Sustainable Development:

The ideal of nature conservation has now been joined by the recognition that saving bio-diversity must go hand in hand with meeting humanity's social and economic needs. This philosophy is the basis for the convention's triple goals of conserving bio-diversity, using its components in a sustainable manner, and sharing the benefits arising from genetic resources fairly and equitably.

4.1 The Ecosystem Approach:

Rather than treating individual species or ecosystems in isolation, effective action views bio-diversity in its entirety, as encompassing all essential processes, functions and interactions among organisms and the environment- including in this human in all their cultural diversity. In this perspective, the "integrated management" of land, water and living resources becomes the most effective way to promote the conservation, sustainable use, and equitable sharing of bio-diversity resources.

4.2 "Mainstreaming" Bio-diversity:

Although challenging, policymakers need to integrate bio-diversity into other sectors and policies, such as natural resources planning, forestry, coastal and marine environment management and agricultural and rural development planning. The Convention can contribute to all chapters of Agenda 21 and vice versa-including those on national planning processes, technical and scientific cooperation, capacity-building, and financial resources, to mention only a few. The distribution of vegetation and livestock is summarized in Table (5).

4.3 Combating Deforestation:

Sustaining the multiple roles and functions of all typed of forests, lands and wood lands is an international problem. Chapter 11 (Agenda 21) states that: There are major weaknesses in the policies, methods and mechanism adopted to support and develop the multiple ecological, economic, social and cultural roles of trees, forests and forestland.

These roles have been repeatedly emphasized in many of the reports, decision and recommendations of FAO, ITTO, UNEP, the world Bank, IUCN and other organization,

The Rio-summit programmes of combating deforestation objectives are as follows:

One. To strengthen forest-related scope and effectiveness of activities related to the management, conservation and sustainable development of forests and to effectively ensure the sustainable utilization and production of forest's good and services in both the developed and the developing countries; by year 2000, to strengthen the capacities and capabilities of national institution to enable them to acquire the necessary knowledge for the protection and conservation of forests as well as to expand their scope and, correspondingly, enhance the effectiveness of programmes and activities related to the management and development of forests,

Two. To strengthen and improve human, technical and professional skill and, as well as expertise and to formulated projects on management, conservation and sustainable development of all typed of forests and forest-based resources, .. etc⁶.

To achieve this goal certain measures should be taken. May be the most important of them as long as Sudan is concerned is: To promote participation of the private sector, labour unions, rural cooperatives, local communities, indigenous people, youth, women, user groups and non-

⁶Rio Earth Summit, 1992

governmental organizations in forest-related activities and access to information and training programmes within the national context.

These measure are particularly needed in Sudan, which it is regarded as one of worst 14 countries with rapidly depleting forest resources. El Siddig (1996) estimated that .5 million hectares of forest are annually cleared in Sudan, leading to devastating results. Table (6) shows the rate of destruction of natural forests:

Table 6: Rates of Forest Depletion in Sudan:

Years	Forest covers as % of the total area	% 1956 as the base year
1956	36	100
1990	19	53
1998	12	33

Source: Calculated from the data provided by the Ministry of Agricultural and Forestry a Khartoum, 1998

If we consider 1956, the independence year, as the base year, the rate of annual depletion is 1.6%. Accordingly, if we assume the same rate to continue, then in nearly 21 years, then Sudan will lose all its forests. To this degree the problem of forest destruction is serious in the Sudan.

The reliability of the available data is questionable, on the best case they are mere estimates. For example El Sidig writes: "The forest cover has declined from 40% of Sudan's area to almost 10-12% as estimated by the National Forest Inventory of 1996."

Table 7: Total Wood Consumption in M³ (million) in Sudan

Sector	Fuel wood		Timber	
	Fire wood	Charcoal	Building poles	Maintenance
Household	6.15	6.10	1.110	0.57
Industrial	1.10	0.01	0.002	0.00
Service	0.03	0.28	0.010	0.02
Other	0.21	0.00	0.000	0.00
Total	7.49	6.39	1.122	0.59
%	47.2	40.4	7.2	3.7

Source: Forest Products Survey Report, FNC, 1996

Forest products go directly to the households consumption and small enterprises. Fuel wood contributes by not less than 70% of Sudan's total energy. Wood energy (firewood and charcoal) consumption represents approximately 87.6% of Sudan round harvest; 47.2% firewood and 40.4% charcoal (Table 7). Firewood is the main fuel, particularly in rural areas.

Besides felling of trees for wood products and agricultural purposes is very extensive and resulted in the depletion of forest cover in vast areas. In Sudan natural forest are either reserved or non-reserved forests. The policy was to concentrate felling and regeneration of trees inside the forest reserves. These reserves are expected to be managed in such a way that grantee development. Unfortunately that was not the case, except for the reveraine forest reserves along the Blue Nile and its tributaries.

No working plans have been constructed to improve the management and prescribe reforestation inside these forests. Forest surveys, forest maps and technical information related to stocking, productivity, structure and species composition are limited to few forest reserves. The natural forest reserves and the natural woodland outside the forest reserves continued to be preserved for revenue collection and accordingly ineffectively protected, a practice that rendered the

legislation and the management programme more oriented toward control and punishment rather than geared towards development and sustainable management. The system reflects a practice of deforestation rather than afforestation and reforestation (El Sidig, 2001).

The reported area of forest resources by 1989 was 640 thousand hectares (Badi, 1989). At present a policy of forest reservation bringing at least 25% of the area of the Sudan under forest reserves to be protected and renewed through proper management plans on sustainable yield basis (Mohammed 1997). Such a policy requires an afforestation strategy that succeeds not only in the rehabilitation process through natural or artificial regeneration but also in sustainable protection and management to maintain acceptable stocking duties. In 1993 a presidential decree was issued increasing the reserved forest areas to 12.4 million feddan (code No 628/1993).

Still this is not the solution of the problem. What is needed is a programme enhancing the protection, sustainable management and conservation of all forest, and the greening of degraded areas, through forest rehabilitation, afforestation, reforestation and other rehabilitation means. Though the implementation of such a programme needs resources, human and financial, still we believe the general situation is more favorable due to oil extraction and export. More money could be availed, fuel and energy other than wood could be used. The most important thing is that the decision makers should realize the real size of the problem. With a solid national political will and regional and international cooperation, there might be some hope to at least conserve the still remaining forest resources.

Agenda 21-chapter 11, under the title of Combating Desertification, summarizes what to be done in the following “Basis for action”

- forests world wide have been and are being threatened by uncontrolled degradation and conversion to other types of land uses, influenced by increasing human needs; agricultural expansion, and environmentally harmful mismanagement, including for example, lack of adequate forest fire control and anti-poaching measures, unsustainable commercial logging, overgrazing and unregulated browsing, harmful effect of airborne pollutants, economic incentives and other measures taken by other sectors of the economy. The impact of the loss and degradation of watershed areas, deterioration of the quality of life and reduction of the options for development.

- The present situation calls for urgent and consistent action for conserving and sustaining forest resources. The greening of suitable areas in all its component activities, is an effective way of increasing public awareness and participation in protection and managing forest resources. It should include the consideration of land use and tenure patterns and local needs and should spell out and clarify the specific objectives of the different types of greening activities.

These recommendations are of general nature. In the case of the Sudan, the programme should consider the following objectives as top priorities i.e.

- to maintain the existing forests and sustain and expand areas under forest and tree cover,
- to prepare and implement, as appropriate, national forestry action programmes and/or plans for the management, conservation and sustainable development of forests,
- to ensure sustainable management and, where appropriate, conservation of existing and future forest resources,

- to facilitate and support the effective implementation of the non-legally binding authoritative statement of principles for global conservation and sustainable development, of all types of forests, adopted by the United Nation conference on Environmental and Development.

5. Food Security:

5.1 Definition:

FAO defines food security as follows: Food security exists when all people at all times have access to enough safe and nutritious food to maintain a healthy and active life. It requires not only that sufficient food is produced, but also that every individual and household has access to the food it needs. Food security is recognized as a basic human right in a number of international declarations.

5.2 Key Facts:

- The worlds 5.8 billion people have on average 15% more food per capita than 20 years ago when the global population was 4 billion in 1969-71 an estimated 35% of the population of developing countries was undernourished. By 1990-92, the figure had fallen to 20%.
- One in seven of the world's inhabitants, or 800 million people are still chronically undernourished. One-third of the world's children are mal nourished. Most of the hungry are in developing countries: 37% of the population in Africa, 20% in Asia and 13% in Latin America and the Caribbean still have inadequate food. Sub Saharan Africa is the one region where the situation has been worsening.
- Global demand for food is projected to rise by up to 50% in the next 15-25 years as a result of population growth and rising incomes.
- World food production grew 3% annually in the 1960s, 2.4% in the 1970s, 2.2% in the 1980s and 1.6% in the last ten years between 1985-95. The FAO predicts the figure will be 1.8% up to 2012.
- Stocks of wheat are at a 20-year low, while those of maize are at a 50-year low. Shortages have pushed up world market price by 30-50% adding an estimated US \$ 3 billion to the food bills of "low-income food-deficit countries."
- Some 60% of global food stocks are in the hands of private companies, while 70% of world grain trade is carried out by just six companies.
- Aid to developing country agriculture has fallen from \$ 10 billion in 1982 to \$ 7.2 billion in 1992 (in constant 1985 US\$), indicating in the FAO's words a " decreasing political will to address the problem of world hunger.
- Since 1974, world agricultural trade (including fisheries and forestry) has grown from \$ billion to \$ 485 billion. But developing countries share of world agricultural exports (excluding fisheries and forestry) fell 27% in 1993.
- For the least developed countries, food imports currently absorb more than one-third of export earnings⁷.

FAO estimates that the food import bills for low-income food-deficit countries will be 55% higher in 200 than in 1987-89 with 14% of the increase (\$ 3.6 billion) due to GATT⁸.

5.3 Five Faces of Food Insecurity:

M. Mortimore, Centre of West African Studies, University of Birmingham, U.K., attributes the causes of food shortage to one or more of the following:

⁷ United Nations Environmental Programme (UNEP), The Global Environment Out –Look, 2002.

⁸ Panos Media Briefing, No. 20 October, 1996

- One. the breakdown of primary production systems,
- Two. the breakdown of food procurement system.
- Three. pauperization, or system regressive redistribution of wealth;
- Four. environmental degradation, and
- Five. Malthusian demography.

5.4.1 Breakdown of primary production system:

In Sudan drought is the main reason causing the breakdown of the primary production system, besides pests, fires and others.

The breakdown of the primary production system (especially farming or livestock system, results in a major loss of output. It may also imply a loss of productive capital and recovery capability (e.g. breeding livestock, seed or tress stocks, tools, perhaps soil fertility). The breakdown of primary production system, and hence the decline in food availability should not necessarily lead to a famine. Reconstructing the Bengal Famine of 1943-44, SEN (1982) argues that such a decline, on a scale sufficient to explain the famine, did not occur but that instead there was a significant decline in the food entitlements of certain socio-economic classes. He extended his argument to the famine in Ethiopia in 1972-4 using official production assessments and price data, and claimed that “the Ethiopian famine took place with no abnormal reduction in food output”

Though others (e.g. Bow Brick, 1986) tried to dispute Sen’s arguments, I believe, in the case of the Sudan, a clear distinction between crop failures (or animal production failures) and food shortage should be made. The main cause behind food gaps in the Sudan is not the loss of output in certain regions, but other factors (e.g. primitive infrastructure, civil strife, disintegration of markets), which play the major role. This is especially true if we look at the food security problem at national level. This assumption could easily be proved by analyzing the actual production of grain for a number of years.

The breakdown of the primary production system can be temporary or permanent. The temporary failure means that the recovery capability of the system is high, while permanent breakdown means that the system could be classified as structurally deficit. The recovery capability reflects what is known as the resilience power of the system.

The problem is, till now no indicators are developed to measure the magnitude of failure for the primary production system nor for its recovery capability. What is available now are only some practices, if applied, might help improving the resilience power of the affected system maximize their output especially in semi-arid farming systems. These are:

- using built-in practices, such as spatial farm fragmentation, long following, shifting cultivation, crop residue mulches, dry planting, crop diversification and the use of short season varieties which maximizes the efficiency of moisture use (Warren and Maizels, 1977).
- applying serially-adaptive repertoires of in-season options, such as varying the planting dates, stand spacing, and variety selection, the level and type of fertilizer use, or (when available) shifting emphasis between dry upland and wet low soils (Watts, 1983).
- farm trees and boundary plants are protected, and yield edible products, that have either a regular place in the diet (e.g. Kawal) which can be increased if other foods are scarce or an emergency role when the unacceptable becomes accepted (e.g Mukheet).

- seed banks, in conjunction with aspects of the social relations of production (loans from kin or patrons, labor-sharing agreements, charity approved by Islamic practice (Zakat) facilitate recovery after thin years have denied the poor of their capital.

These measures are expected to maintain the production system, maximize its output and at the same time increases its recovery capability.

Livestock systems appear to offer parallel options:

- Flexible use of space and mobile grazing management attempt to maximize the efficiency of resources use, which may compare favourably with modernized management in comparable environments (Western, 1982)
- within season options such as extended mobility and herd division, offer the possibility of adaptive response to a crisis in pastures availability. This especially important when there is increase in livestock and simultaneously deterioration in range (Tables 8, 9, 10) .
- alternative foods may be sought in wild vegetation, or increased hunting (Bernuus, 1977).
- social inequality, as in farming preserves some breeding stock, and animals loans within the frame work of the community assist the poor to recoup some of their losses (White, 1984).

Table 8: Livestock in Sudan (in million) by type (1956-1998)

wear/type	1956	1966	1976-77	1986-87	1996	1998
Cattle	7.2	9.7	15.4	19.7	31.7	34
Sheep	7.5	9.4	16.2	18.8	37.2	42
Goats	6.5	8.6	11.2	13.9	35.2	37
Camels	1.5	2.3	2.4	2.7	3	3

Source: Ministry of Animal Resources, Khartoum, Sudan, 1999

Table 9: Distribution of Livestock per State (in %) in 1998

state/type	Cattle	sheep	Goats	Camels
Western States	36.00	39.7	36.2	60.6
Eastern States	4.8	11.7	6.9	25.2
Central States	26.80	20.5	20.1	10.2
Northern States	3.10	3.6	5.4	3.1
Southern States	28.80	23.3	30.3	0.0
Khartoum State	0.05	1.2	1.1	1.5
Total	100.0	100.0	100.0	100.0

Source: Ministry of Animal Resources, Khartoum, Sudan, 1999

Table 10: Range Classification and Changes for selected periods (as %)

Period	Excellent	Good	Fair	Poor	Total
1971-81	30.50	64.75	4.75	0.0	100
1971-81	0.83	25.00	4.75	63.17	100
1991-2000	0.00	6.8	28.7	64.5	100

Source: Calculated from different sources

5.4.2 The breakdown of food procurement system:

It means a break down in access to food for a large proportion of the population, through the loss of direct production, or by the loss of market purchasing power or by the failure of non-market distribution systems or all three of these.

- The "entitlement approach" of Sen, appears to have clarified how economic groups find themselves unable command food through the progressive loss of economic resources and other forms of entitlement. This is especially serious in Sudan where statistics show that more than

90% of the population are below the poverty line (some estimates of this group go up to 96% of the total population).

Since food scarcity is the most visible face of famine if not its defining property, the response to it has usually taken the form of food aid, supported by government or imports, to the famine areas i.e by government, donors and or NGOs.

This type of intervention inevitably focuses attention on vulnerability. Progressive exhaustion of entitlements is seen as a diminution of flexibility through time culminating in desperation when food procurement transcends all other priorities including the protection of productive assets and is finally superseded by starvation. Though it is not the remedy, in emergencies such an intervention is justified.

At the same time affected groups try to modify the procurement system to cope with the emerging situation (the so-called coping strategies). The following steps might help the procurement system to work:

- switching to alternative foods (e.g. wild foods) or increasing foods normally used as supplement to grains;
- increased dependence on the market. This might not be a great help in the Sudan since research proved that our local markets are highly disintegrated particularly markets of the regions with often food deficiency (e.g. markets in Darfur);
- migrating to towns in other parts of the country or to other countries (e.g. cotton pickers).
- Liquidating assets starting with least needed ending with the most needed (e.g. tools and house etc.)

5.4.4 Pauperization or Regressive Redistribution of Wealth

In situations of food scarcity especially in famine time, there occurs a redistribution of wealth (productive assets saving moveable property and cash) from the poor to the rich either in situation or distant (usually urban) places. Adverse movement in the terms of trade make it harder for the poor to recover afterwards. The recurrence of thin years intensify pauperization stepwise, widening social inequality and (since assets embody economic opportunities) reducing the adaptive capabilities of the poor. This harsh situation is usually further exacerbated by what is known as market exploitation (poor people sell at low prices and buy at high seasonality effect).

5.4.5 Environmental Degradation:

The clock is ticking an environmental time bomb. It is now 4.48 p.m. At the rate of 27 million hectares lost a year to the desert or to zero economic productivity; in a little less than 200 years at the current rate of desertification there will not be a single fully productive hectare of land on earth. It will be the earth's midnight STILES and BRENNAN, 1986.

Drought and desertification is the most serious environmental problem in the Sudan. All other signs of environmental degradation, such as soil degradation, challenges of bio diversity, climatic changes etc are highly related to drought and desertification. At the same time the relationship between food security/insecurity and environmental degradation in Sudan, especially in arid and semi arid areas is reflected by:

- long term and cumulative environmental degradation resulting from inappropriate cultivation practices over-grazing excessive fuel wood cutting burning and deforestation;
- reduction primary productive systems and thereby accentuates food crisis, the process is self reinforcing in that increased poverty (both in depth and in social extent) drives the poor to over

use natural resources to which they have access discounting long term benefits against survival in the short term. Writing of Ethiopia Winer (1989) states: "today's children will see one third of the highlands incapable of sustaining cropping while the population trebles in their life time".

The explanation for the mismanagement and misuse of natural resources is sought either in population growth or in political economy. Kebbed and Jacob (1988), says: "Desertification is caused almost entirely by human misuse of the environment. This misuse, which is not necessarily the result of ignorance, takes the form of felling trees to provide fuel, over grazing by domestic animals, and harmful agricultural practices".

Though the defense of Mortimore might be true, that: Poor people value the long term benefits of productive assets, to which they enjoy secure rights of access, and try to manage them in such a way as to realize these benefits, even at high cost in terms of short term benefits foregone; still poor people are forced to sacrifice the future for the present in most cases, simply because they have to survive.

5.5.5 Malthusian Demography:

Food insecurity namely famines cause a major increase in mortality either from starvation or from reduced resistance to diseases. Such mortality temporally checks the increase of the population, whose rate (especially in African countries) is excessive in relation to the natural source base, exceeding or threatening to exceed human carrying capacity. Thus food shortage may result from over population.

Tolba (1986) advocating this Malthusian view, says: Each piece of land has what we call its carrying capacity (for humans and animals) when that number is exceeded, the whole piece of land will quickly degenerate from over grazing or over use by human beings.

If this view is correct, the appropriate policy response is aggressive family planning, which, as the term implies, assumes that a reduction in fertility will be perceived as beneficial by the families concerned. At the same time, as said by Tolba, since over population is widely believed to be the major factor for environmental degradation, such programmes will (reduction in fertility save the environment as well.

The Malthusian logic is faulty from different aspects. It forgets that Africa, suffering from food shortages, is at the same time the most thinly populated continent. But the studies in Africa proved that productivity (human and resources) is the lowest. If at the same time we think the great progress in sciences and technologies and their expected positive impacts on production then no danger is actually threatening the African continent future. Also the evidence that is available on the demographic impact of famine is less convincing still. CALDWELL (1975) concluded that the overall impact of the drought of the 1970s was negligible, and that the population continued to grow at about two percent, fertility also being little affected. This was not withstanding much evidence of under nutrition both during and after the famine (Hogan et al, 1977). Even in Muritania, the excess mortality along nomads was limited to an estimated 44.00 in a population of 1.2 million (Greene, 1974).

We conclude and say, the Malthusian view, at least needs further analysis, if not to be totally rejected.

Finally we can summarize the five faces of food insecurity and suggested alliterative perception in Table (11)

Table 11: Behaviour under food insecurity stress

System	Primary Perception	Alternative Perception
Primary production	Break down	Resilience
Food procurement.	Break down	Adaptation
Wealth distribution.	Pauperization	Countervailing processes
Environmental management.	Degradation	Conservation
Demography.	overpopulation	Labor intensification, diversification

I do not see the radical solution of food insecurity in Sudan, in international relief and provision of food, but in revising our policies. They should be oriented towards sustainable agricultural and rural development. Food and relief assistance, are to be justified only on emergencies e.g. natural disasters because such interventions never eradicate the roots of the problem. I base my arguments on the following reasoning:

While helping to solve a short run crisis, such interventions, can achieve little towards long run prevention of food shortages, because they are short term by nature.

Like any other form of external project aid, they run the risk of creating a dualism in the host economy, differentiating between beneficiaries and those beyond the "project fence".

Dependency in terms of suppressed economic initiative, autonomy and attitudes maybe a long run legacy of the best intentions.

However necessary, international interventions do not accord well with the self- reliant objectives.

References:

Dingel, M.A et.al.

Food Security in the Sahelian and Desert countries, (in Arabic), Nov., 2000.

El Tigani M. Salih

The Geographical Extent of Desertification in Sudan, NDDU, Khartoum, 2000

Kamil Hassan and Salih Hussien

Impact of Drought and Desertification on food security Dept. of Rural Economy Faculty of Agri, U. of K Sep. 1997

Michoal Mortimore

Five Faces of Famine: The Autonomous sector in the Famine Process, University of Birmingham, U.K, 1998.

Tabyregen Agnes Aboum et. al.

A Critical Review of Operation Life Line - Sudan, Oct. 1990

United Nations

The Elimination of Food Insecurity in the Horn of Africa, July, 2000