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# Causes and Impacts of Land Degradation and Desertification: Case Study of the Sudan

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**Abstract** Desertification, a phenomenon referring to land degradation in arid, semi-arid and dry sub-humid regions as a result of climatic variations and human activities, is considered as one of the most severe environmental and socio-economic problems of recent times. The principal aim of this study was to explore the impacts of desertification, degradation and drought on both the natural resources and man's livelihood in the Sudan and to suggest appropriate forest resource management interventions. The study was based on a fact finding tour in the Sudan and data collection on drought trends as reflected in rainfall trends in the study area, and on trends concerning the productivity of natural resources. Information was also compiled from existing records on rainfall, forest land cover, forest stocking, rangelands and carrying capacity and on agricultural productivity and population trends. Results showed that in rain-fed agricultural zones in the Sudan, deep ploughing and leveling of the surface soil caused an increase in its susceptibility to wind erosion, which, in turn, has led to a severe decline in its fertility and, in some places, the formation of sand dunes. The implications of these trends on the natural resource base include environmental degradation, food insecurity and aggravation of income inequalities among the Sudanese producers. The study has suggested Agroforestry technology as a potential solution to this continued problem of declining rural agricultural production in the Sudan.

**Keywords** Agroforestry, Desertification, Drought, Drylands, Natural Resources, Rainfall Trends, Sudan

## 1. Introduction

The term Sahel (an Arabic word for shore) is used to refer to the semi-arid zone to the south of Sahara desert. It is one of the world's warmest regions, with a short summer rainy season of three months[1,2]. Climatologically, the Sahel is characterized by frequent droughts - low, poorly distributed and highly variable monthly and seasonal unpredictable rainfall. Arid, semi-arid and dry sub-humid zones are characterized by, low and erratic rainfall that does not exceed 700mm per annum, periodic droughts, and different combinations of vegetational cover and soils. Inter-annual rainfall varies from 50-100% in the arid zones of the world with averages of up to 350 mm. In the semi-arid zones, inter-annual rainfall varies from 20-50% with averages of up to 700 mm. Regarding livelihoods systems, generally speaking, light pastoral use is possible in arid areas whilst rain-fed agriculture is not usually possible. In semi-arid areas agricultural harvests are likely to be irregular, although grazing is satisfactory[3,4]. The dry sub-humid areas receive higher amounts of rainfall than the other categories of drylands which can reach more than 800 mm annually. Drylands are characterized by high maximum temperatures and large temperature differences between day and night. Other climatic characteristics include strong winds, and low humidity. These are reflected in an increased vapour pressure deficit with implications for water use efficiency, transpiration, and evaporation.

Drylands are frequently subjected to drought which is the main limiting factor on biomass production and crop yields. Human induced factors such as overcultivation, overgrazing and other forms of inappropriate land use, when practiced under the conditions prevailing in the drylands, may result in significant degradation of vegetation and, soil leaching and in many cases, in desertification[5].

Against this backdrop, this study was conducted to explore the impacts of desertification, degradation and drought on both the natural resources and man's livelihood in the Sudan. Data for this study was derived from both primary data (observation) and secondary data or a review of relevant literature, and a compilation of other available information on drought trends as reflected in rainfall trends in the study area, and on trends concerning the productivity of natural resources in the wider context of land degradation and desertification. Information was also compiled from existing records on rainfall, forest land cover, forest stocking, rangelands and carrying capacity and on agricultural

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productivity and population trends.

## 2. Dryland Problems

Many drylands show clear evidence of environmental degradation. Drought and unreliable and variable rains are a recurrent problem. Even without climate change, the drylands face a daunting array of threats including population pressure, social changes such as the settlement of traditionally nomadic peoples, and exploitive agricultural and grazing practices that increase deforestation, soil erosion, salinization and water depletion. Many political and institutional problems have conspired to degrade 20% of the world's drylands, including 22% of Asia's susceptible drylands, and 25% of Africa's.

Land degradation and desertification conistitute one of the most serious environmental problems facing the world today. Desertification threatens the drylands of Sub-Saharan Africa more than any other region in the world. Once the vegetational cover is removed, the fragile soils are exposed to winds and battering rains. Erosion is inevitable. Early storms are often accompanied by strong winds. Wind speeds exceeding 100 km/hour have been recorded at ICRISAT is Sahelian Centre in Niger. According to[6], blowing sand subjects seedlings to abrasion and often results in their being completely covered by sand, causing serious problems for crop establishment. In many areas desertification takes dramatic forms, such as, shifting sand dunes that move on to villages and fields, the formation of deep gullies, and crusts that seal the soil`s surface and markedly increase runoff.

Desertification has been described as self-propagating[7] and it feeds on itself as expanding areas become useless for crops or livestock, whilst the pressure on the islands of remaining fertile land that remain increases. Farming is taken beyond the limits of sustainable rain-fed agriculture. Whole families, sometimes whole villages, migrate to better-watered areas. As[8] classifies about 75% of the world's drylands as degraded. Examples of dryland degradation include salinization and the loss of vegetation or water resources. One of the greatest threats is desertification, which robs the land of its soil, biodiversity, and productivity. The spread of desertification results in a degraded landscape. Millions of people may be forced to leave the land when it can no longer sustain them. Pressures from human and livestock populations coupled with the effects of recurrent drought have led to a serious degradation of vegetational cover, erosion, and the depletion of soil fertility on a large scale in many parts of sub-Saharan Africa.

### 2.1. Land Degradation

Land degradation is, usually, the result of complex inter-relationships between biophysical and socio-economic issues which affect many people and their land, specially in the tropics and developing countries. The term land degradation involves both soil and vegetation degradation. Soil degradation refers to negative changes in the physical, chemical, and biological properties of the soil, whereas vegetation degradation is the reduction in the number of species and the vegetational composition.

Usually land degradation is described in terms of the loss in natural resources (soil, water, fauna and flora) or in the biophysical process by which it functions**.** Soil can be eroded, salinized or impoverished. Water can be lost through evapotranspiration, evaporation, infiltration, run-off, pollution, or overuse. As habitats diminish, so also do the abundance, uniqueness and diversity of living things[9,10]. Many factors contribute to land degradation. Since the essence of the dryland`s environment is climate variability, the successful use of drylands requires a balance of capability, utilization, and resilience. Land degradation occurs when this balance is lost. The causes of dry land degradation are complex, and may be the product of anthropogenic or climatic factors, such as the impact of drought and desiccation on ecosystems, the overgrazing of these rangelands, unsustainable land-tenure rights, the undervaluation of land resources, and pricing failures, and numerous other social and economic processes (table 1).

The link between desertification and poverty is direct and intimate and affects all those who depend on the land as a basic resource, whether for crops, livestock, or fuel-wood. Poverty is the main reason for the steady decline in rural incomes resulting in complex demographic, economic, and social changes.

**Table 1.** Causes of dryland degradation[9]

| FACTORS | RESULTS |
|---|---|
| Droughts | Extent, frequency, and severity |
| Livestock | Pressure "too long" |
| Crops | Encroachment on grazing lands |
| Fires | Natural and deliberately lit |
| Boreholes | Too many and too close together |
| Locusts | Extent, frequency, and severity of outbreaks |
| Human factors | Social, economic, and political |

### 2.2. Desertification

Desertification has been defined as land degradation in arid, semi-arid, and dry sub-humid areas resulting from various factors, including climatic variations and human activities[11]. Another definition of desertification is the spread of desert-like conditions of low biological productivity due to human impact under climatic variations[12,13,14].

It is estimated that three-fourths of drylands have suffered from some degree of desertification[15,16,17,18]. The removal of vegetation cover exacerbates desertification and accelerates soil erosion which causes reduced soil fertility and eventually renders the land on productive; a situation that has often lead to the assumption that it is a human induced process which leads to the depletion of soil nutrients and a reduction of biological productivity. Desertification is one of the central problems that pose very real and severe challenges to the sustainable development of the dryland`s ecosystem. Rainfall variability both in time and space, coupled with the inherent ecological fragility of the drylands, weakens the resilience of the ecosystem and its ability to return to its original condition.

According to[19,20], desertification has been with us for thousands of years, but it did not receive attention for a very long time. It was not until the twentieth century that governments and people in general finally realized that land degradation and desertification threatened their future. The desertification of land resources endangers basic production systems as well as natural ecosystems. It places about one billion people in 110 countries at risk, mainly in developing regions.

In the Sahel, the slash and burning of natural forests and bush lands in order to clear land for agriculture is considered one of the main causes of deforestation and vegetation removal that contributes significantly to desertification. Man can either destroy his environment or be constructive and solve problems that occur within it. By increasing the population of perennials in the agricultural zone, farmers become agents for the stabilization of their land. They can then live in harmony with their environment in a symbiotic relationship where the land benefits from man's presence through the increased number of perennials. Furthermore, man benefits from his active control of desertification.

## 3. Desertification and Land Degradation in the Sudan

Desertification and land degradation are among the central problems for the sustainable development of the dryland ecosystem, especially in the case of the Sudan (Figure 1). Recurring droughts and land degradation are closely linked. While drought increases soil degradation, soil degradation, in turn, magnifies the impact of drought.


**Figure 1.** Map of Sudan showing the study area

According to[21] land degradation, due to natural causes, is assumed to occur at a rate, which is almost equal to the rate of natural rehabilitation. However human-related factors account for accelerated forms of land degradation. Over cultivation of croplands, overgrazing of range and pastoral lands, slash and burn techniques, shifting cultivation, inappropriate use of irrigation water (salinization) and industrial pollution are some of the factors which can cause degradation (see Figure 2).

Desertification and degradation also expand outwards from focal points, usually associated with human or livestock concentrations, especially, around watering points. A study in western Sudan has shown a steady increase of bare soil around boreholes over time, increasing from 20% to 55% in 30 years[22,23,24].

It also showed that in the east Kordofan district of western Sudan, with an area of about 29,000 square km, there were 150 boreholes, many of which supplied overlapping grazing areas, which have had great impact on the deterioration and degradation of the ecosystem. In the case of the Sudan population pressure is increasing in areas with very limited natural resources. Colonalization of the Sudan also brought about urban development and roads, transport, education, hospitals, and piped water. This resulted in a slow migration of people away from rural areas in order to take advantage of urban facilities. This increased the concentration of people and livestock around urban areas and drastically increased the pressure on the surrounding land for cropping, grazing, and fuel. It is, therefore, significant, that highly populated areas and livestock watering points were the places where signs of desertification in the Sudano-Sahelian first became apparent[25].

Desertification is considered one of the main factors that cause the migration of rural populations to urban centers; thus, creating so-called "environmental refugees"[26]. As reported by[27] the impact of land degradation manifests itself in different forms (e.g. see Figure 3).

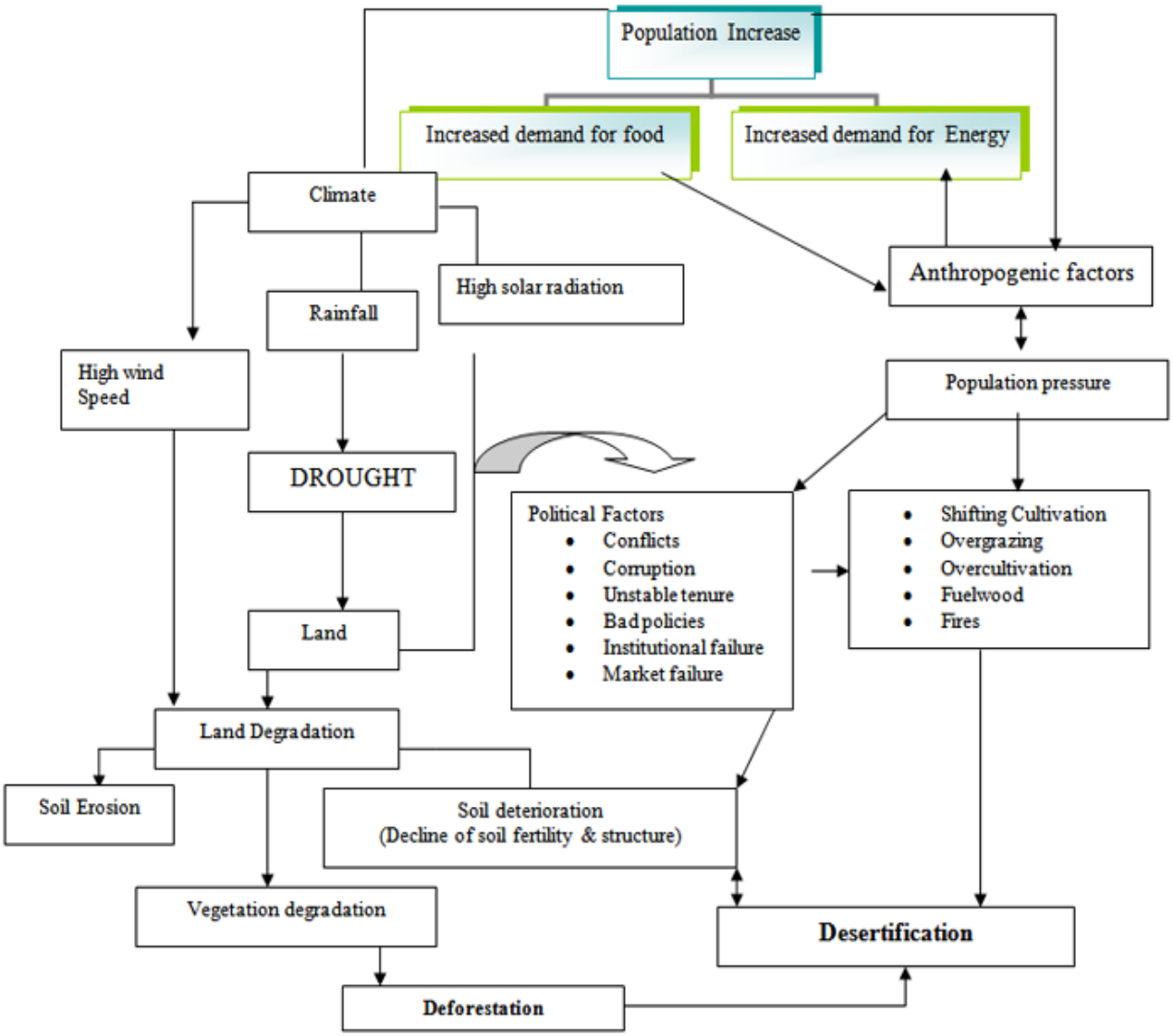


**Figure 2.** Schematic representation of the combined forces causing desertification in the Sudan: desertification in the Sudan is the combination of both natural and human factors

**Figure 3.** Degraded land at El Rawashda in Gedaref State of the Sudan (Photo: Edinam Glover)

In the case of the Sahel in general and the Sudan in particular, communal ownership with-well defined structures, based on traditional institutions is still appropriate in many situations, and therefore suggests a policy of stabilizing those communally-owned resources which are most vulnerable to land degradation[21]. Political and social instability have a strong bearing on land degradation in most parts of the dry Sahel. Civil strife in southern Sudan and Somalia for example, has led to the displacement of large numbers of people to Kenya. Some of these people have been settled in refugee camps thus adding to the problem of an increasing population in the affected areas. The Kenyan Government has housed most of these refugees in two major refugee settlements, namely, in the Kakuma and Dadaab camps. At present, the Kakuma camp is home to 70,958 refugees from 9 different countries with 72% coming from Sudan and 22% from Somalia[28]

According to[29,30] the degradation of vegetation on overstocked pastures takes place both quantitatively and qualitatively, useful species disappear and are replaced by unpalatable species, for example, the poisonous scrub *Calotropis procera* (iushar) has spread widely on exhausted soils. Unpalatable plants, such as *cassia acutifolia* (senna senna), *Acanthospermum hispidum* (horab hausa), and *Guiera senegalensis* (Gubeish) occupy vast areas and replace former, palatable pasture grasses, such as *Cenchrus biflorus* (haskanit), and the *Eragrostris* species and *Aristida* species.

The old stable dune belt (Qoz) is the main rain-fed cultivation zone in Darfur and Kordofan. In the Sudan rangelands occupy approximately 50% of the country's area. They cover many ecological zones, namely, the desert, semi-desert, and low rainfall savannah. They produce about 80% of animal feed requirements. Livestock rearing ranks after crop production as a major economic activity. Crop production and animal husbandry together form the back bone of Sudan's economy. Livestock production is widely practiced under a traditional system. The government has realized the potential of animal resources for earning foreign exchange. Moreover, natural grasses and herbs play a significant role in soil conservation, watershed protection, desertification control, carbon sequestration, maintaining biodiversity, providing medicines, and in the release of plant nutrient elements during the process of humification and mineralization of decomposed grass roots[31, 32]

Open grazing is the common practice, which has many disadvantages. This is mainly due to the fact that grazing and animal rearing is practiced under communal ownership which lacks control and management and often leads to the degradation of vegetation and soil and results in social conflicts. Attempts have been made to change the traditional pattern, by calling for a ranching system as an approach for livestock raising in the Abufas reserved range (1960s), the Geraih El Sahra settlement scheme (late 60s), on the Barbanusa ranch (early 70s) and Gazelle Gawazat experimental ranch (mid 70s) and on the Elodaya communal improved range (early 80s), all of which aimed to improve rangeland in order to bridge the aforementioned deficit.

Figures 4 and **5** illustrate the situation in the Sudan during the early 1980s and up to 2002. Despite the fact that rainfall has decreased, the vegetation cover is in the process of recovering. However, there is tremendous pressure from grazing, especially by goats. In other areas, on the clay plain, there is a continuing land degradation process.[33], estimated that overgrazing accounts for 47% of the clearance of natural vegetation, whereas mechanized cropping and woodcutting, and urban demand for charcoal account for 22% and 19% respectively. The increasing need for wood for construction and fuel in the Sudan may accelerate the trend of woodland destruction.

**Figure 4.** The impact of desertification (moving sand), on houses in Nile state, Sudan (Photo: Mohamed El Fadl)

**Figure 5.** The result of desertification, 2002 (Photo: Mohamed El Fadl. Nile State, Awateeb village)

# 4. Rainfall Patterns of the Sahel and the Sudan

Results from various sources indicated that the Sahel region is renowned for its twin environmental problems of drought and desertification. Evidence from various reports[34, 35, 36, 37, 38, 39, 40], indicated a downward rainfall trend.[41,42], reported that the documentary records based on the last 70 years show a slight decline in rainfall from 1955 and acute drought in 1968 and rainfall below average up to 1973. This decline in rainfall results in the familiar pattern of vegetation degradation, soil erosion, and decreased crop yields and livestock productivity coupled with an increase in migrations of people. Generally, a marked and progressive deterioration of rainfall has occurred since the mid-1960s culminating in the mid-1980s. These patterns can be seen from the annual rainfall series in the study area (see Figure 6).

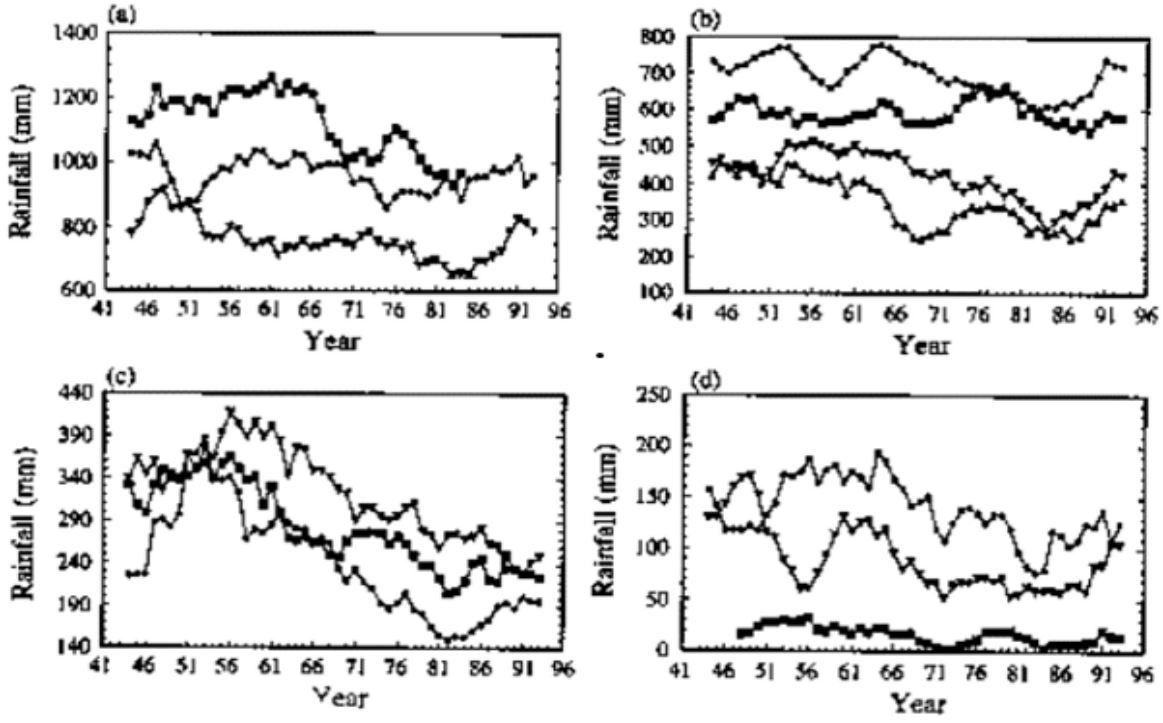


**Figure 6.** Annual rainfall time series expected as seven-year running means in the following locations in the Sudan: (a) (●) Juba; (■), Wau; (▼), Malakal.(b) (●), Ed Damazin;(■), El Gedarif; (▼), Nyala; (▲), El Obeid; (c) (●), El Fasher; (■) Kassala; (▼), Wad Medani; (d) (●), Shambat; (■), Dongola; (▼), Port Sudan. Source:[42]

Rainfall variability on a time scale from years to days is as much a characteristic of climate as the total amount of rainfall recorded. Low values, however, do not necessarily lead to drought; nor is drought necessarily associated with low rainfall. The reality is that in drylands rainfall is fluctuating, and therefore good and bad years will continue to occur. Some regional patterns of rainfall can be expressed in terms of variability, trends (upward or downward), and persistence. Even allowing for the differences between countries in individual years, the period 1960-1993 has experienced widely different conditions from year to year.

The years from 1960 to 1963 were among the wettest of the period, while the seventies and eighties experienced, for the most part, lower rainfall. The downward trend from 1960 to 1970 affected the whole continent, but only had a negative impact on food production in the low rainfall areas. The years 1973, 1984, and 1992 were bad, while 1963, and, to a lesser extent 1989 were remarkable years in that almost the whole continent experienced above average conditions. The year 1973 was interesting in that it constituted the first poor year after a run of good years. As such, it caught most countries unprepared. In contrast, the impact of 1984, which was more severe than 1973 in climatologically terms, was less serious for the economies of many countries which was also the race in the Sahel. In 1973 almost all the African countries suffered, north and south alike.

The Sahel area, including the Sudan is one of the driest and most variable in Africa. Runs of dry years and runs of wet years are a typical feature of the climate of the countries, in this sudano-Sahelian group where extreme years (either good or bad) are more likely than average ones. There is a misconception about the term among many scholars who think it means the sea shore. The Sahelian zone lies between the Sahara in the north and the Sudanese zone in the south. It is spreads in a fringe along the desert from the Atlantic Ocean to Ethiopia, Somalia, and Kenya. The Sahelian zone passes progressively into the desert in the north as rainfall decreases and in the south it is replaced gradually by the savannah. There is a belief that desertification in the Sahelian belt is spreading southwards at the rate of 6-10 km per year. The Sudano-Sahelian zone experienced a downward trend in rainfall until 1988, which was followed by a series of about-average years. The worst drought years were 1983 and 1984, but severe droughts were also recorded in 1972, 1973, and 1977 (see Figure. 7). Deficiencies in the number, quality, and length of rainfall records make it extremely difficult to construct an accurate chronology of precipitation behavior in the Sudan as a whole. Nevertheless, it is possible to make some observations about rainfall behavior during this century. The declining trend in rainfall is expected to continue in the Sahel region[43, 44, 45]. In the first half of the century, and especially in the first decade, the climate of the Sudan was probably drier than it had been during the second half of the nineteenth century.

The single driest five-year period recorded in Khartoum in the 20$^{th}$ century was centered on 1912 with 101 mm.[46] pointed out that 1913 was a particularly dry year, with the isohyets 150 km or more south of their mean positions; the Nile flood was the poorest during the period of modern records. The available data suggests that annual rainfall

totals below 100 mm must have been common in the Sudan at this time. From 1920 (see Figure 8) the climate became noticeably wetter, with more reliable rainfall from year to year and several sequences of years when rainfall exceeded the recent 30-year on averages.

At Khartoum the five-year period centered on 1922, with 289.8 mm of rain, was the wettest on record, but at Ed Dueim the wettest period occurred later, with a mean of 428 mm in the five-year period centered on 1938. In 27 out of the 39 years between 1920 and 1956 general precipitation totals were above the long period normal figures. Undoubtedly, agricultural practices and planning decisions that were made during this favorable wet period need to be reviewed in the light of precipitation behavior in the last two decades. Climatic parameters have both a direct and indirect impact on many land degradation processes, especially through their impact on vegetation and soil conditions. Rainfall variability is an important factor in dryland climates[47]. Drought has been shown to be one of the extreme climatic stresses that contribute to land degradation processes[48].

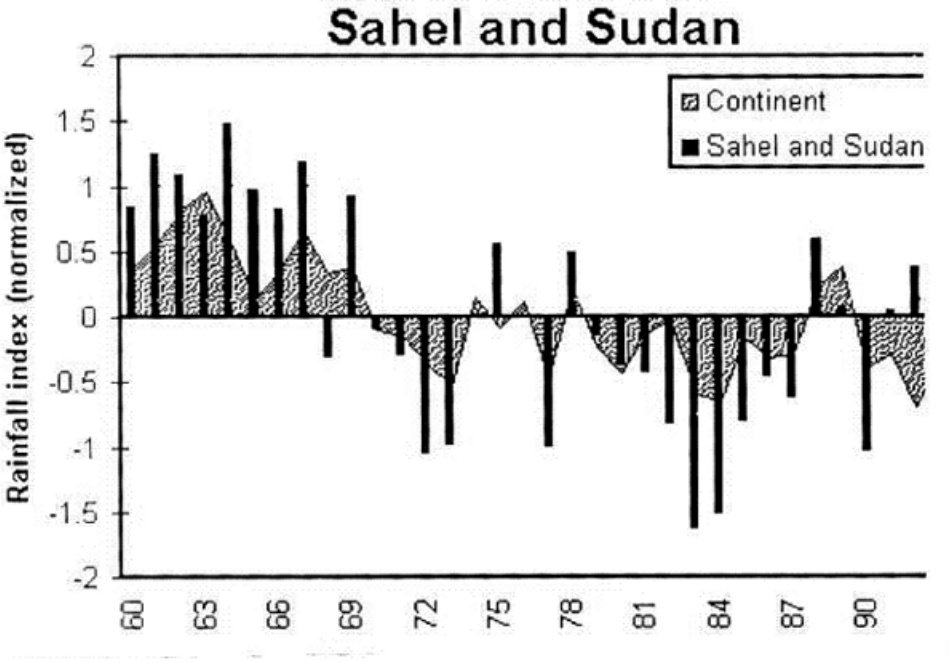


**Figure 7.** Rainfall patterns in the Sahel and the Sudan[44, 45]

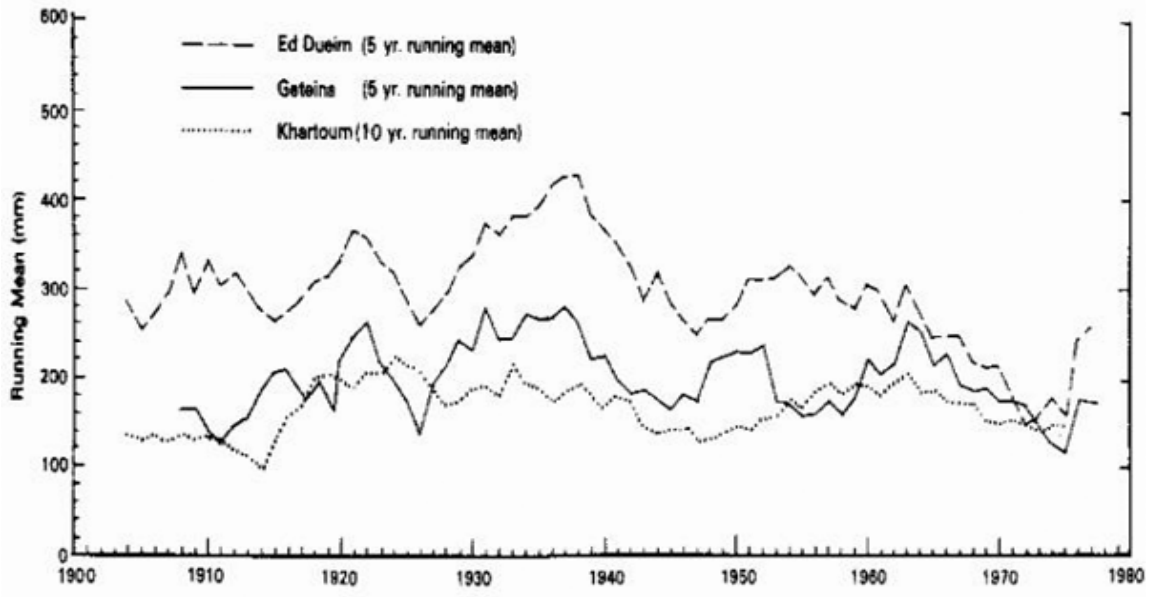


**Figure 8.** Rainfall trends in the Sudan from 1900 to 1980 (http://www.unu.edu/unupress/unupbooks)

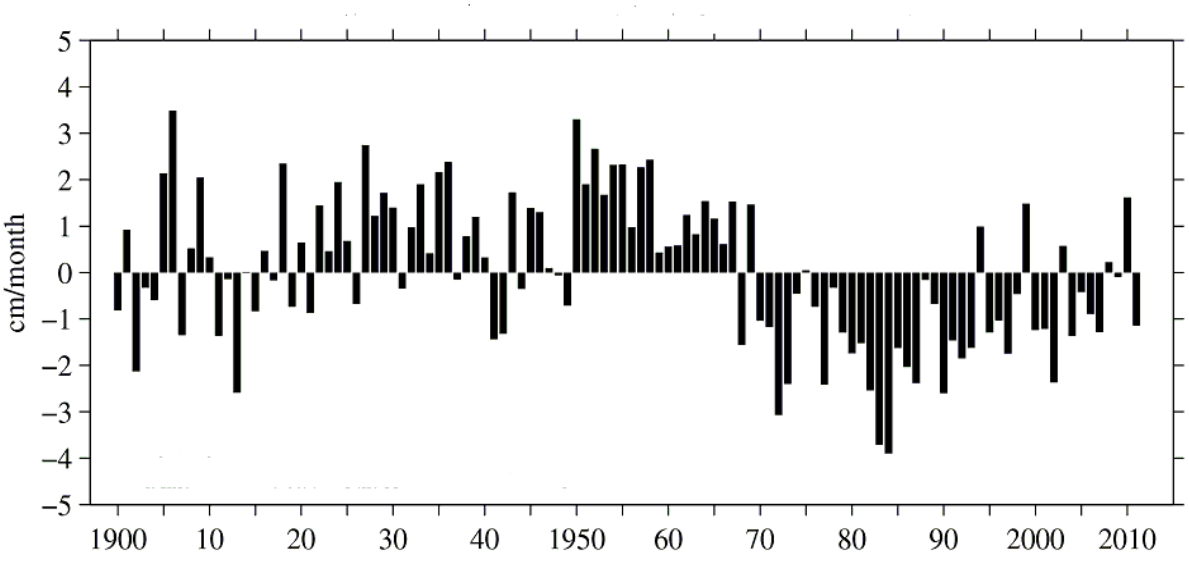


**Figure 9.** Sahel Precipitation Anomalies 1900-2011 June through Ochober averages over 20-10 N, 20-10 E. 1900-2011 Climatologic. Source: NOAA Global Historical Climatology Network Date[52]

## 5. Recent Trends in the Sahel Rainfall Regime

Figure 9 shows that the general rainfall trend seen in the Sahel was mirrored in the Sudan: the wet 1950s and 1960s were followed by a prolonged dry spell in the Sahel starting in the late 1960s lasting until the early 1990s. The Sahel has remained drier than normal well after 1995. The general trend towards more rain in the Sahel in the 1990s and early 2000s is also seen in the Sudan. Available statistics indicate that current trends in the Sahel rainfall regime led to divergent conclusions: while[49] that the Sahelian drought ended during the 1990s, in a recent comprehensive review,[50] reported that a rainfall recovery occurred in the northern Sahel (north to $16^{o}$ N) over 1998–2003 but that this recovery was limited further south. In a study,[51] realized that with respect to the 20-year wet period 1950–1969, the 20-year dry period 1970–1989 was characterized by a smaller number of rain events of approximately unchanged intensity. It is reported that this decline was especially evident for the core of the rainy season, over western Sahel, dry conditions are still dominant[52].

## 6. Effects of the Drought in the Sudan

Sudan is frequently subjected to drought, which is the main limiting factor on biomass production, and crop yields.[53], reported the first serious sign of soil degradation in the Sudan]. He reported that there was rapid deterioration of soil and vegetation were occurring in parts of the Red Sea Hills which he considered as a warning that such problems might be developing elsewhere, particularly around town peripheries and settlement areas in the Kordofan and Darfur Provinces of western Sudan. The population pressure in Sudan appears still to be growing, to judge from the growth in area of cultivated land[54]. Nevertheless, a little caution is needed regarding the explanation. Studies of degradation, even in Africa, have not found it easy to relate population densities to degradation. For example, in the same part of Sudan to which[55], referred,[56] could find no correlations between population density and degradation. There are several reports, which argue that, growth rates in dryland populations among paternalists at least are not high[57]. In the Sudan, the slash and burning of natural forests and bush lands in order to clear land for agriculture is considered one of the main causes of deforestation and vegetation removal that contributes significantly to desertification.

## 7. Agroforestry for Sustainable Land-use in the Sudan

In Sudan, the current trend is mainly one of increasing exploitation of the natural resources, leading to over-exploitation in large areas, owing to the lack of alternatives for a growing population. Generally, external inputs such as chemical fertilizers are either comparatively difficult to come by or lacking in the Sudan. The use of these inputs is not lucrative under the present circumstances, and land productivity depends largely on the natural resources. The adverse effect of over-exploitation is characterized by environmental degradation, scarcity of tree products, marginal crop and pasture yields, removal of vegetation cover by overgrazing[58], soil loss as a result of monocropping, and over-grazing leading to erosion, water run-off and loss of topsoil or soil nutrients, and reduction of biodiversity (local disappearance of the most palatable and useful species, fodder trees and most wildlife[59].

Clearly farming systems in the Sudan have come under

some stress as the pressure on farm land increases. The challenge now is to look for more sustainable ways of farming. It is for this reason that innovative approaches in farming practices are sought all over the world for 'sustainable' farming systems. Owing to adverse impacts of land degradation and desertification with consequent decline in agricultural productivity, it is necessary to avail to the farmers a technology that is acceptable to them, as a means of rehabilitating the degraded drylands. One such appropriate method is the use of agroforestry[60]. Thus agroforestry technology has been seen by many as a potential solution to this continued problem of declining rural agricultural production in the tropics and for that matter, the Sudan[61, 62]. Agroforestry as an "informal" art based on knowledge is an age-old land use principle that has been practiced for thousands of years by farmers all over the world[63, 64]. As the word and concept became generally accepted in international land-use domains, many definitions of the term were put forward, as described in detail by[65].The definition of agroforestry that the World Agroforestry Center (known as the International Center for Research in Agroforestry, ICRAF before 2002) has used since the early 1980s is as follows:

"*Agroforestry is a collective name for all land-use systems and practices in which woody perennials are deliberately grown on the same land management unit as crops and/or animals. This can be either in some form of spatial arrangement or in a time sequence. To qualify as agroforestry, a given land-use system or practice must permit economic or ecological interactions between the woody and non-woody components*"[66].

This definition provides a classification in agrosilvicultural (trees with crops) and silvopastoral (trees with pastures) practices, sequential and simultaneous systems in zonal and mixed arrangement of trees and crops. The aim of agroforestry practice is to provide rural communities with timber and wood fuel; control water and wind erosion, improve soil fertility; provide livestock fodder, increase yield; provide income to the rural community, thus contributing to rural development[67].

The Forests Act 1989 of the Sudan has already stressed the need to practice agroforestry and obliged large-scale mechanized farmers to leave or to plant a percentage not less than 10% of the total area of a rain fed project, and a percentage not less than 5% of the total area of an irrigated project, in the form of wind breaks or shelter belts for the purpose of protection and production[68]. Major multipurpose trees that can be grown on agricultural lands in the area include *Acacia senegal*, *Acacia seyal*, *Eucalyptus* and *Ziziphus*. These trees can protect the soil against erosion. The trees also enhance infiltration of water into the soil. They "mine" nutrients from deep soil and make them available to shallower depths through (mainly) litter fall. Measures of soil fertility have shown increased levels of nitrogen, phosphorous and organic matter under Acacia trees. Increase in crop yields is estimated to be as high as 15%. More research is needed on the critical role wind breaks and shelter belts play in increasing agricultural production.

# 8. Conclusions

The desertification in the Sudan is the combination of both natural and human factors, which results in a decline of productivity or the degradation of natural resources, such as the constant destruction and deterioration of the land, which reduces the usefulness of these areas to man. It is impossible to separate climate-induced factors, which caused environmental changes from land degradation induced by humann activity. In extreme situations, drough or recurrent drought has worsened in the case of the Sahel, and in Sudan in particular.

In the Sudan rainfall is the most limiting factor, as it is erratic and unevenly distributed. The people of the Sudan depend, economically, on agricultural crop production and animal husbandry and both practices have a direct impact on dryland degradation. Unsuitable and damaging forms of land use are the main causal factors of land degradation and include: Overcultivation, overgrazing, shifting cultivation or slash and burn techniques, tree felling and illegal logging. The nomadic life-style of the rural communities located next to forest land has also contributed to the depletion of resources as a result of conflicts amongst themselves and with other stakeholders over scarce resources which are in a fragile condition. Population growth is a major cause of land use-change, as farmers try to grow more food to feed rising numbers of people by increasing either the yield per hectare or the area under cultivation. So current forms of land tenures or the lack of clear landowning policies constrained the implementation of sustainable management strategies for controlling or rehabilitating the degraded lands, because there is a tendency to be careless about communally-owned land. Political factors also have great influence on deterioration and land degradation in terms of conflics, corruption, unstable land tenure systems, bad policies, institutional and market failures.

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