

# COMBATING DESERTIFICATION IN SUDAN: EXPERIENCES AND LESSONS LEARNED

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## ABSTRACT

**Problem statement:** Sudan is the largest (2.5 million km<sup>2</sup>) country most seriously affected by desertification in Africa. The arid and semi-arid lands

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cover an area of 1.78 million km<sup>2</sup>, which represents about 72% of the country's total area<sup>1</sup>. Sudan has collaborated with and contributed to the International efforts to combat desertification. It is one of the first countries that signed the United Nations Convention to Combat Desertification (UNCCD) and assigned the National Drought and Desertification Control Unit (NDDCU) for the coordination of programmes to mitigate the effects of drought and to combat desertification as a focal point. Since the 1930s, programmes to combat desertification and its component projects and interventions have been launched in Sudan through technical and financial assistance (local and international) to improve land resources, production systems, and protection of the environment. Sudan, like other African countries, needs plant cover: an earlier study for the UN Food and Agriculture Organization (FAO) indicated that Sudan has lost between 250,000 and 1,250,000 hectares of the total area of its forests since 2005; this is the main reason for the expansion of the desertification phenomenon. Therefore, unless serious and immediate action is pursued, the gap between the sustainability of resources and the degree of exploitation will widen further<sup>2</sup>.

**Objectives:** The objective of this paper is to review the efforts taken by Sudan in combating desertification from governmental and private sectors, and to assess the reasons for the failure of past efforts to combat desertification.

**Methodology:** Previous acts and agreements from National and International sources have been collected. The hazards of desertification and their impacts on economic and social lives have been evaluated.

**Findings:** Many conclusions and lessons emerged from previous experiences of government, NGOs, civil society and private sectors in implementing desertification programmes in Sudan. The analytical review of Sudan desertification policies showed a lack of an intersectoral approach that integrates forestry activities and land use into the social, economic and developmental process of the country. They also lacked linkages to other sectors that use and actually compete for the available natural resources.

**Values:** Therefore it was recommended that capacity building, public awareness, and integration of NGOs, governmental sectors including research institutions, ministries and international organisations is urgently needed.

**Keywords:** Sudan; desertification; conflicts; environment

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<sup>1</sup>Republic of Sudan. Ministry of Agriculture and Forestry; NDDCU; SNAP; A frame work of combating desertification in Sudan in the context of the UN Convention to combat desertification, Khartoum-Sudan, March 2006.

<sup>2</sup>African News. [www.Xinhuanet.com](http://www.Xinhuanet.com) (2016).

### INTRODUCTION

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 (IPCC, 2001). Another definition of desertification is the spread of desert-like conditions of low biological productivity due to human impact under climatic variations (Helldén, 1991; Reynolds, 2001; Reynolds and Stafford Smith, 2002).

It is estimated that three-quarters of dry lands have suffered from some degree of desertification (UNCOD, 1977; FAO, 1984; UNEP, 1992; FAO, 2000). The removal of vegetation cover exacerbates desertification and accelerates soil erosion; this causes reduced soil fertility and eventually renders the land unproductive. This situation has often led to the assumption that it is a human induced process that 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 dry land's ecosystem. Rainfall variability, both in time and space, coupled with the inherent ecological fragility of the dry lands, weakens the resilience of the ecosystem and its ability to return to its original condition (Abdi et al., 2013).

According to Dregne and Rozonov (1991) and Maliva and Missimer (2012), desertification has been with us for thousands of years, but has not received attention for a very long time. It was not until the 20<sup>th</sup> century that governments and people in general finally realised that land degradation and desertification threatened their future.

There are conflicting propositions regarding the dynamics of the Sahelian desert, which lies in the Northern part of the African continent. The absence of a universally agreed definition of drought, and an understanding of its relationship to desertification, makes understanding the Sahelian ecosystem difficult. The definitions of the terms ‘desert’ and ‘desertification’ are complex issues in themselves, and open to various interpretations (Richards, 1994; Toulmin, 1995). In a 1975 report, Lamprey stated that it is evident that the desert’s southern boundary has shifted south by an average of 90-100km in the previous 17 years, representing a southwards shift of 5-6km per year. This assertion is contested on the grounds that the basis of Lamprey’s comparison was wrong, and that the ‘shift’ as a result of a severe drought has been stabilised. Hellden (1991) did not concur with such expansion in the Sudan, and asserted that there was no evidence that patches of desert were spreading outward from villages and water holes into the dry lands of the Sahel area (Hellden, 1991).

### HISTORY OF DESERTIFICATION IN SUDAN

Natural disasters in the contrasting forms of drought and flooding have historically occurred frequently in Sudan; they have contributed significantly to population

displacement, poverty, diseases and the under-development of the country. A silent and even greater disaster is the ongoing process of desertification, driven by climate change, drought, and the impact of human activities.

Desertification and land degradation are among the central problems for the sustainable development of the dry land ecosystem, especially in the case of Sudan (see Map 1 below). Recurring droughts and land degradation are closely linked. Drought increases soil degradation, which, in turn, magnifies the impact of drought (Abdi et al., 2013).

Historical data, anecdotal field reports and modelling all point to the same general trend. Overall, rainfall is becoming increasingly scarce and/or unreliable in Sudan's Sahel belt: this trend is likely to continue. On this basis alone, large tracts of the Sahel will be severely impacted by declining food productivity over the next generation and beyond.

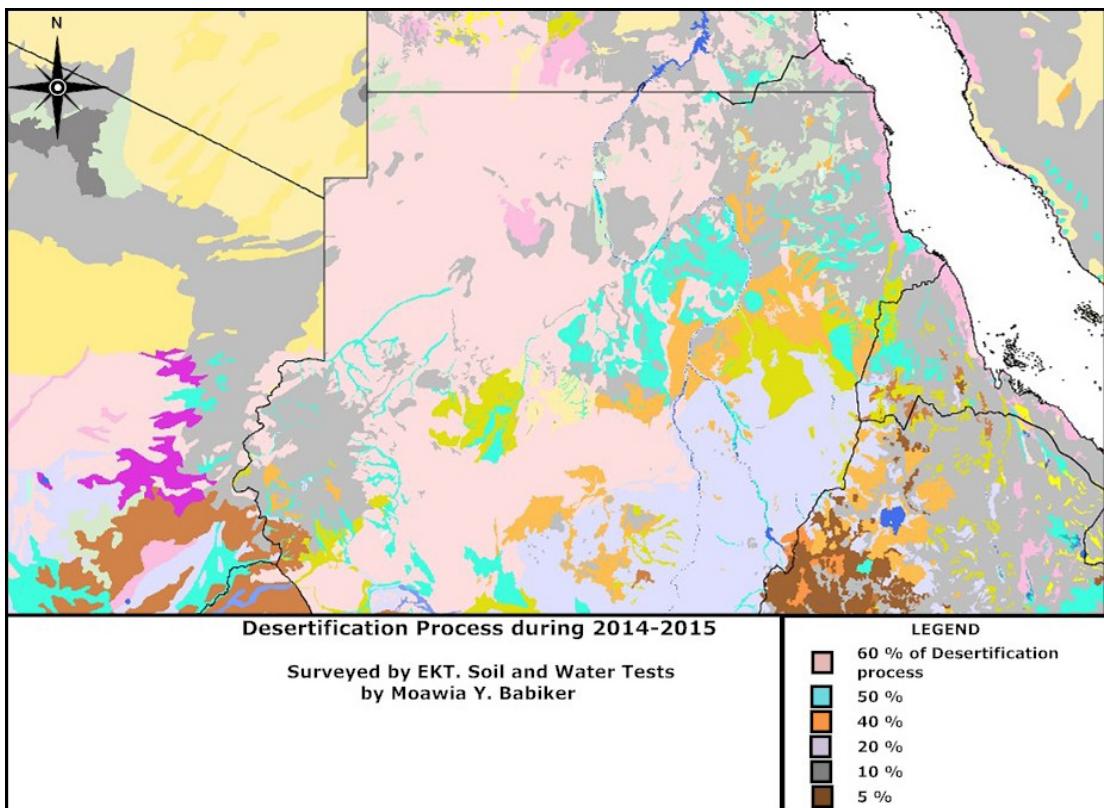
Annual variability and relative scarcity of rainfall - in the north of Sudan in particular - have a dominant effect on agriculture and food security, and are strongly linked to displacement and related conflicts. Drought events also change the environment as dry spells kill otherwise long lived trees, and result in a general reduction of the vegetation cover, leaving land more vulnerable to overgrazing and erosion.

Together with other countries in the Sahel belt, Sudan has suffered a number of long and devastating droughts in the past decades. All regions have been affected, but the worst impacts have been felt in the central and northern states, particularly in Northern Kordofan, Northern state, Northern and Western Darfur, and Red Sea and White Nile states.

Desertification is considered one of the main factors that cause the migration of rural populations to urban centres; thus, creating so-called "environmental refugees" (UNEP, 1991). As reported by UNEP (1991) the impact of land degradation manifests itself in different forms.

50 to 200 km southward shift of the boundary between semi-desert and desert has occurred since rainfall and vegetation records were first held in the 1930s. The remaining semi-desert and low rainfall savannah which represent some 25% of Sudan's agricultural land, are at considerable risk of further desertification. This is expected to lead to a significant drop (approximately 20%) in food production.

Insufficient and highly variable annual precipitation is a defining feature of the climate of most of Sudan. Desertification, therefore, is considered as Sudan's greatest environmental problem (see Map 1 below). In northern Sudan, there is high awareness of the issue of desertification within the academic community, and there is historical evidence of a number of attempts to quantify and/or limit the extent of the problem since at least the 1950s (Reynolds, 2001; FAO, 2000). As early as 1953, a landmark study discussed several of the sources of the problem (such as overgrazing), as well as its implications on long-term damage and reductions in productivity (UNEP, 1992; Reynolds, 2001).



**Map 1 Map Showing Desertification during 2014-15**

Source: Revised by the author

The most severe drought occurred in 1980-1984, and was accompanied by widespread displacement and localised famine. Localised and less severe droughts (affecting between one and five states) were also recorded in 1967-1973, 1987, 1989, 1990, 1991, 1993 and 2000 (Reynolds, 2001; IPCC, 2001).

Isolated drought years generally have little permanent effect on the environment. In the case of central Sudan, however, the 18 recorded years of drought within the last half-century are certain to have had a major influence on the vegetation profile and soil conditions seen in 2006.

Recent research has indicated that the most likely cause of these historical droughts was a medium-term (years) change in ocean temperature, rather than local factors such as overgrazing (Helldén, 1991; Reynolds, 2001). Therefore, the potential for such droughts to recur remains.

Although most of the country is arid, the economy has predominately depended on the agricultural sector, including livestock production, forestry and fishing (see Figure 1). Together, they used to contribute about half of the GDP before the discovery

and exploitation of oil in 1999. Despite the emergence of Sudan as an oil exporter and the diminishing share of the agricultural sector in overall export earnings, agriculture continues to be the backbone of the country's economy in terms of its contribution to GDP. The sector contributed on average about 35% of the country's GDP from 2009 to 2010 (see Figure 2) (MOA, 2015).

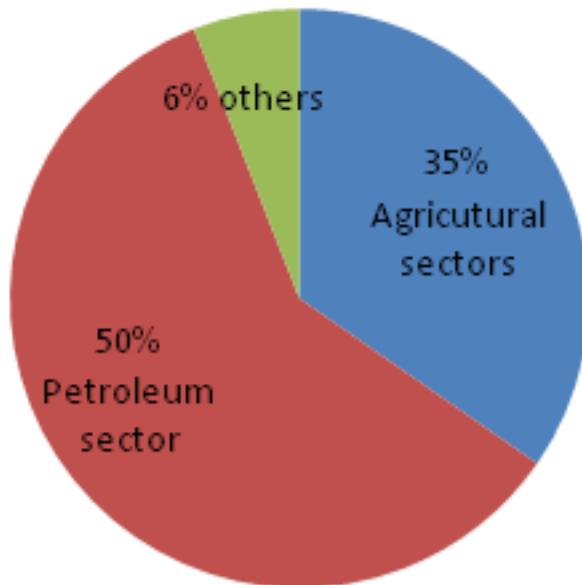


Figure 1 Contribution of Different Sector in GDP (2009–2010)

Source: MOA (2015)

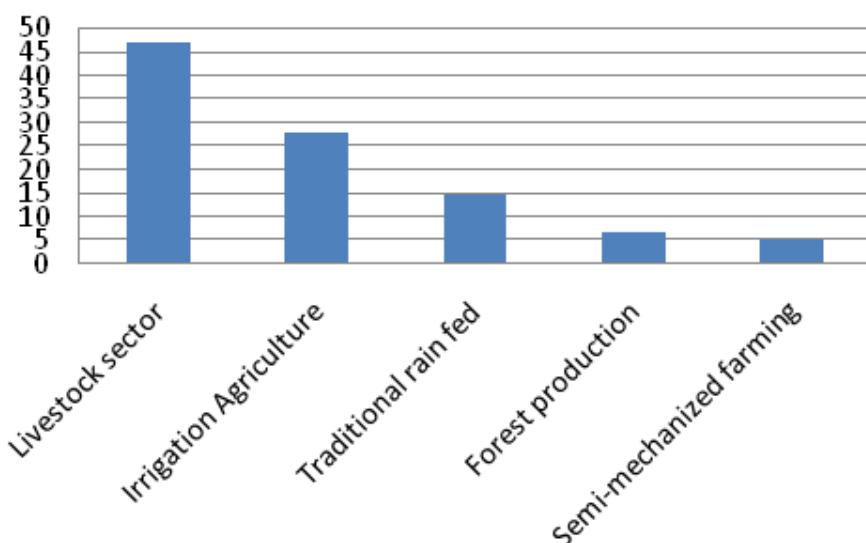
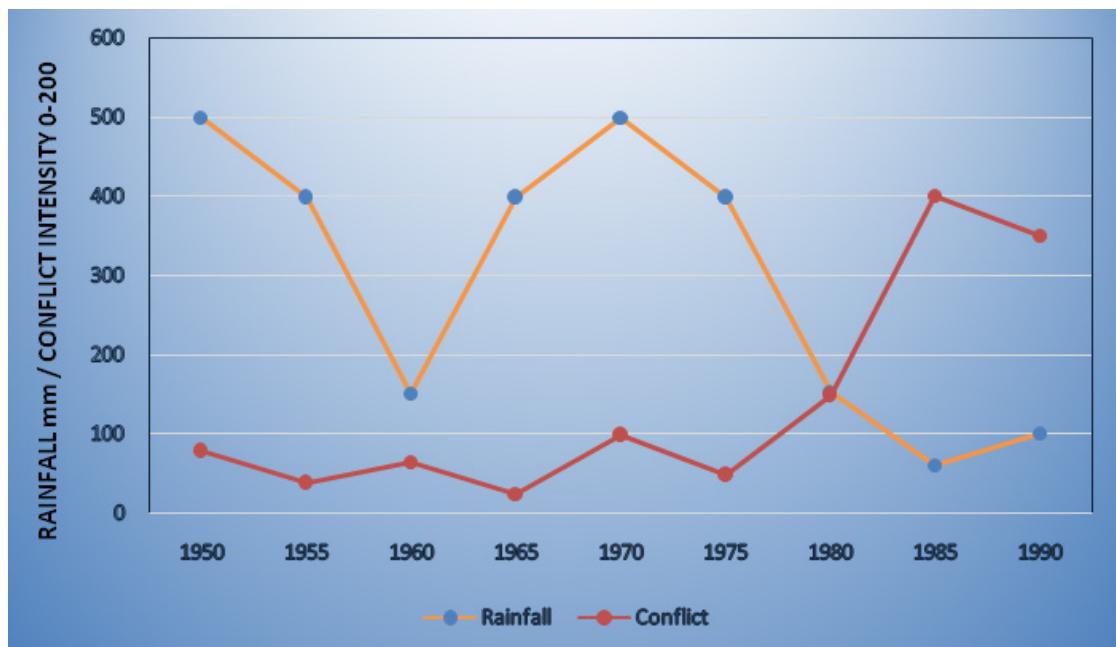


Figure 2 Share of Agricultural Sectors in GDP

Source: MOA (2015)

## **DESERTIFICATION IN DARFUR**

Droughts and insufficient rainfall are characteristic of western Sudanese territories, primarily in North Darfur and Kordofan. Over the past 100 years there have been five periods of prolonged drought in the region. Two of them have happened in the last 20 years. In these areas the average precipitation ranges from 100 to 600 mm per year, which, with its lower limit, poses a high probability of serious adverse consequences in the agricultural and livestock sectors. The rainfall in 1950-1990 caused three long periods of drought, one of which occurred in the mid-sixties and was relatively light. The second period, which occurred between 1972 and 1975, was relatively heavy, but the third one in 1982-1984 was almost a catastrophe. This period of drought was accompanied by the outbreak of armed clashes. The most severe and intense of these clashes occurred in the mid-1980s. Over time, those skirmishes turned into a full-scale warfare (Suliman, 2008). The graph below shows the relationship between rainfall and conflicts erupting in this area over 40 years (1950-1990). The chart shows a trend - a correlation between droughts and occurrence of armed conflicts. (Figure 3)



**Figure 3 Correlation between rainfall and conflict in North Darfur (1950–1990)**

*Source:* M. Suliman, Darfur, Resource War and Identity War, Academic Press, Cambridge 2004

The graph also shows the difference between the impact of the drought on the social situation in the mid-1970s and the mid-1980s. The first one was moderately

severe, but it did not cause an intensification of social unrest and armed conflicts. The second drought in the eighties of the last century contributed to famine, and armed conflicts that took place in the region. Migration has intensified. Drought has contributed to the collapse of the rural economy. Many animals died. Shepherds often hastily discarded other animals for low prices. The life of the population was difficult. At this moment, the rural community is susceptible to disintegration, to surrender, to falling into armed conflict, and finally to war. It was in northern Darfur in the mid-eighties of the last century. Many years later, in 2007, the United Nations Environment Program (UNEP) published a comprehensive analysis of the depth of the ecological crisis in various parts of the Sahel. It turned out that one-third of the forested area was lost in 1973-2006 in Darfur. Based on these studies, it can be concluded that this type of drought and lack of precipitation is sufficient for the natural environment to change significantly, regardless of human influence. This resulted in a displacement of 40 years to the south of the desert climate by about 100 km. Such a scale of historical climate change is unprecedented. Reducing precipitation changed millions of acres of marginal semi-arid areas into the desert. This process has changed the northern part of the Sahel into almost deserted terrain. This also led to the displacement of the pastoral community to the south in search of pastureland (Mundy, 2010).

## REVIEWING CHALLENGES TO COMBAT DESERTIFICATION IN SUDAN

Sudan started combatting desertification many years ago, when the report of the Soil Conservation Committee of 1944 concluded that soil degradation and desertification was mainly due to the misuse of land resources rather than as a result of climate change (Seedahmed, 2017). Desertification continued to worsen day-by-day and threatened the economic and social progress of the country and the lives of its inhabitants.

Between 1972-1976, the Sudan government established the National Committee for Combating Drought and Desertification under the chairmanship of the National Research Council and the Ministry of Agriculture. It commissioned the preparation of studies and solutions to the problems of desertification and drought. The Committee issued a report on the status of desertification in Sudan and project proposals to address the phenomenon. The report was presented at the United Nations Conference on Desertification in Nairobi in 1977 (Seedahmed, 2017).

In 1979, the Ministry of Agriculture was assigned a part-time coordinator to follow up desertification control projects. In 1980, a full-time coordinator was appointed. The National Bureau for Drought Control and Desertification was established under the supervision of the Ministry of Agriculture under the administrative supervision of the Minister of State for Agriculture. A decision was taken to form a Permanent Council for Desertification, in which all relevant ministries and departments, as well as academic and research bodies, were mentioned.

The International organisation also played a significant role in desertification issues in Sudan. The Sudano Sahelian Office (UNDP) provided technical and financial support in the early 1980s to the Office to Combat Desertification, which was designated as the Office for the Coordination of Desertification Programs. The Office was able to hold four regional workshops to raise awareness and to consult on the phenomenon of desertification, and how to address these problems in the beginning of the eastern region, followed by Kordofan, Darfur region, and then the northern region. These workshops had been adopted on the consultative approach and involved all concerned in identifying and addressing the problem of desertification. Sudan also defined the consultative approach from bottom to top to prepare the National Action Plans (NAPs) (Seedahmed, 2017).

Sudan succeeded in obtaining funds for the gum arabic belt and the grassland development project, and five grants from the Australian Government in the field of natural resources.

In 1986 Sudan established the Relief and Reconstruction Commission that was affiliated to the Ministry of Agriculture, but external funding was suspended due to a conflict of competencies.

In 1988, the Council of Ministers decided to establish a central ministry for refugee and relief affairs, and included in its structure an administration to combat desertification. After strenuous attempts, the two ministries were disbanded in connection with desertification, which was reintroduced to the Ministry of Agriculture.

This was followed by the establishment of the Drought and Desertification Coordination Unit (NDDU) by a ministerial decree issued on 17 March 1991. This decree confirmed the subordination of the unit to the Ministry of Agriculture and Livestock at the time, under the direct supervision of the Minister of Agriculture. The resolution specified the terms of reference of the unit and the terms of reference of the Coordination Council, which was formed under the chairmanship of the National Coordinator and the membership of 15 other bodies.

The unit was able to obtain technical support from the European Union in Sudan in 1993, which was used in the establishment of the first Geographic Information System (GIS) unit in Sudan. An expert from the British Hunting Company was hired to determine the geographical extent of desertification.

## FORMULATION OF SUDAN'S NATIONAL ACTION PROGRAMME

After the implementation of the International Convention to Combat Desertification the Sudan began preparing the National Action Plan with the assistance of the United Nations Development Programme. The stages of formulating the National Action Programme (NAP) (Seedahmed, 2017) were first to organise workshops involving

national partners and community leaders in the 13 affected states, where experts from the same states prepared specialised working papers and discussed the following topics:

1. The priorities of the state programmes in combatting desertification and mitigating the effects of drought.
2. Previous experiences in combatting desertification and mitigating the effects of drought.
3. Identifying the roles of all stakeholders in combatting desertification.

Second, the organisation of specialised workshops at the federal level, mainly concerned with the development of a unified strategy for the implementation of the NAP to combat desertification. In this context, 10 national working papers were prepared by national experts in economic and social development and environment conservation. The papers included topics related to the programme, such as resource mobilisation, the role of decision-makers, and voluntary organisations in combatting desertification.

The third phase was a national forum in which representatives from the affected states and government officials participated. There had been active contributions from the United Nations Development Programme and the United Nations Office to Combat Desertification. The presence of state governors and representatives of constitutional institutions was an expression of political commitment. The paper included six main themes, including funding, capacity building, traditional knowledge, programme priorities, institutional structures, follow-up and evaluation, as reflected in previous workshops.

In 2001, the Arab Organization for Agricultural Development (AOAD) asked the Minister of Agriculture to commission two national recruits to draft the NAP document based on the information available from the workshops and the National Forum. The two advisers prepared the National Action Programme in 2002, and submitted it to the Secretariat of the International Convention to Combat Desertification in the form of a draft in Arabic (Seedahmed, 2017).

The National Committee of Voluntary Societies working in the field of desertification has undertaken a parallel effort to complement the government's efforts. The national plan for civil society organisations in combatting desertification has been prepared and integrated into the national plan.

In 2009, the Desertification Law was provided for the establishment of a national council under the auspices of the President of the Republic.

In 2015, the task of combatting desertification became the responsibility of the Ministry of Environment, Natural Resources and Urban Development, with the issuance of Presidential Decree No. 32. When the Presidential Decree No. 21 of 2017

was issued, the National Council for Combating Desertification was included in the Ministry of Environment, Natural Resources and Urban Development.

In 2016, a Secretary General of the National Council to Combat Desertification was appointed.

The establishment of the Council is being carried out through the establishment of a permanent headquarters in the national capital, followed by the establishment of branches of the Council in the States, and the authorisation of an organisational and functional structure for the Secretariat of the Council.

The Council will have the following powers and authorities (Seedahmed, 2017):

1. to formulate policies, plans and propose legislation to combat desertification in cooperation and coordination with relevant parties;
2. to develop a long-term national programme of action for the optimal and balanced use of land and natural resources;
3. developing human resources and providing necessary support in the fields of desertification studies and desert culture in all relevant fields;
4. to follow up the implementation of the National Action Programme and endeavour to develop and promote it;
5. to support the physical and human capacities of the National Action Programme to combat desertification;
6. encourage scientific, economic and social research to support the National Action Programme in coordination and cooperation with the educational and research sectors;
7. encourage the use of technologies that help to protect land from degradation;
8. to establish a network of scientific research institutions to integrate physical and human capacities to combat desertification;
9. to develop and implement comprehensive awareness programmes targeting land users from agriculture, pastoralists, and others;
10. to review the policies, legislation and regulations of the Council periodically to keep abreast of developments in combatting desertification.
11. to establish an effective national organisation from the bottom up, and develop its material and administrative capacities to enable it to combat desertification and achieve sustainable development;
12. to supervise the fund and approve its regulations, administrative structure and reports;
13. to supervise the General Secretariat of the Board, approving its administrative structure and approve its financial and administrative regulations and reports;
14. to authorise the projects submitted by the fund to develop its resources;
15. to recommend the competence of delegations representing Sudan in relevant fora, workshops and meetings internally and externally;

16. to recommend to the competent authority the necessary studies in the field of desertification and its control and the parties entrusted with the preparation of the study;
17. to prepare reports on any practices or irregularities that the Board considers to exacerbate desertification.

Many projects were proposed to combat desertification in Sudan, e.g.:

1. Project for the reconstruction of the gum arabic belt (its three stages in Kordofan and Darfur);
2. Project for the reconstruction of pastures (Kordofan);
3. Project for the Rehabilitation of Grassland for Carbon Absorption (Kordofan St.);
4. Projects for the provision of tree belts in the Nile and North Nile Governorates;
5. Kordofan Resource Development Project;
6. Sustainable Natural Resources Development Project (Green Belt Project);
7. Wadi Al-Kwa Project (North Darfur - UNDP);
8. Adaptation projects to the effects of climate change.

## RESULTS

The review of the history of combatting desertification in Sudan revealed that serious attempts were made many years ago to formulate regulations and legislations, and to coordinate with international and regional agreements. Despite these efforts, desertification is still defined as the major threat to sustainable development and human lives.

Many conclusions and lessons emerged from the previous experiences of government, NGOs, civil society and private sectors in implementing desertification programmes in Sudan. The analytical review of Sudan desertification policies showed a lack of the intersectoral approach that integrates forestry activities and land use into the social, economic and developmental process of the country. They also lacked linkages to other sectors that use and actually compete for the available natural resources.

Therefore, fast action should be implemented to stop sand movement and improve soil quality. This is in addition to the interpretation of research results that dealt with modelling and drought control.

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## BIOGRAPHY

**Sarra Ahmed Mohamed Saad** was awarded a PhD in Soil Science in 2002 from the University of Goettingen, Germany. She graduated from the Faculty of Agriculture, University of Khartoum, majoring in Soil Science. Dr Saad was appointed to the National Centre for Research, Department of Environment in 1992, and is currently working as senior researcher of Soil Science. She is leading many research projects dealing with the problem of food security, soil productivity and climate change,

in addition to organic farming and its applications in Sudan. She is a member of many scientific societies inside and outside Sudan and has been awarded prizes for scientific achievements in Sudan. She also holds patents for producing compost from organic waste. Dr Saad has supervised many postgraduate students at the MSc and PhD level, and has offered consultancy to both government and private sector about organic food production and fertilisation strategies, especially in poor fertile soils. In addition to Arabic, Dr Saad speaks German, English, French and Spanish.

**Adil M.A. Seedahmed** graduated with a BSc in Forestry from the University of Khartoum; has a Post-Graduate Diploma in Development Planning, ITC, the Netherlands, and an MSc in Agriculture, from the University of Western Australia. He worked in the Desertification Unit, Ministry of Agriculture, then the Dinder National Park Project, the Nile Transboundary Environment Action Project and the NAPA Implementation Project (with the Higher Council for Environment and Natural Resources in the first phase and the UNDP in the second phase). He is a member of the Executive Committee of the Sudanese Environment Conservation Society.

**Allam Ahmed** ([www.allamahmed.org](http://www.allamahmed.org)) obtained his MSc/MBA from the Royal Agricultural University, UK and awarded the RAU Scholarship and Prestigious Book Prize for Best MSc/MBA Dissertation. He completed his PhD in Economics (*Technology and Knowledge Transfer for Development*) in two years at Edinburgh Napier University, UK. He is a Fellow and Chartered Marketer of the Chartered Institute of Marketing, UK. Allam is based at the Science Policy Research Unit - SPRU (*world leader in research, consultancy and teaching in the field of Science and Technology Policy*) University of Sussex, where he established and lead the postgraduate programme MSc International Management. Visiting Professor at the Royal Dock School of Business and Law, University of East London, UK (2016-now) and Visiting Professor at Brighton Business School, University of Brighton, UK (2012-2015). Allam has an extensive background in academia, public and private sectors, specialising in KM, technology transfer, SD, business process re-engineering, change management and organisational transformation. He is the Founding President of World Association for Sustainable Development and all its journal; Founding Director of Middle Eastern Knowledge Economy Institute; and Founder of Sudan Knowledge. In 2009 Allam led the Government of Abu Dhabi major and first of its kind in the Middle East Knowledge Management Framework (Musharaka). His work featured and archived by major international institutions and top universities such as World Bank; UN; EU; DFID; Government of St Lucia; WFP; Imperial College; Cambridge; Oxford; Princeton; Yale; Harvard; MIT; Stanford; Toronto; etc. Expert Advisor to the European Commission on International Scientific Cooperation (2006-2008); International Co-ordinator

UNESCO Chair on Transfer of Technology (2008-now); and Advisor African Capacity Building Foundation (2011-2013). He is listed in the WHO'S WHO IN THE WORLD 2009-2017.

**Ahmed Mohamed Adam Eldoma** has a BSc in Forestry (Honors) from the University of Khartoum, Faculty of Agriculture, an MSc in Natural Resources Management, from the Faculty of Science, University of Edinburgh, Scotland, UK, and a PhD in Tree Physiology and Genetics from UPM, Malaysia. He is currently an Associate Professor at the College of Forestry and Range Science, Sudan University for Science and Technology. Dr Eldoma has worked as an ACF at The Forestry National Corporation, Sudan, as Production Control Officer seconded to the Sudan Gum Arabic Company for two years. He has worked in different capacities at the College of Forestry and Range Sciences including, Head Department of Silviculture, Dean of the Faculty, Head of the Research Unit, and Secretary of University of Sudan Research Council. Dr Eldoma has worked as a coordinator for The Sudan Finland Forestry Program, and The Sudanese-Japanese Dry Land Research Group, sponsored by the Institute of Humanity and Nature, Kyoto, Japan. He has conducted several research projects and supervised many Postgraduate students at the MSc and PhD level. He is currently working as the Project Manager of the Natural Resources, Land Use Database and map for Darfur implemented by GAF AG Company based at Munich, Germany. He has authored two books and 22 journal articles.

**Sufyan Abd Elrzig Mohammed Ossman** is currently working as Head of Agricultural Unit in Khartoum Refinery Company in Khartoum-Sudan. He was awarded a BSc in Forestry and Range Sciences, and MSc in Environment and Forestry from Sudan University of Science and Technology in 2002 and 2013; respectively. He has participated in many workshops inside and outside Sudan related to disaster management; quality control of water and wastewater; management of petroleum installation; compost production and uses; proliferation of orchards, production of medicinal and aromatic plants; COP 21 in France 2015, COP 22 in Morocco and COP 23 in Bonn.