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Climate Change Adaptation in Sudan: Implementation and Policies

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Abstract

The majority of the Sudan is arid plains of low soil fertility, limited water resources and compounded by a range of human pressures that create a state of vulnerability, in addition to climate change impacts. Changing climatic conditions are causing adverse changes in the distribution and productivity of Sudan's natural resources - its forests, soils and grassland - are expected to have significant repercussions for millions of people. In 2003, Sudan Initial National Communication to UNFCCC assessed the likely impacts of climate change including decreasing annual rainfall, increasing rainfall variability and increasing average annual temperature, resulting in the reduction of ecosystem integrity, decline in crop yield, drought, diseases and insect infection, and decrease in biodiversity. In 2007, NAPA identified the key agro-ecological zones affected by climate change, vulnerable States and presented 32 initiatives for adaptation in the agriculture, water and health sectors. The project to implement NAPA priority interventions to build resilience in agriculture and water sectors to adverse impacts of climate change was sponsored by LDCF/UNDP and implemented by HCENR in the five vulnerable States representing five agro-ecological zones. The project objectives were to implement urgent set of adaptation-focused measures that will minimize and reverse the food insecurity of smallscale farmers and pastoralists. The project has introduced micro-scale irrigated agriculture, improved rainwater harvesting techniques, drought resistant early maturing crop varieties, high value horticultural crops and measures to improve livestock health and productivity. The project also promoted community participation, enhanced women roles and community based natural resources management. Upscaling of several best practices has started. Detailed project achievements are presented. The strategic nature of NAPA and NAP is briefly discussed and several policy issues are suggested such as mainstreaming of adaptation in development plans, extending political support, development of policies for water resources management, food security, national land use plan and sustainable use of national natural resources. Further, there is need for strengthening research, extension, planning, early warning system and enhancing the coordination role of HCENR.

Keywords: Climate change, NAPA, NAP, implementation, policies, best practices upscaling

Introduction

Sudan encompasses an area of about 1.9 million km^2 and stretches over a land between latitudes 10-23°N and longitudes 21°45-38°30′E. Sudan borders South Sudan and six other African nations, and the Red Sea. The majority of the land is

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composed of vast arid plains interrupted by a few widely separated ranges of hills and mountains. Water resources outside the Nile basin are limited, soil fertility is low and drought is common. Compounded by a range of human pressures, these underlying conditions create a state of vulnerability in Sudan, in addition to climate change impacts and the livelihood risks associated with current and future climate variability and change.

Annual rainfall in the north ranges from close to zero near the Egyptian border to about 200 mm around the capital Khartoum. Along the southern border, annual rainfall rarely exceeds 700 mm. The combined effects of the Inter Tropical Convergence Zone (ITCZ) and the country's topography dominate Sudan's climate. The result is wide spatial variation in rainfall. The erratic nature of rain and its concentration in a short growing season pose a serious threat to rainfed agriculture, which is the most prevalent type of agriculture in Sudan.

The country's land resources are dominated by arid and semiarid ecosystems, which constitute more than 80% of the area of the country. Low rainfall savannah makes up the majority of other land types, with small montane vegetation areas taking up the remainder.

Arable land constitutes about one third of the total area of the country, with about 21% of this land under cultivation. Over 40% of the total area of Sudan consists of pasture and rangelands. Since human communities, flora, and fauna have become highly adapted to subsist within these areas, climate change poses a major threat. Under changing climatic conditions, adverse changes in the distribution and productivity of Sudan's natural resources - its forests, soils, and grasslands - are expected to have significant repercussions for millions of people.

The Nile Basin traverses Sudan from south to north. The Blue and White Nile converge just north of the capital, Khartoum. Sudan's current water resources, as well as its ability to harness them, are limited and prone to severe shortage. The Nile water basin contributes most of Sudan's available surface water. However, though the Nile transports over 93 billion cubic meters (bcm) of water per year on average, Sudan's share is only 20.5 bcm per year, in accordance with the 1959 Nile Water Treaty with Egypt. The water resource situation for remote areas is especially precarious as flow from seasonal streams is limited in quantity and duration and varies in terms of turbidity.

Sudan is also burdened with low human and economic development and serious environmental problems. In recent years, Sudan has made significant development strides, yet profound poverty and other challenges persist. Factors such as life expectancy, school enrollment and GDP per capita reflect a disturbing situation.

Climate Change Impacts and Adaptation

Sudan initial national communication to UNFCCC (2003) assessed the likely impacts of climate change, including decreasing annual rainfall, increasing rainfall variability and increasing average annual temperatures, causing serious challenges. These were identified to include reduction in ecosystem integrity and decline in crop yield. Frequent droughts forced changes in planting dates, disease and insect infestation and decrease in biodiversity. In turn, these were noted to lead to increased risks of food shortages, famine and poverty. Building on these

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studies, the Government of Sudan, with support from GEF/LDCF and UNDP, prepared its National Adaptation plan of Action (NAPA, 2007). This identified key agro-ecological zones affected by climate change, vulnerable States and sites, and critical sectors and sub-sectors.

The NAPA was completed in participatory manner in March 2007 and was approved and commended by the Council of Ministers. The NAPA included 32 different initiatives spread over the five agro-ecological zones and included the agriculture, water and health sectors. The NAPA developed criteria for evaluation and priorities for implementation of adaptation initiatives. NAPA included recommendations for capacity building, policy reform, and institutional integration.

Adaptation Opportunities

The impacts of climate change and the impacts of social and environmental baseline processes, occurring in the absence of climate change, may serve to compound one another. Thus, a more in-depth look at these relationships is needed for systematic integration of main UNFCCC concepts in the national policy processes. Nevertheless, the Council of Ministers approved the First National Communication and NAPA and in its session-No 46 for 2010 directed HCENR to coordinate NAPA implementation with the Agricultural Revival Program.

The strategy goals of the 25-year vision, as well as ongoing national policy processes are having parallel aims to climate change adaptation (i.e Poverty reduction strategy paper and rural development initiatives). The NAPA follow-up project is clearly embedded in baseline activities and through its focus on reducing the additional risks associated with climate change. It will enhance the effectiveness of on-going development investments. It has been often noted that Sudan strategic planning is sectorial in nature, led by limited groups of politicians and a few professionals, and never based on wide grassroots consultations and is often subjected to poor implementation.

The long-term solution to the vulnerability of Sudanese communities and economic sectors to climate change is effective mainstreaming of adaptation strategies into the national planning process. This is directly related to the achievement of the Millennium Development Goals (MDGs), the promotion of sustainable national and local agenda, and the integration of climate change risks into all of these planning processes. While resources are vital to success, they are not sufficient to promote human development in a sustainable manner. Particular emphasis should be given to building capacities of civil societies' organizations.

Limited efforts have been spent to foster awareness of climate risks to food security. This is mainly attributed to that government institutions are subject to frequent changes due to political instability, resulting in limited incorporation of MDGs like United Nations Framework Convention on Climate Change (UNFCCC). Further, the drought contingency planning framework contains a weak component for ensuring food reserves. The Strategic Reserve Authority (SRA), established in 2000, is not yet effective in achieving its goals and objectives.

ISSN 1816-8272

Adaptation Implementation Project

A project was developed by Sudan Government/UNDP/GEF based on the NAPA titled "Implementing NAPA Priority Interventions to Build Resilience in Agriculture and Water Sectors to the Adverse Impacts of Climate Change in Sudan". The Project is implemented in a challenging context. This project addresses several of the highest NAPA priorities. The adverse socio-economic conditions, the strained natural environment, the complex political situation, security challenges and over all weak governance in the agriculture sector make it very challenging to effectively support natural resource management in remote and marginalized areas in Sudan .

The project objective is to implement an urgent set of adaptation-focused measures that will minimize and reverse the food insecurity of smallscale farmers and pastoralists, and thereby reducing vulnerability of rural communities to climate change. The project outcomes include:

- Resilience of food production in the face of climate change.
- Institutional and individual capacities to implement climate risk management responses in the agriculture sector strengthened and better understanding of lessons learned.
- Emerging best practices captured and up-scaled at the national level.

The project design initially covered five locations representing agro-ecological zones with visible climate change impacts and recurring food insecurity. The five concerned States were Central Equatoria, Gedarif, North Kordofan, River Nile and South Darfur. However, following the secession of the Republic of South Sudan, the interventions in Central Equatoria State were suspended.

Increasing Resilience, Increasing Food Security and Adapting to Climate Change in Sudan

The Mid-Term Review conducted by independent consultants for UNDP and Sudan Government in Mid 2013 reported that Project interventions to build the resilience of food production systems have focused on introducing and testing the viability, efficiency and effectiveness of simple and improved technologies - usually as part of a package. For example, the Project, at different sites, has introduced micro-scale irrigated agriculture (through development of boreholes), improved water harvesting and storage, and supported direct pumping from the river to replace flood irrigation. It has made available improved seeds and introduced a number of highly marketable horticultural crops. It has improved the health and productivity of livestock. These interventions have significantly reduced vulnerability and enhanced local food security.

The Project has also supported actions to improve natural resources and enhance ecosystem resilience. These include protection against desertification through the establishment of shelterbelts around villages and farmlands, improvement of rangelands through reseeding, and the distribution of improved stoves and gas cylinders to reduce the demand for fuelwood. All of these activities have increased adaptive capacity, responded to locally identified needs, and implemented in a highly participatory manner, with strong contribution from local communities. These actions were highly appreciated by the beneficiaries. At most

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sites, awareness raising, training and some organizational support have surrounded all actions, and the focus on women has been strong.
In many sites, the Project has recognized the importance of financial security in sustaining results. The support to community based revolving funds, which are currently working efficiently and expanding, is a good example of this. Efforts are now needed to improve institutional management skills (e.g. financial bookkeeping) and to link community-based institutions with the commercial banks and micro-finance lending entities.
In Gadarif State, the project has worked with four communities in Sadaa village. It has helped in establishing or re-establishing of four village development committees (VDC) that are responsible for planning and decision-making. Under the VDCs, several thematic groups are active, for example initiating and managing forestry activities and accessing gas stoves. The Project has also initiated revolving funds (RFs). The VDCs, groups and RF are now functioning, with little support from the Project. The project has also conducted several training sessions to farmers, covering a diverse range of issues such as the use of improved seeds (early maturing and drought resistant varieties), animal breeding and rangeland improvement. It has also raised the awareness of the local communities on the issue of climate change. The project is fully understood and greatly appreciated by the beneficiaries.

The beneficiaries have reported a great increase in food security and improved livelihoods through:

- Two hundred (200) women and 500 men have benefited from improved rainwater harvesting techniques in 1800 feddan (one feddan = 0.42 ha).
- Ninety (90) women have benefited from gas stoves;
- One thousand (1000) men and 10000 women have benefitted from training;
- The State government reports expanding the rainwater harvesting techniques in an area of 200,000 feddan.
- Large numbers have benefitted from improved rangelands (seed broadcasting), use of early-maturing crop varieties and improved revenue (due to improvement in animal health and husbandry measures).

In North Kordofan State, the project has managed to reach a sizeable number of beneficiaries in six affected villages, with successful investments in capacity building of VDCs. It has piloted micro scale irrigated agriculture to fully replace the traditional dry farming and produce high market value horticultural crops. It has helped improving animal production through improved feeding regimes. It has also protected villages and agricultural farms from sand encroachment via the erection of living shelter belts. It has also contributed to biomass conservation through the introduction of gas cylinders. The project is fully understood and greatly appreciated by the beneficiaries.
The beneficiaries have reported a great increase in food security and improved livelihoods through:

- Potato production was introduced for the first time in the area and yields as high as 16-27 tons/feddan were achieved.

ISSN 1816-8272

- Improved nutrition has increased milk production in goats from 0.3 liters/day to 3.0 liters/day.
- As a result of improved nutrition, sheep achieved a weight gain of 240 grams per day and twining rates increased from 10 to 23% across the flock. The above results have encouraged the private sector to invest in the production of improved animal feeds by installing a feed mill in Bara town to supply improved feeds for animals.
- Farmers from outside the project sites have become engaged in livestock production using improved feeds.
- Communities participated in sand dune fixation through planting indigenous trees and distributing range plant seeds.

In the River Nile State, the Project initially worked with four villages and recently expanded its activities to six villages. The Project has helped in establishing or strengthening a VDC in each village. The VDC is responsible for planning and decision-making. The Project has also developed/strengthened two revolving funds in each village, one for irrigation pumps (for men) and one for gas stoves/cylinders (for women). The project has provided ongoing extension support to the village, focusing mostly on technical issues related to agriculture, livestock and water management. It has raised the awareness of the local communities about climate change and the importance of shelterbelts. The project is fully understood and greatly appreciated by the beneficiaries.

The beneficiaries have reported a great increase in food security and improved livelihoods through:

- About 4000 men and 500 women have benefited from the introduction of cash crops in the irrigated farms through use of diesel pumps which have greatly increased their income. An area of 1220 feddans has been converted to multi-cropping systems.
- The government has provided 200 pumps, in addition to the 60 pumps provided by the project.
- Seven hundred and five (705) women have obtained gas stoves that helped them in saving the time that used to be spent in collecting firewood and thereby contributing to their health improvement and conserving forest.
- Twenty-six (26) km of shelterbelts have been established to protect several villages from sand dunes (using drip irrigation from solar powered water from rehabilitated wells).
- Many families have benefited from the water pumped by solar energy for drinking and irrigating the home gardens that helped in increasing the resilience of the local communities to climate change.

In South Darfur State, the project has worked with farmers in 20 villages (only six in the first year). It has provided ongoing extension support to the villages, focusing mostly on technical issues related to rainwater harvesting, agriculture, home gardens and livestock. It has also established five successful demonstration sites. Working through existing farmer groups, it has facilitated the integration of good science into local natural resource management practices. It has raised

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understanding of climate change and how to adapt. The project is fully understood and greatly appreciated by the beneficiaries.

The beneficiaries have reported a great increase in food security and improved livelihoods through:

- Seven hundred and two (702) women and 377 men have benefited from the improved rainwater harvesting techniques, access to improved early maturing varieties and agricultural tools that covered 2777 feddan.
- Establishment of home gardens and rehabilitation of rangelands.
- High revenues were generated by a large number of people as a result of improvement in animal health and husbandry measures.
- More than 400 women were trained in making improved mud stoves.
- Improved breeds of goats distributed.

Climate Change Strategies and Policies

Adaptation and economic diversification to build resilience in developing countries in general and in Sudan in particular in the context of sustainable development is the main priority, whereas mitigation is only an opportunity. The adaptation is well recognized in the UNFCCC, where developed countries are obliged under Article 4.4 to support the cost that developing countries may incur to cope with the adverse impacts of climate change. However, developed countries have not been providing sufficient funding for adaptation. Around 80% of climate change finance provided by the developed countries is allocated for mitigation.

Several policy issues were identified during the NAPA preparatory phase, The NAP consultation process which covered all the States of the Sudan, also proposed policies that were considered important for implementing the NAP. The following are the major policy recommendations:

- Mainstreaming of the NAPA and NAP in the development plans of the States.
- Provision of political support for the NAP at the national and State level.
- Updating and activating the environmental policies and legislation.
- Transparency, responsibility and accountability should be emphasized.
- Policies for water resources management to emphasize water harvesting, efficient and sustainable utilization of water resources to stress provision of safe potable water for rural, urban and nomadic populations.
- Strategies and policies should guarantee food security.
- A national land use plan should be adopted.
- Poverty reduction should be included in the adopted plans.
- Encourage sustainable use of natural resources.
- Adopt best practices to conserve biodiversity and vegetation cover and combat desertification.
- Introduce technical packages in agriculture that could help to build resilience and enhance adaptation to climate change (water harvesting, drought resistant varieties, shelterbelts, etc).
- Document and promote indigenous knowledge adaptation practices and encourage exchange of experience between the States.

ISSN 1816-8272

- Policies to support modernization and development of the agricultural and livestock systems.
- Avail microcredit for small farmers and pastoralists.
- Strengthen the role of extension in all adaptation processes (awareness adaption and learning mechanisms and identifying and promotion of best practices).
- Support the involvement of research in adaptation activities (technology transfer, development of adaptation package).
- Establish CBOs and ensuring the active participation of communities in all phases of adaptation planning and implementation.
- Undertake concerted efforts to achieve effective horizontal and vertical coordination between all the stakeholders (Climate Change Unit at HCENR, line ministries at the national and State levels, the CBOs, and the local leaders).
- Empower women through their active participation.
- Capacity Building of all stakeholders.
- Establish a national early warning system, and assist in establishing community based local early warning systems.

Discussion and Conclusions

The LDC expert group (UNFCCC) defined adaptation to climate change as human - driven adjustment in ecological, social and economic systems or policy processes in response to actual or expected climate stimuli and their effects or impacts. Accordingly, adaptation planning is closely related to development planning. National adaptation planning can enable to assess vulnerabilities, mainstream climate change and to address adaptation.

The strategic nature of NAPA and NAP should be stressed. Such processes should be extended even after the end of the project. There is need for documentation of economic, social and environmental changes. Lessons of best practices should be the basis for upscaling efforts.

AIACC AF 14 project has been a very successful and useful experience in identifying useful tools and practical adaptation options for vulnerable communities in Sudan and other countries in the region. In Sudan, activities were selected for drought affected vulnerable communities towards environmental management strategies for sustained livelihood activities.

The project undertook three case studies and assessed current and recent historical experiences (1980s). Each case study explored examples where local knowledge (indigenous, informal, autonomous) and/or external knowledge (e.g. formal technical) have been applied in form of sustainable livelihood (SL) or natural resource management (NRM). Case studies assessed community's resilience to climate extreme before and after the project.

Case studies were conducted by commissioned researchers through desk-based and field research for six-month period. Analyses of success drivers were compiled. Specific examples observed include both autonomous natural resources management systems developed in Darfur, and those stimulated by NGO or other supportive organization such as rangeland rehabilitation in Bara, North Kordofan.

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The capacity to finance should not be restricted to coping mechanism, but livelihood diversification activities that could reduce climate vulnerability should be included. Further, community savings should be encouraged in liquid or live forms (e.g. livestock, food store).

Access to basic low technical materials for development and improvement of low infra- structure (such as water harvesting system, food storage facilities) is also important. Moreover, these communities assign great value to basic tools and inputs such as improved seeds, and access to farm and earth moving equipments.

Human skills are critical to coping and resilience. As the human skills grow, resilience and adaptive capacity also grow. Indeed social capital is one of the most important determinants of resilience to shocks. Family and informal social networks, community groups, VDCs, self help group (Nafeers), and effective local decision- making bodies and institutions are also recognized as important resources for building and preserving the capacity to cope to climate impacts.

NAPA and NAP processes in Sudan are country - driven, gender sensitive, participatory and followed transparent approach. The NAPA and NAP processes are guided by scientific knowhow and benefited from indigenous knowledge and were planned to be integrated into relevant social, economic and environmental policies and actions. NAPA and NAP are not meant to result in duplication of efforts undertaken in the country, but rather facilitate, coordinate and complement efforts.

Responding to the challenge of climate change is a national priority for Sudan. Impact of climate change is already affecting rural communities, natural resources, agricultural productivity and coastal infrastructure. The increasing frequency of severe droughts and declining rainfall are already an urgent priority, which requires immediate action in cooperation with international community.

Literature Consulted

Abdalla, S. H. 2010. Vulnerability of water resources of Sudan to climate change. Ministry of Irrigation and Water Resources, Sudan.

Fadl El Moula, I. and Elgizouli, I. 2008. Climate change and impacts in Sudan and the future prospective to mitigate climate change. A paper presented to the workshop on Climate change, Wad Medani, Sudan.

FAO. 2005. Multipurpose Africover Databases on Environmental Resources. FAO organization, Rome.

HCENR. 2003. Sudan's First National Communication under the United Nations Framework Convention and Climate Change, volume I main communication, Ministry of Environment and Physical Development-Sudan.

HCENR. 2005. Adaptation to climate change and related impacts, the case of Sudan. UN Commission on Sustainable Development. Ministry of Environment and Physical Development, Sudan.

HCENR. 2007. National Adaptation Program of Action (NAPA) Ministry of Environment and Physical Development, Sudan.

Higher committee for studying the present and future of agriculture in Sudan. 2008. Executive Programme of Agricultural Revival (Nahda).

ISSN 1816-8272

Ministry of Finance and National Economy. 2008. National poverty eradication strategy paper: A statement of vision and development context.
National Council for Strategic Planning. 2007. The Twenty Five Year National Strategy (2007-2031).

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