Africa Group of Negotiators experts Support

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Desertification and Climate Change in Africa[1]

Photo credit: https://landportal.org

KEY MESSAGES

1. **Desertification has increased in African drylands in recent decades, led by land use change, climatic variability and poor land management practices.**
2. **People living in drylands in Africa are highly vulnerable to desertification and climate change, because of their impacts on a wide range of livelihood based resources.**
3. **Desertification and climate change affect gender disproportionately, with women and youth being the most affected.**
4. **Without implementation of adequate measures, climate change will exacerbate the vulnerability to desertification among dryland populations in Africa.**
5. **Policy responses and integrated land management practices, as well as indigenous and local knowledge are needed to consider the complex and multi-faceted nature of causes and effects of desertification.**

Introduction

Desertification as land degradation in arid, semi-arid, and dry sub-humid areas result from many factors, including climatic variations and human activities. It leads to reduction in crop yields and weakens the resilience of agricultural and pastoral systems - key livelihood pillars in Africa. Through its effect on vegetation and soils, desertification leads to changes in carbon pools and sinks and release of associated GHGs. It also tends to increase albedo, decrease in energy available at the surface and associated surface temperatures, producing a negative feedback on climate change. Desertification is not limited to irreversible forms of land degradation, nor is it equated to desert expansion, but represents all forms and levels of land degradation occurring in drylands.

Two thirds of Africa is classified as drylands, of which 319 million hectares has been estimated to be highly vulnerable to desertification. These areas are concentrated in Sahelian region, Horn of Africa and Kalahari in the south. Increasing concentration of poverty in the drylands of sub-Sahara Africa has been documented, where 41% of the total population lives in extreme poverty, which is partly attributed to desertification. Drought and desertification are at the core of serious challenges and threats facing sustainable development in Africa, with far reaching adverse impacts on human health, food security, economic activity, physical infrastructure, natural resources and the environment, with incidence in national and global security.

There is high confidence that climate change will exacerbate the vulnerability to desertification among dryland populations, and that the combination of pressure from climate change and desertification will diminish opportunities for reducing poverty, enhancing food and nutritional security, empowering women, reducing disease burden, improving access to water and sanitation.

The process of desertification includes both biological and non-biological processes, and is attributable to the physical, chemical and biological properties of terrestrial ecosystems. Some of the key drivers of desertification include soil erosion; global warming

[1] *Based on Chapter 3 of the IPCC Special Report on Climate Change, Desertification, Land degradation, Sustainable Land Managment, Food Security and Greenhouse gas fluxes in Terrestial Ecosystems, 2019.*

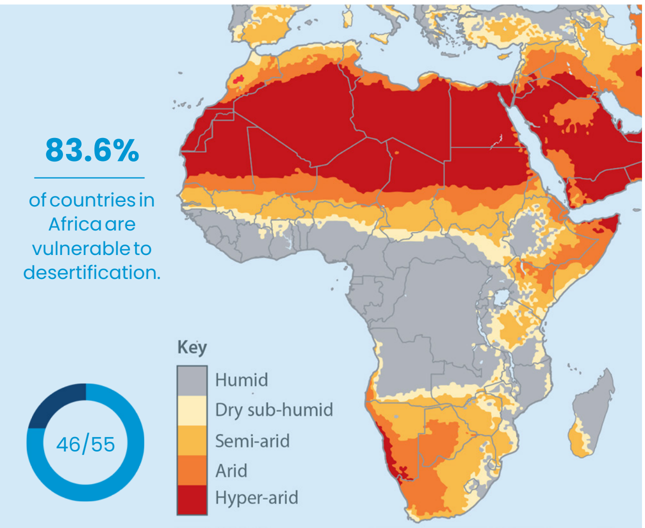
leading to the rise of CO_2 levels; sea surface temperature anomalies which drive rainfall changes; invasive plants which affect ecosystem services, wildfire which reduces vegetation cover, increases runoff and soil erosion, reduces soil fertility and affects the soil microbial community.

Anthropogenic drivers of desertification include: cropland expansion, unsustainable land management practices such as overgrazing by livestock, urban expansion, infrastructure development, and extractive industries. High and growing consumption of land-based resources has also been indicated as the ultimate driver of land degradation, e.g. through deforestation and cropland expansion, escalated by population growth.

The institutional, policy and socio-economic drivers of desertification include land tenure insecurity, lack of property rights, lack of access to markets, and to rural advisory services, lack of technical knowledge and skills, agricultural price distortions, agricultural support and subsidies contributing to desertification, and lack of economic incentives for sustainable land management.

Despite environmental, socio-economic and institutional constraints, dryland populations have historically demonstrated remarkable resilience, ingenuity and innovations, distilled into indigenous and local knowledge to cope with high climatic variability and sustain livelihoods. For example, the indigenous and local knowledge across Africa and informal community bylaws were successfully used for regulating grazing and controlling rangeland degradation. Currently, however, indigenous and local knowledge and practices are increasingly lost or can no longer cope with growing demands for land-based resources. Unsustainable land management practices increase the risks from droughts, floods and dust storms.

The Status of Desertification in Africa



Map: Dryland areas are expected to become more vulnerable to desertification in Africa.

It is estimated that 46 of the 55 countries in Africa are vulnerable to desertification, with some already feeling the effects. Moderate or higher severity degradation over recent decades has been identified in many river basins including the Nile (42% of area), Niger (50%), Senegal (51%), Volta (67%), Limpopo (66%) and Lake Chad (26%). The Horn of Africa is getting drier exacerbating the desertification situation. The observed decline in vegetation cover is diminishing ecosystem services. Based on Normalized Difference Vegetation Index (NDVI) residuals, Kenya experienced persistent negative (positive) trends over 21.6% (8.9%) of the country, for the period 1992–2015. Fragmentation of habitats, reduction in the range of livestock grazing, higher stocking rates are considered to be the main drivers for vegetation structure loss in the rangelands of Kenya.

Despite desertification in the Sahel being a major concern since the 1970s, wetting and greening conditions have been observed in this region over the last three decades. The Sahara is reported to have expanded by 10% over the 20th Century based on annual rainfall. However, cropland areas in the Sahel region of West Africa have doubled since 1975, with settlement area also increasing by about 150%. In Burkina Faso, from 1984 to 2013, bare soils and agricultural lands increased by 18.8% and 89.7%, respectively, while woodland, gallery forest, tree savannas, shrub savannas and water bodies decreased by 18.8%, 19.4%, 4.8%, 45.2% and 31.2%, respectively. In Fakara region in Niger, a 5% annual reduction in herbaceous yield between 1994 and 2006 was largely explained by changes in land use, grazing pressure and soil fertility. Greening has also been observed in parts of southern Africa but it is relatively weak compared to other regions of the continent.

In the Okavango river Basin in southern Africa, conversion of land towards higher utilisation intensities, unsustainable agricultural practises and overexploitation of the savanna ecosystems have been observed in recent decades. In the arid Algerian High Plateaus, desertification due to both climatic and human causes led to the loss of indigenous plant biodiversity between 1975 and 2006. Sudan has over 64 Mha being degraded, with the Central North Kordofan State being most affected. However, reforestation measures in the last decade sustained by improved rainfall conditions have led to low-medium regrowth conditions in about 20% of the area. In Morocco, areas affected by desertification are predominantly on plains with high population and livestock pressure. The annual costs of soil degradation were estimated at about 1% of Gross Domestic Product (GDP) in Algeria and Egypt, and about 0.5% in Morocco and Tunisia. Drylands of eastern Africa currently face growing encroachment of invasive plant species, such as *Prosopis juliflora,* which constitutes land degradation since it leads to losses in economic productivity of the affected areas. Land degradation through reduction in species richness in central Senegal has also been noted.

The African continent has the largest source of desert dust; perhaps 50% of atmospheric dust comes from the Sahara. About 25% of global dust emissions have anthropogenic origins, often in drylands. Thus their loss due to intense land use and/or climate change can be expected to cause an increase in sand and dust storms. In several locations, including the west of northern Africa, a considerable amount of mineral dust aerosols, sourced from nearby drylands, reaches the oceans. About 60% of dust transported off Africa is deposited in the Atlantic Ocean.

Some arid lands are very vulnerable to groundwater reductions because the current natural recharge rates are lower than during the previous wetter periods (e.g. the Atacama Desert and Nubian aquifer system in Africa).

Impacts of Desertification in Africa

Desertification is affecting about 45% of the African continent's land area, out of which 55% is at high or very high risk of further degradation. The major mechanism through which climate change and desertification affect food security is through their impacts on agricultural productivity. There is robust evidence pointing not only to negative impacts of climate change and desertification on crop yields, but also on the losses in agricultural productivity and incomes in drylands. The forecasts for Sub-Saharan Africa suggest that higher temperatures, increase in the number of heat-waves, and increasing aridity, will affect the rain fed agricultural systems. Without the carbon fertilization effect, climate change will reduce the mean yields for 11 major global crops – millet, eld pea, sugar beet, sweet potato, wheat, rice, maize, soybean, groundnut, sunflower and rapeseed – by 15% in Sub-Saharan Africa, 11% in Middle East and North Africa by 2050.

Desertification has led to reduction in agricultural productivity and incomes; it has also contributed to the loss of biodiversity in many dryland regions. It is further projected to cause reductions in crop and livestock productivity, modify the composition of plant species and reduce biological diversity across drylands. In sub-Saharan Africa particularly, crop production may be reduced by 17–22% due to climate change by 2050. About 821 million people globally were food insecure in 2017, of whom 31% were in Africa. Sub-Saharan Africa, particularly East Africa, had the highest share of undernourished populations in the world in 2017, with 28.8% and 31.4%, respectively. In North Africa, long-term monitoring (1978–2014) has shown loss of important perennial plant species due to drought and desertification e.g. *Stipa tenacissima* and *Artemisia herba alba.*

Desertification alongside pressures from climate variability and anthropogenic climate change will contribute to poverty, food insecurity, and increased disease burden, as well as potentially to conflicts. Climate change will amplify water scarcity, with negative impacts on agricultural systems, particularly in semi-arid environments of Africa.

There is increasing poverty levels in drylands of Sub-Saharan Africa where 41% of the total population live in extreme poverty. For eastern Africa, both recent droughts and decadal declines have been linked to human-induced warming. There is high confidence that many oases of North Africa are

Herders migrating with livestock.

Photo: http://media-3.web.britannica.com/eb-media/55/20155-004-C8550C5E.jpg vulnerable to climate change. Loss of energy sources: majority of the population in Africa continue to rely on traditional biomass which account for about 50% of the total energy consumption in the region. These include fuelwood, agricultural residue, charcoal, crop straws and livestock manure.

Methodologies to Evaluate Desertification

Desertification results from complex human-environment interactions coupled with biophysical, social, economic and political systems, which are largely unique to any given location. This renders desertification difficult to map at global scale, and implies that the relative contributions of climatic, anthropogenic and other drivers of desertification vary depending on specific socioeconomic and ecological contexts. However, depending on the definitions applied and methodologies used in evaluation, the status and extent of desertification globally and regionally still show substantial variations.

Three methodological approaches are applied for assessing the extent of desertification: (1) expert judgement, (2) satellite observation of net primary productivity, and (3) use of biophysical models. These approaches together provide a relatively holistic assessment but none on its own captures the whole picture. Expert judgment is important because degradation remains a subjective feature whose indicators are different from place to place. Biophysical models use global datasets that describe climate patterns and soil groups, combined with observations of land use, to define classes of potential productivity and map general land degradation.

All biophysical models have their own set of assumptions and limitations that contribute to their overall uncertainty, including: model structure; spatial scale; data requirements (with associated errors); spatial heterogeneities of socioeconomic conditions; and agricultural technologies used. Models have been used to estimate the vegetation productivity potential of land and to understand the causes of observed vegetation changes. For instance, an ensemble of ecosystem models adopted to investigate causes of vegetation changes from 1982-2009, using a factorial simulation approach indicated CO_2 fertilisation to be the dominant effect globally though climate and land cover change were the dominant effects in various dryland locations.

The most widely used remotely sensed vegetation index is the NDVI, which provides a measure of canopy greenness that is related to the quantity of standing biomass. Main challenge associated with NDVI is that although biomass and productivity are closely related in some systems, they can differ widely when looking across land uses and ecosystem types, giving a false positive in some instances. For example, bush encroachment in rangelands and intensive mono-cropping with high fertiliser application gives an indication of increased productivity in satellite data though these could be considered as land degradation.

Drylands of eastern Africa currently face growing encroachment of invasive plant species, such as *Prosopis juliflora,* which constitutes land degradation since it leads to losses in economic productivity of affected areas but appears as a greening in the satellite data. Another case study in central Senegal found degradation manifested through a reduction in species richness despite satellite observed greening.

Interventions

Desertification remains a major challenge with far reaching adverse effects that have environmental, social and economic dimensions and implications to significant population in Africa. While significant efforts have been made to address desertification in Africa, it remains clear that further interventions are needed, particularly those that will consider the complex and multi-faceted nature of causes and effects of desertification. Listed below include some of the major intervention options that have been put in place to address desertification and climate change.


Landscape Restoration

Photo: Aulia Erlangga (CIFOR).

Case Study: Great Green Wall (GGW) in Sahel

The Great Green Wall (GGW) is a flagship initiative of the African Union to build prosperity and resilience in Sahel though combating desertification and climate change, and addressing food insecurity and poverty. It aims to transform lives of millions of people by creating a great mosaic of green and productive landscapes across the region. The GGW Strategy was adopted by countries and partners in the year 2012. It targets 780 million hectares, comprising arid and semiarid zones, of which 21% needed restoration due to inadequate tree cover. About 232 million people live in the GGW target areas. In the spirit of GGW strategy, target countries have made land restoration a priority in their national strategies and action plans.

Early results have indicated that degraded lands can be restored. For instance, it has been reported that 15% of drought-resistant trees have been planted, largely in Senegal, with 4 million hectares of land restored. Also, successful grassroots greening efforts in Niger have helped close the gap between the project's ambition and reality. The farmers of Niger practice natural regeneration of the land, using innovative practices such as reviving the roots of plants and trees, and digging "half-moon" pits to store water. Trees destroyed during droughts are allowed to recover over years, and then carefully maintained. These methods have succeeded in restoring 5 million hectares of land and planting around 200 million trees.

Policy responses

Global policy framework: Several global policy interventions exist to provide guidelines and frameworks to combat desertification. The three Rio Conventions: the United Nations Convention to Combat Desertification (UNCCD), the United Nations Framework Convention on Climate Change (UNFCCC) and the Convention on Biological Diversity (CBD) provide such framework. They target to address land degradation including desertification and emphasize actions that promote sustainable development and enhance ecosystem-based approaches to adaptation in drylands.

At the *regional level,* there are instruments at the continental level that provide a framework for dealing with climate change, desertification and land degradation. These include: i) Agenda 2063; ii) the African Ministerial Conference on Environment (AMCEN); and iii) The Malabo Declaration that promotes sustainable land management and governance, irrigation and water management, animal resources development, technology generation, dissemination and adoption, agripreneurship for youth and women and value chain development. There are also established climate change centres in Africa, including African Centre for Meteorological Applications for Development (ACMAD) also serving as WMO Regional Climate Centre (RCC). The flagship programme of the AU on addressing desertification and land degradation is the Green Wall for the Sahara Initiative, stretching from Mauritania to Djibouti that aims to slow the advance of the Sahara Desert, enhance environmental sustainability, control land degradation, promote integrated natural resources management, conserve biological diversity, contribute to poverty reduction, and create jobs.

At the *sub-regional level,* regional economic communities (RECs) have put in place regional policies that deal with matters of land degradation and climate change. For example, the East African Community (EAC) Climate Change Policy aims to guide Partner States and other stakeholders on the preparation and implementation of collective measures to address Climate Change in the region while assuring sustainable social and economic development.

At the *national level,* many countries in Africa have developed various policies and frameworks to guide national actions and investments aimed at addressing land degradation. Some of these include the Nationally Determined Contributions (NDCs), National Adaptation Plans (NAPs) and National Biodiversity Strategies and Action Plans (NBSAPs). In addition, there are many programs and projects that are being implemented directed to address land degradation. Strong synergies exist between the land degradation neutrality (LDN) concept and the NDCs of many countries, with linkages to national climate plans. LDN is also closely related to the SDGs in the areas of poverty, food security, environmental protection and sustainable use of natural resources.

Integrated response options

Sustainable Land Management approaches: Soil and water conservation practices, reforestation and farming systems have to be given special attention, taking into account the need to maintain soil fertility. These approaches are important in reducing soil erosion, enhancing water percolation into the ground, reducing soil degradation and increasing soil fertility and therefore crop production. For better results, integration of multiple traditional /indegineous approaches is essential.

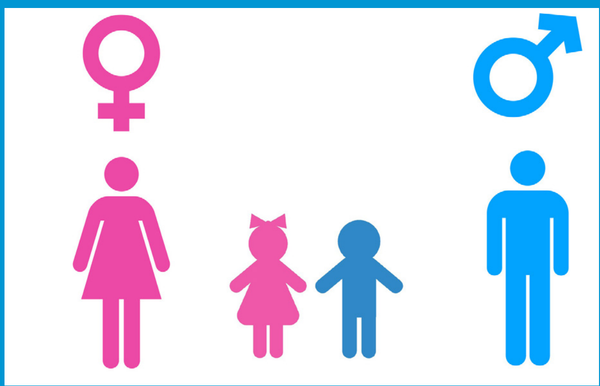
Agronomic practices: Intercropping maize and sorghum with *Desmodium* (an insect repellent

Trials of drought tolerant beans in Malawi, which is suffering from its worst drought in three decades N. Palmer CIAT.
Photo: Coutesy of CGIAR System Organization

Agroforestry
Photo credit: World Agroforestry Centre/ Joseph Gachoka.

forage legume) and *Brachiaria* (an insect trapping grass), which is being promoted in drylands of East Africa, can lead to a two-to-three-fold increase in maize production and an 80% decrease in stem boring insects. In addition to changes in cropping methods, forms of agroforestry and shelterbelts are often used to reduce erosion and improve soil conditions. Other measures include rainwater harvesting including traditional zai (small basins used to capture surface runoff), earthen bunds and ridges, *fanya juu* infiltration pits, contour stone bunds and semi-permeable stone bunds. Rainwater harvesting increases the amount of water available for agriculture and livelihoods through the capture and storage of runoff, and at the same time reduces the intensity of peak flows following high-intensity rainfall events. In terms of climate change mitigation, the contribution of rangelands, woodland and sub-humid dry forest (e.g., Miombo woodland in south-central Africa) is often undervalued due to relatively low carbon stocks per hectare.

Gender Considerations



Combined impacts of desertification and climate change on socio-economic development in drylands are complex and are difficult to isolate from the effects of other socio-economic, institutional and political factors. However, there is high confidence that climate change will exacerbate the vulnerability of dryland populations to desertification, and that the combination of pressures from climate change and desertification will diminish opportunities for empowering women alongside other impacts.

Socially structured gender-specific roles and responsibilities, daily activities, access and control over resources, decision-making and opportunities lead men and women to interact differently with natural resources and landscapes. For example, water scarcity affected women more than men in rural Ghana as they had to spend more time in fetching water, which has implications on time allocations for other activities. Despite the evidence pointing to differentiated impact of environmental degradation gender issues have been inadequately addressed in many land restoration and rehabilitation efforts, which often remain gender-blind.

Women and children are impacted more than men by environmental degradation, particularly in those areas with higher dependence on agricultural livelihoods. In many dryland areas, female-headed households, women and subsistence farmers are more vulnerable to the impacts of desertification and climate change. Some local cultural traditions and patriarchal relationships also contribute to higher vulnerability of women and female-headed households through restrictions on their access to productive resources.

Socially constructed gender-specific roles and responsibilities are not static because they are shaped by other factors such as wealth, age, ethnicity and formal education. Hence, women's and men's environmental knowledge and priorities for restoration often differ. In some areas where sustainable land options (e.g. agroforestry) are being promoted, women were not able to participate due to culturally-embedded asymmetries in power relations between men and women. Nonetheless, women particularly in the rural areas remain heavily involved in securing food for their households, which is associated with land productivity and women's contribution to address desertification is crucial.

In relation to representation and authority to make decisions in land management and governance, women's participation remains lacking particularly in the dryland regions. Therefore, ensuring proper gender mainstreaming is necessary. This includes equitable access of women to resources (including extension services), networks, and markets.

Gaps

Significant efforts have been made to enhance understanding desertification in Africa. However, there are still many areas that require further work:

1. Methodological challenges in measuring, assessing and monitoring desertification at scale, given the complex and multi-dimensional nature of desertification.
2. Knowledge gaps, particularly on observed poor adoption of innovations for coping with desertification among many communities in Africa.
3. Lack of evidence to rigorously and conclusively attribute changes in the observed poverty in most of the drylands to desertification impacts.

Conclusion

Desertification results from complex human-environment interactions coupled with biophysical, social, economic and political systems. The multiplicity and complex nature of desertification makes it difficult to attribute and map at the global scale. Climate change exacerbates vulnerability to desertification among dryland populations, in Africa as they depend on agriculture and natural resources which are climate sensitive. Desertification exacerbated by climate change affects different gender classes disproportionately, with women, youth and children being the most affected.

Recommendations

1. Putting in place **enabling policy environment** that would catalyse a shift in the way communities use and manage land with appropriate disincentives that would deter practices that contribute to desertification.
2. Rolling out **early warning systems** that would enhance quick and appropriate response to desertification and climate change.
3. Supporting **scientific and socioeconomic research and innovations** to better understand the mechanism of desertification, people's vulnerability and approaches for adoption of best practices with a robust MRV system.
4. Enhancing **technology development and transfer** that would enable countries and communities to respond to adverse effects of desertification and climate change.

Further Reading

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