AGNES
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Land Degradation and Climate Change in Africa[1]

Photo: https://www.gouvernement.fr/en/the-ipcc-s-report-act-now-against-land-degradation-and-climate-change

KEY MESSAGES

1. **Land degradation is rampant in Africa, accounting for 46% of the total land area.**
2. **Land degradation at the current pace is projected to render more than half of the cultivated land in Africa unusable by 2050.**
3. **Land degradation and climate change mutually reinforce each other, creating serious implications for food security, biodiversity and livelihoods in Africa.**
4. **Effective early warning systems are an essential and important alert mechanism for addressing land degradation.**
5. **An integrated landscape approach is a promising way to address the broad and multi-faceted nature of land degradation across Africa's different agro-ecological zones.**

Introduction

Land degradation refers to the loss of the productive capacity of soils characterized by loss of soil fertility, biodiversity and overall deterioration of natural resources. Land degradation processes occur through soil, water and biota. One of the principal signs of land degradation is the loss of soil organic carbon, making the process one of the biggest contributors to climate change, by increasing emissions and reducing carbon sinks.

Agriculture and deforestation are dominant drivers of land degradation, especially through inefficient use of agricultural resources, soil loss in cultivated lands, and expansion of cultivated land. Land degradation and climate change are known to mutually reinforce each other in that land degradation reduces carbon sinks resulting in more emissions while climate change through heat stress and rainfall variability intensifies the rate and magnitude of land degradation. Land degradation interacting with climate change represents one of the biggest and most urgent challenges for humanity today, with deep implications for food production, food security and natural resource conservation, thus providing a strong incentive for taking action against it.

The status of land degradation in Africa

Despite the importance of land degradation, there are few accurate and updated data on its extent, severity and trend at continental level. Available estimates show that land degradation affects 46% Africa's land area with at least 485 million (65%) people affected, which translates to US$9.3 billion annual cost. Additional estimates show that 75-80% of the continent's cultivated area is reportedly degraded, with a loss of 30 to 60 kg of nutrients per hectare per year.

There is a high spatial variability in the extent and trend of the degradation process according to the nature of soil, the type of agro-ecological zone and the level of human and livestock impacts on natural resources. For instance, studies show a decreasing trend in severity of land degradation from the deserts and arid areas to the humid and sub humid zones of Africa. While in the

[1] *Based on Chapter 4 of the IPCC Special Report on Climate Change, Desertification, Land degradation, Sustainable Land Management, Food Security and Greenhouse gas fluxes in Terrestrial Ecosystems, 2019.*

arid, semi-arid and dry sub-humid zones only 3 to 30.6 % of lands are non-degraded (very low to low), in the sub-humid and humid zones the non-degraded lands cover around 38.1 to 47.2%. In the highland areas, almost 84 % are degraded at a severity ranging from medium to very high.

Badly degraded land. Experts say nearly 65 per cent of Africa's land is under threat even as the continent's food imports exceeded its exports by 30 per cent. (PHOTO: COURTESY)

Data on Africa's main river basins show that the basins of the Orange, Niger and Nile rivers and the Lake Chad basin are characterized by high to very high land degradation (78 to 86 %) while the Zambezi and Congo River basins are less degraded. In Kenya, recent studies on spatial and temporal patterns show that land degradation is increasing in severity and extent in many areas and that over 20 per cent of all cultivated areas, 30 per cent of forests, and 10 per cent of grasslands are subject to degradation. Estimates of the extent of land degradation within Eswatini suggest that between 49 and 78 % of the land is at risk. Further, it is estimated that more than 30% of the land area of Burundi, Rwanda, Burkina Faso, Lesotho and South Africa is severely or very severely degraded. These rates and extent of land degradation undermine and pose serious threats to livelihoods of millions of people in Africa struggling to edge out of poverty.

Drivers of land degradation in Africa

The main causes of land degradation in Africa include, *inter alia,* demographic growth, conflicts and wars with expanded refugees settlements, inappropriate soil management, deforestation, shifting cultivation, insecurity in land tenure, variation of climatic conditions and intrinsic characteristics of fragile soils in diverse agro-ecological zones.

The land degradation process is driven by both climate (direct) and human (indirect) factors. Climate change drivers of land degradation include changes in temperature, rainfall intensity, windstorms and changes of the distribution and intensity of extreme weather events. Change in rainfall regimes drive changes in vegetation cover and composition and trigger processes such as erosion of agricultural soils. Soil erosion rates for example, tend to increase with increasing mean annual rainfall. Vegetation cover is a key factor in determining soil loss through both water and wind erosion.

FOCAL POINTS OF CLIMATE CHANGE PRESSURES ON LAND DEGRADATION

Soil - Organic matter, salinization, burning.

Water - Waterlogging of dry ecosystems and drying of wet ecosystems.

Biota - Vegetation clearing, woody encroachment, species invasions, and pest outbreaks.

Climate change is also projected to decrease the area suitable for agriculture in tropical regions. Climate-related events such as sea level rise also influences the rates of coastal erosion. In Senegal, for example, land degradation affects 64% of arable land with 74% of this degradation being caused by erosion and the rest by salinization. In Nigeria, the overall total soil loss as a consequence of water erosion is estimated at 30 million tons per year. In Sudan, due to arid climate and poor irrigation, more than 500,000 ha of soil are affected by salinization. The situation in North Africa appears to be deteriorating, with more than 150,000 ha of salinized land in Morocco, Libya and Egypt. In Ethiopia, about 1 billion tons of top soils are lost annually due to soil erosion, costing the country 3% of its Agricultural Gross Domestic Product (Doukkali *et al.,* 2018).

Human drivers of land degradation in Africa include demographic growth, grazing pressures, agricultural practices, agricultural expansion, forest clearing and fuel wood harvesting. The degradation of soil quality due to cropping, made worse by climate change, results in a loss of productive potential of the land, driving conversion of non-agricultural land, such as forests to agriculture.

Reduced productivity of most agricultural crops will continue to drive land-use changes in Africa. In arid, semi-arid and dry sub-humid areas of Africa, land degradation due to erosion and salinization is exacerbated by poor agricultural practices (in particular poor management of irrigation and fertilization). In Malawi and Zambia, chemical land degradation, including soil pollution and salinization/alkalinisation, has led to 15% loss in arable land in the last decade alone.

Poor agricultural practices are also at the root of soil acidification. Acidification increases with the duration of land use, especially in ferruginous and ferralitic soils, which are the most prevalently cultivated in sub-Saharan Africa. In Burkina Faso for instance, it is proven that ferruginous soils become acidified within 6 to 7 years of exploitation. As for ferralitic soils, acidity can be observed after only 4 years of exploitation. Another study in Gabon also showed that Libreville soils grown for more than 10 years are acidified with a significant decrease in fertility (Doso, 2014). Other drivers of degradation in Africa are logging, grazing pressure, species invasions, plant pest/disease spread, fire regime shifts and burning policies in wild and semi-natural ecosystems, and dependence on fuelwood and charcoal.

Interaction Between Land Degradation and Climate Change

Land degradation processes contribute to climate change by enhancing the mineralization and release of CO_2, a major greenhouse gas into the atmosphere. Processes like expansion of rice cultivation, ruminant stocks and manure disposal and nitrogen over-fertilization combined with soil acidification lead to the release of GHGs to the atmosphere. Logging, clearing, fire regime changes, woody encroachment, and grazing pressure lead to reduced plant cover and reduced biomass stocks, causing net warming effects and net carbon releases from soils and plant stocks.

Figure 1 below shows how land degradation processes such as forest clearing for agricultural use lead to greenhouse emissions causing climate change and how climate change on the other hand through high temperatures and extreme weather events contributes to climate change. The figure also shows how climate change and land degradation interact to affect livelihoods, poverty, food security, migration and conflicts.

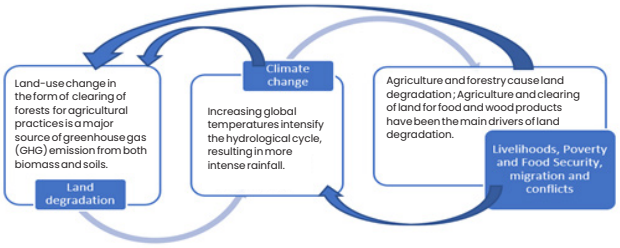

Figure 1: Relationships between land degradation, climate change and livelihoods (constructed from the SRCCL narratives)

Climate change accelerates land degradation through changes in different climate variables such as temperature and precipitation. For example, increased heat stress due to rising temperatures reduces vegetation cover thereby reducing available carbon sinks. On the other hand, variation in rainfall intensity, wind storms and other extreme weather events influence key land degradation processes such as inland coastal erosion.

Landslides, a form of land degradation induced by extreme rainfall events, are expected to increase due to intensification of rainfall in some regions and climate change might increase the chances. Early studies conducted in Africa further hint to a significant causal link between land degradation and violent conflict, e.g. in Rwanda and Darfur. Case study 1 below clearly shows the relationship between land degradation and violent conflict (Percival and Homer-Dixon, 1995)[2].

Case Study 1: Environmental Scarcity and violent conflict in Rwanda

Until the violence that followed the explosion of President Juvenal Habyarimana's plane in 1994, Rwanda's population was 7.5 million people, and was noted to be among the highest population densities in Africa. Ninety five percent of this population resided in the countryside and a huge proportion (90%) relied on agriculture for their livelihoods. Increasing population and land sub-division among family members, the amount of land available for subsistence use decline drastically leaving many landless and unemployed. Food production to sustain the high population growth was threatened by land scarcity and degradation. Literature shows that although the role of environmental scarcity in aggravating the 1994 conflict was limited, it was not insignificant. Environmental scarcities, particularly as they affected food production, undoubtedly increased grievances within the Rwandan rural population and political leaders used the opportunity to encourage Hutus to wipe out Tutsi's so they could possess their land. As a result, a violent conflict occurred where more than 1 million people died and two million became refugees.

[2] *Percival and Homer-Dixon (1995). Environmental Scarcity and Violent Conflict: The Case of Rwanda.*

Climate-related land degradation is expected to have net negative impacts on agricultural productivity in most parts of Africa and alter the regional suitability of various crops, leading to an overall negative impact on food security. Estimates show that past erosion in Africa has caused yield reduction of 2–40%, and that if present trend continues, the yield reduction by 2020 may be 16.5%. In the southern region of Africa, large areas of Angola, Mozambique and Zambia have been deforested. More specifically, 13% of the farmland in Zambia is severely eroded due to exposure from deforestation. In Zimbabwe, the extent of the cultivated area and the intensity with which it is farmed or grazed has left 10% of communal land seriously eroded. In the Sahel, land degradation is estimated to cause a 3% per annum decline in agricultural production, seriously compromising food security in light of high population growth (Doukkali *et al.,* 2018). In Senegal for example, agricultural expansion, particularly groundnut cultivation has led to a decline in fallow land and savannah vegetation.

Deforestation caused by agricultural expansion in Madagascar Photo: Dudarev Mikhail/Shutterstock.com

If land degradation continues at the current pace, it is projected that more than a half of cultivated agricultural area in Africa could be unusable by the year 2050 and the region may be able to feed just 25 percent of its population by 2025. Agriculture being one of the main economic activities in Africa (which represents around 40 percent of the region's GDP and employs about 60 percent of the active labour force), this would lead to a catastrophe with unprecedented repercussions. For example, in Ethiopia, GDP loss from reduced agricultural productivity is estimated at $130 million per year. Land degradation in the drylands of Uganda threatens the country's economy and escalates poverty. This is because these drylands constitute the Uganda cattle corridor, which accounts for over 90 percent of the national cattle herd and livestock production contributes 7.5 percent to the GDP and 17 percent to the agricultural GDP.

The interaction between climate change and land degradation also has implications for poverty and livelihoods through its threat multiplier effect. Estimates show that 1.5 billion people were dependent upon degraded land to support their livelihoods in 2007, and more than 42% of the world's poor population inhabits degraded areas. People living in marginalized agricultural areas face a poverty–environment trap that can result in increased land degradation under climate change conditions.

Projections indicate that by 2050, 50 to 700 million people are projected to have migrated due to loss of livelihood activities from climate-related land degradation. For example, 70% of internal migrants interviewed in the context of the "Where the Rain Falls" project in the Nile Delta and in slums in Old Cairo mentioned both land degradation and water shortages as some of the drivers shaping their decision to migrate. In the Middle Draa Valley of Morocco, a household survey found that land degradation was a major – but not the sole – factor in both past migration decisions and migration intentions (Organization for Migration & UNCCD, 2019). Climate-related land degradation can also reduce the availability of livelihood safety nets as shown in case study 2 below, resulting in migration

Case study 2: Livelihood Safety Nets in Nigeria

The wetlands in north-east Nigeria around Hadejia–Jama'are floodplain provide dry season pastures for seminomadic herders, agricultural surpluses for Kano and Borno states, groundwater recharge of the Chad formation aquifer and 'insurance' resources in times of drought. The floodplain also supports many migratory bird species. As climate change and land degradation combine, delivery of these multiple services can be undermined, particularly as droughts become more widespread, reducing the utility of this wetland environment as a safety net for people and wildlife alike.

Responses to Land Degradation

Policy responses

Actions to address land degradation in the context of climate change should be founded on sound international, regional and national policies. At the global level, the three Rio Conventions—on

Biodiversity, Climate Change and Desertification—derive directly from the 1992 Earth Summit. Each instrument represents a way of contributing to the sustainable development goals of Agenda 21. The three conventions are intrinsically linked, operating in the same ecosystems and addressing interdependent issues. These are complemented by the agenda 2030 - Sustainable Development Goals (SDGs) and the Paris Agreement adopted in 2015.

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.

Technical responses

Responses to land degradation follow the logic and strategies of the LDN concept that entails avoiding, reducing and reversing land degradation, using interventions that provide synergies of adaptation and mitigation. Two of the strategies are Sustainable Land Management (SLM) and Sustainable Forest Management (SFM). On the one hand, SLM is an agricultural innovations systems approach that supports multi-stakeholder co-production of knowledge, institutional innovations, a focus on value chains and strengthening of social capital to facilitate shared learning and collaboration. This could accelerate the scaling up of sustainable technologies and practices. Agroforestry is a particularly important strategy for SLM in the context of climate change because of the large potential to sequester carbon in plants and soil thus enhancing climate resilience of agricultural systems.

Integrated landscape approach

The integrated landscape approach is another response option to land degradation. The approach is founded on four pillars namely understanding how the landscape functions, exploring societal demands and environmental change on different landscapes, designing future landscape options and finally transforming landscapes by negotiating appropriate landscapes and implementing them. The approach also proposes a joint learning cycle to help operationalize the principles of the integrative landscape approach in practice and develop climate smart landscapes (Minang *et al.*, 2015). It therefore encompasses much more than the land's natural resources by looking at the conflicting demands of space, and embraces SLM as one of its key technical treatments. With this approach, different forms of SLM fit into each other, enhancing conservation of the overall landscape. Ecosystem integrity is recognized as the linchpin in

sustained landscape health and meeting multiple objectives. While the landscape approach sets the overall framework, SLM provides many of the most powerful tools for action to achieve multiple co-benefits at scale.

Photo: https://www.centralafricanforests.org

Other SLM responses to land degradation include agronomic measures (managing the vegetation cover), soil management (tillage and nutrient supply), and mechanical methods (durable changes to the landscape). On the other hand, the SFM entails managing forests based on the ecological, economic and socio-cultural pillars of sustainable development.

Early Warning Systems

Early warning systems (EWSs) have also been identified to be important in the efforts to manage impacts of land degradation. They are effective systems for understanding, monitoring and forecasting drought and land degradation as well as strategic approach for identifying and prioritizing appropriate responses, and evaluating the impact of the interventions. For example, the LADA project funded by GEF has developed and tested effective assessment tools for land degradation in dry lands (FAO, 2002). Results from the project included provision of robust data, a harmonized methodology, practical guidelines, capacity building and cost-effective catalytic support to national and international processes, creating opportunities for up scaling the tool to all countries in Africa to address data limitations.

Gender considerations

The use and management of land is found to be highly gendered and is expected to remain so for the foreseeable future. Studies have shown that climate change will exacerbate the vulnerability of populations living in already degraded lands to amplify the gendered impacts of climate change. 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.

In addition, the low adaptive capacities of women and youth due to factors such as limited rights to land use, less access to other capital assets and dominant cultural practices affects the options available to women to respond to both land degradation and climate change. Despite these limitations, many initiatives to address land degradation are either gender neutral or gender blind. Gender analysis is critical as a precursor of implementing gender-responsive land degradation interventions. This approach will identify and address differentiated roles, capacity gaps and opportunities that affect land management across gender categories.

Challenges in addressing Land Degradation

Weak enabling environment: Institutional and governance issues such as weak land and land use policies tend to hinder the adoption of good land management practices. Mainstreaming land degradation control plans into relevant national policies, programs and strategies is still a challenge for many African countries.

Economic and financial constraints: Lack of economic incentives such as compensation mechanisms for environmental services is a barrier to investing in high capital and labor demanding land degradation interventions such as soil and water conservation measures. This can be attributed to a poor payment for environmental services (PES) system and weak institutionalization of the system. Another limiting factor is access to affordable credit facilities to support. Consequently, most of the SLM programs and activities in Africa are largely donor dependent.

Social and behavioral constraints: High poverty levels that are already perceived as an underlying cause of land degradation in Africa are sustained by external and internal forces such as diminishing

soil fertility and land productivity, vulnerabilities created by climate variability especially persistent drought and other extreme events among others. This makes it difficult to invest in SLM practices, most of which take long before benefits can be realized. Gender inequalities have also been noted to affect women's participation in interventions for addressing land degradation.

Technological and knowledge constraints: Inadequate learning and adaptive knowledge management skills, including skills for monitoring and evaluations of impacts and data limitations have been noted to be a major barrier to addressing land degradation. The inherent vulnerability of soils to degradation under various land-use options also limits the level of application and success of good land management practices. It is therefore expedient to have area- and case-specific technological packages for land degradation interventions. In addition, there is continued high reliance on inefficient biomass fuel technologies.

Opportunities for Addressing Land Degradation in Africa

Innovative land degradation interventions: Many innovations in SLM are now known and recognized for their multiple environmental, social and economic benefits. Some measures offer adaptation options and other co-benefits, such as agroforestry, involving planting fruit trees that can support food security in the face of climate change impacts or application of compost or biochar that enhances soil water holding capacity and so increases resilience to drought.

Comprehensive landscape approach: The approach takes into account the different agro-ecological zones of Africa to address the multi-faceted nature of land degradation.

Photo: Sam Thompson / DFID Rwanda / russavia / CC / Wikimedia Commons

Climate change policies and national action plans: Interventions such as SLM, comprehensive landscape approach and EWSs need to be mainstreamed into national development planning and budget so as to secure political commitment and allocation of resources. Now that countries are updating their NDCs, it is imperative that land degradation needs are incorporated in the new NDCs.

Conclusion

Land use and land use changes, driven largely by agricultural expansion, deforestation and forest degradation, have not only contributed to land degradation but also to limited food availability for a growing population, increase in greenhouse gas emissions, and biodiversity loss. Land plays a critical role in climate change, as a sink as well as a source of CO_2.

Recommendations

1. Enabling policy environment: Mainstreaming land degradation interventions into national action plans, strategies and programs will foster commitment and mobilize resources for addressing land degradation in the long-term.

2. Investment in the comprehensive landscape approach: A comprehensive landscape approach is the best way forward to address the broad multi-faceted nature of land degradation across the range of agro-ecological and climatic zones in Africa.

3. Strengthening of EWSs for land degradation: EWSs are essential for understanding, monitoring and forecasting the extent of land degradation as well as providing mechanisms for identifying and prioritising appropriate responses, and evaluating the impact of the interventions.

4. Capacity building: Governments need to invest in both technical and institutional capacities that enhance knowledge co-generation, learning and adaptive management skills, institutional innovation and information sharing. This will in turn drive behavioral change and catalyse adoption of SLM practices.

Further Reading

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