Somali Studies: A Peer-Reviewed Academic Journal for Somali Studies,
Volume 9, 2024, pp. 59-89

Mitigating Land Degradation in Somalia

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Abstract

Land degradation, characterized by a continued decline in the functionality and productivity of ecosystems due to human activities, poses a significant challenge in Somalia, particularly affecting small-scale farmers and their agricultural lands. The study identified a widespread prevalence of land degradation nationwide. It delves into the causes, effects, and current status of land degradation in Somalia, primarily focusing on generating effective mitigation strategies.

This study underlines the urgency of addressing land degradation in Somalia and proposes a set of mitigation measures. However, the effectiveness of these strategies necessitates establishing a strong institutional framework that includes comprehensive support systems and a rigorous monitoring and evaluation program.

Keywords: Somalia, land degradation, soil erosion control, land management.

1: Introduction

Land degradation is a negative alteration in the condition of land, triggered by direct and/or indirect human-induced processes comprising anthropogenic climate change, expressed as long-term decline or loss in the biological productivity of land resources, ecological integrity or value of land to humans. According to UNCCD (United Nations Convention to Combat on Desertification) report, 23% of the global land has lost its productivity, while 75% of the total worldwide land has been changed to unsuitable uses. Land degradation is taking place at a progressive level, and has reached an advanced rate in the last 50 years. Over 3.2 billion people living worldwide are threatened by the processes of land degradation, and this may be one of the main reasons, together with climate change, forcing 50 million to 700 million people to migrate from their homes by 2050 (Chabay, 2018). Based on the estimations of the Food and Agriculture Organization (FAO), approximately 25% of all global land is austerely degraded, 36% is slightly or moderately damaged but seems to be stable, and 10% is improving. Unsustainable land management practices such as uncontrolled livestock grazing, poor construction of transport systems, and unregulated or unplanned urban settlements in environmentally sensitive areas initiate the process of land degradation (Rioux et al., 2017).

Land degradation in Somalia has potential effects on improving the country's traditional pastoral production systems, which are the chief sustenance for the country's overall economy. Rangeland degradation has been threatening some parts of the country, particularly the northern rangelands, while the southern parts have confronted a strong formation of sand dunes. Most of the country's land, particularly those areas around water holes or wells, are degraded at all. The study recognized land degradation as a serious economic, environmental and social problem, and an unceasing major threat to the provision of environmental services

and the capacity of small landholders to encounter their own growing demand.

Land degradation distresses the survival and livelihood of human beings; however, humans themselves accelerate the process of land degradation through their inappropriate activities. It affects human beings through its impacts, from the reduction of food production potential, environmental deterioration for human habitation, and destruction of road networks by gully erosion. Human activities accelerate it through the overexploitation and mismanagement of land resources.

By endeavoring to find a solution to the mentioned problems, the paper sets various research objectives that are interrelated with the subject of the study. The study aims to ascertain the causes of land degradation in Somalia and discover its effects on the environment, agricultural productivity, and the livelihood of human beings. Subsequently, the paper gathers information on the current land degradation status in Somalia. In addition, it reveals the rate of sustainable land management practices in the country. Furthermore, the study navigates various measures for mitigating the land degradation process in the country.

The study used a qualitative research methodology and gathered the required information through a literature review. All the data in this study were gathered and examined, and the most reliable data that met the research objectives was carefully chosen and applied to the study.

1.1: A Global Context of Land Degradation

The term “land degradation” indicates a significant reduction in the productive capacity of the land. It is a complex process that involves various causative factors, among which are climate change, land use and land cover changes; in addition, the human dominated land management

practices play a dominant role in the land degradation process (Barbier 1997; Sivakumar and Ndiang'Ui 2007; Symeonakis et al. 2007; Bajocco et al. 2012). Land degradation is a global phenomenon that occurs in many countries, and in very different ecological, socioeconomic and climatic situations. It remains a major threat to the ability of the world to meet the rising demand for food and other environmental services. It is a complex phenomenon that involves the interaction of the changes in the physical, chemical and biological properties of soils and vegetation (NRC 1994). Around 3.2 billion people in the world are affected by land degradation; in addition, land degradation affects a quarter of land area in all agroecological zones around the world (Lal et al., 2012). Annually, about 5-8 million hectares of formerly productive land go out of cultivation due to global land degradation (TerrAfrica, 2006). There are two interconnecting complex systems involved in the process of land degradation, which are the natural ecosystem and the human social system, and both changes in the biophysical natural ecosystem and socioeconomic conditions will affect the land degradation process (MEA 2005).

Pressure from population growth, poverty, and market and institutional failures are frequently identified as the main causes of land degradation in the world (Kirui and Mirzabaev 2014). Natural and anthropogenic causes of land degradation still continue to exist, and some even accelerate largely due to climate change and population growth. Land degradation is a worldwide problem arising from the changes in the patterns of land use, particularly affected by the activities of farming and settlements.

Land degradation has a negative effect on human beings by deteriorating the environment in which humans and other living organisms inhabit, causing road destruction through gully formation and reducing the food production potential. Humans intensify the land degradation process by overexploitation and inappropriate management of land resources. Land degradation is a slow destructive environmental process, which takes

place (from the onset of the rains to several years) before exhibiting its observable detrimental symptoms in the field and, hence, undetected until it becomes advanced. In the course of its development, it leaves a trail of destruction that may be very difficult to eradicate and may incur much cost to mitigate. Some destructions include eutrophication, inhibition of plant growth from loss or decline of soil nutrients, vegetation loss, disturbance of the hydrological cycle through siltation of surface water sources and destruction of trees, among others. Consequently, these impacts largely affect food security, create environmental problems and interfere with the economic well-being of a country.

1.2: Climate in Somalia

Somalia is a country in the Horn of Africa that has an arid to semiarid climate, which varies among locations between tropical and sub-tropical, and between desert and semi-humid. The north and south Inter-Tropical Convergence Zone (ITCZ) with alternative movement of northeast monsoon winds that blows from the Arabian coast, the south winds from the Indian Ocean and southwest monsoon winds that blows from Africa side influence the climate of Somalia.

The monsoon winds provide unsteady rainfall, which provides four seasons in the year:

1. *Gu' Season (Spring)* is from April to June; in addition, it is the highest rainy season in the country.
2. *Hagaa Season (summer)*, from July to September, is a windy, dry and cool period in the whole country; however, there are also some showers in the northwest highlands and south coastal areas along the Indian Ocean.

3. *Dayr Season (autumn),* is in between October and December, the second rainy season but less amounts of rainfall when compared with the Gu' season.
4. *Jiilaal Season (winter),* from January to March, is the longest hot and dry period in the entire country.

Notwithstanding with the above seasons, the country's mean annual precipitation is about 282 mm. The distribution of the precipitation in the parts of the country is about 50mm along the coast of Gulf of Adan, 150 mm in the interior plateau, 200-500mm in the south and more than 500mm in the southwestern parts and the northwest highlands. In addition to low average annual rainfall, the country experiences minor droughts at every 3-4 years and severe droughts of every 8-10 years. However, the country's average annual temperature is about 28 ^{0}C in the hinterland but it may be as high as 47 ^{0}C along the coast of the Gulf of Adan and as low as zero ^{0}C in the mountain areas. Moreover, the temperature in the interior and the coast of the Gulf of Adan is dry and hot, but cool along the Indian Ocean coast and inland areas in floodplains between Shebelle and Jubba rivers. The hottest periods in the year is in the *Hagaa season* along the coastal zones of the Gulf of Adan and during the *Jiilaal season* for the rest of the country. In addition to the high temperature, a high relative humidity of between 60 and 80% experiences the country.

1.3: Land Use and Land Cover (LULC) Change as a Contributor to Land Degradation Process

Land cover in Somalia consists of natural vegetation, which includes forest, wooded vegetation, bush lands, grasslands, open shrubs, and open to closed herbaceous formations. In addition, the different types of land cover in the country are natural waterbodies, crop fields, urban and associated areas (rural areas, airports etc.). Changes in the governance since pre-colonial time before 1887 up to date, long time civil war and

climate change in the country have caused considerable changes to the land use patterns and policies. Some of the changes such as cultivation of large area of rangelands for agriculture without any sustainable land management, uncontrolled charcoal production for export as well as for local consumption, unmanaged grazing of livestock and individual land ownership for rural and urban development programs have contributed to the current state of land degradation in the country.

However, the land use type in Somalia is pastoralism, rain-fed and irrigated agriculture, forest etc. Pastoralism comprises nomadic pastoralism, which practices export of livestock as a private sector of livestock industry. It is a growing private sector and provides the highest revenue in the country, surpassing fourfold in the value of crop industry. Livestock industry provides more than 60% opportunities for employment and its earnings is about 80% of the country's foreign exchange earnings. Somali pastoralists primarily rear cattle, goats, sheep, and camels.

Meanwhile, the northern parts of the country, annual rainfall cannot solely use for crop farming except for small areas of land around Hargeisa, Borama and Gabiley. The rest of the region is supported the less rainfall with irrigation water form ground water sources, where it available as alternatives, for crop production. Rain-fed agriculture is practiced in southern parts of the country around the Shebelle and Jubba river basins. The rain-fed agriculture is practiced only two crop growing seasons, *Gu'* and *Deyr* seasons. Crops such as sorghum, maize, millet, cowpeas, mung beans, groundnut, sesame, cassava and vegetables are grown for human consumption and some for animal fodder. Crop production in Somalia is very poor due to several grows and yield limiting factors such as soil erosion, low soil moisture content, high variation in the availability of rainfall, shallow and stony soil, and low soil fertility and productivity.

Irrigated agriculture is common in the floodplains of the Shebelle and Jubba rivers. In northern regions, water for irrigation is available within pockets of deep soil for orchards, or from shallow springs and wells, which are the main water sources for crop irrigation, with water pumped to the fields. Irrigated crops grown in Somalia are maize, sesame, vegetables and some fruit trees on small scale, while crops such as grape fruit, mango, banana, papaya, guava and lemon are on a large scale production for domestic consumption and with some exports.

2. Land Degradation in Somalia

Land degradation seriously affects the economic and social wellbeing of large units of the global population, including the Somali people, to varying degrees. Somalia is highly vulnerable to land degradation. Land degradation has been wrongly conceptualized in many parts of Somalia due to lack of understanding about the land degradation and its processes. Many Somalis often misinterpret land degradation; some assume that land degradation is a divine tragedy, which can happen anytime without their unsuitable activities. However, others think that, land degradation is something that occurs in natural and does not have any preventive or control measures. Actually, land degradation occurs naturally but the great problem of land degradation is not the natural processes of land degradation. The different users of the land are unaware that their mismanagement and overexploitation of land resources (such as the overgrazing of livestock, deforestation, improper agriculture practices, and among others are the main causes of the aggravated land degradation process. One of the most important thing that needs to clearly understand is that ‘land degradation is not an event but is a process or change that brings a negative impact on the environment’. Land degradation affects the environment through one of its processes or combinations of processes of two or more including erosion of soil, sedimentation, continuous reduction of biodiversity whether its loss in quality or

quantity, loss of vegetation, soil nutrient decline, increase in the acidity and salinity of the soil etc. Another important thing is that human beings exacerbate the land degradation process while land degradation negatively affects themselves.

The Somali Government recognizes land degradation as a major impairment to the national economic development as it adversely affects livestock and agricultural production that significantly contribute to the Gross Domestic Product (GDP) of the country. Land degradation has been particularly causing a severe drought and has harshly reduced the agricultural production, a main source of Somalia's economy. It is a principal threat to the functioning of the ecosystem in areas classified as high and low agricultural potential in Somalia. Land degradation is increasing severely as one-thirds of arable land in the country is degraded and lost its valuable fertility.

The major forms of land degradation in Somalia are loss of topsoil, soil erosion, loss of vegetation due to overgrazing and the cutting of trees for charcoal production and for use as construction materials (FAO, 2009). Agricultural land degradation is associated with damage to the biological productivity and the usefulness of the land resource (Gretton and Salma, 1996). Therefore, maintenance of land quality is essential for sustainable development of agriculture sector, to enhance agricultural productivity, thereby improving the livelihood in rural areas and food security in Somalia. On the opposite, overuse and overexploitation of the ecosystem in quest for higher agricultural production leads to unintended land degradation. Abysmal agronomic practices, such as burning of animal manure, and lack of soil and water conservation measures are major causes of poor agricultural productivity in Somalia (Omuto et al., 2011). However, there is huge signs of land degradation in Somalia particularly the northwestern regions (Togdheer, Waqooyi Galbeed, and Awdal) and the northeastern part (Bari, Nugaal, and Sanaag). Land degradation in

Somalia is a severe problem to the small scale farmers and their agricultural soils causing low crop yield and consequently food security problem. There are trends of land degradation in Somalia and the sustainable land management practices are very little, thus, need to be upscaled.

2.1: Types of Land Degradation

Based on the findings from the reviewed literature, the most dominant forms of land degradation in Somalia are:

1. Soil degradation brought by chemical degradation, wind and water erosion;
2. Water degradation has resulted in aridification and a decline in the quality of surface water;
3. Biological degradation, such as loss of biomass, severe damage to the quality and quantity of biodiversity, and decline of vegetation cover.

Land degradation has contributed to vegetation loss, gully erosion, decline of valuable topsoil, siltation of surface water and irrigation canals, invasion of non-palatable plant species, and loss of plant nutrients in areas suitable for agricultural production. Although the combination of these different types of land degradation occurred in the whole country, the dominant types regarding each region were topsoil loss caused by wind erosion in northern regions, degradation of water in the south, and vegetation loss in south and central regions.

In addition, some areas of the country, such as the northwest and the south and areas near the shores of the Indian Ocean, were heavily damaged by invasive plant species. The invasive plant species, which include *Prosopis juliflora* (Garanwaa or Ali-Garoob) and Cactus

(Tiintiin), colonize these regions by replacing the high palatable native plant species of high capacity seed production and high adaptability to several climate situations and various soil types and conditions. *Prosopis juliflora* is a shrub or tree suitable for stabilizing and protecting sand dunes and uncultivated land with no vegetation grown to prevent soil erosion and, subsequently, environmental pollution; however, its consequence is that it destroys the edible natural grass, displaces native plants and reduces the quality of pasturelands.

Furthermore, rangeland degradation and the formation of sand dunes are two major types of land degradation in Somalia. Dregne Harold E. (1982) concluded that all rangelands in Somalia were degraded, while a survey conducted by the World Bank (1987) found that Somalia's northern rangelands were the most serious of the degraded lands (accounting for as much as 50 per cent of the total rangeland) because of their steep lands, high amounts of livestock and immediacy to livestock export Ports.

Most of the country's land, particularly areas around the water holes or wells, is degraded. A study on the assessment of environmental and natural resource management in Somalia conducted by Omuto, Vargas, and Alim (2009) found that the country is affected by two predominant types of land degradation, which are physical and biological land degradation. Furthermore, Omuto, Vargas and Alim et al. (2009) identified two other forms of land degradation, which are chemical degradation and urban degradation; though, they put their combined prevalence to less than 1%. Chemical degradation of the land is mainly viewed as the loss of plant nutrients from the soil.

i. Physical Land Degradation

Physical degradation of land is mainly referred to the loss of soil through erosion; however, it includes phenomena such as sedimentation of water

ways by the off-site effects of erosion, soil structure deterioration and increased stoniness. About 36.6% of the whole degraded land in Somalia, or approximately 50% of the affected rangelands of Somaliland (more than 53% of all degraded land in Somaliland) are in the form of physical degradation of the land (Omuto, Vargas and Alim, 2009). Physical land degradation is extremely dominant in the Northern parts of the country compared to the Southern regions (Omuto, Vargas and Alim, 2009). According to Jibril (2014), soil erosion caused by the movement of wind and water and the impact of livestock and vehicle traction are the various types of physical land degradation. As most of the land surface is exposed or has low vegetation cover, rainfall (particularly the Gu' season – between April and July) erodes topsoil and then carries it into water bodies such as streams, rivers, or oceans. When the intensity of the rainfall is very high, the absence of natural water barriers (such as forests or trees and other vegetation) increases flooding risks, as recently experienced in Puntland (Hassan, 2013), consequently causing severe erosion of the top fertile soil.

As the land degradation process is gradual, it may start as small channels known as rills (rill erosion) and ultimately transform into large channels called gullies (gully erosion). Physical erosion by the movement of water takes place throughout Somalia, including Somaliland, but Sanaag and Sool (two regions in the Northern parts of Somalia) are the most prevalent regions where the formation of large gullies is obvious (Abdi and Ibrahim-Buffalo, 2014). During dry periods (from the beginning of December up to March), wind erosion is a major problem and intensifies land degradation in Northern Somalia. Wind erosion causes severe soil loss due to the high velocity of prevalent winds along the shoreline and southwestern areas of the Gedo region (Omuto, Vargas and Alim, 2009). The average wind speed in Somalia is about 0.2 to 8.5 m sec-1 and tends to vary between years and seasons (Muchiri, 2007). Hargeisa has the highest wind speed record, averaging about 17 m sec-1 in June and July,

and in the Southern parts (especially Lower Juba areas), the average wind speed is from 8 -10 m s-1 (Muchiri, 2007). High wind speed combined with the absence of vegetation that could act as windbreaks commonly transports tons of soil, further increasing the degradation of fragile and arid ecosystems. Furthermore, physical land degradation indirectly affects the diet of livestock through the removal of topsoil and, subsequently, reduction in the availability of forages due to the low growth of grass plants caused by low fertile soils, consequently causing low productivity in the livestock Sector.

ii. Biological Land Degradation

Biological degradation is mainly regarded as loss in vegetation cover, biodiversity loss, and the increase of undesirable plant species. Biological degradation is about 37.89% of the overall damage caused by land degradation in Somalia, with approximately 30.48% of the total biological degradation in Somaliland (Omuto, Vargas and Alim, 2009). However, the annual rate of deforestation in Somalia is 1.03%, which is three times the deforestation rate of a neighbouring country (like Kenya, which is only 0.3%) and nearly twofold the average rate of deforestation in Africa, which is only about 0.62% (FAO, 2009). The primary causes of deforestation are overgrazing, shifting cultivation and unregulated charcoal production. In Southern parts of Somalia, shifting cultivation has particularly contributed to a large degree of biological land degradation. This is because the region has been facing continued conflict and rapid environmental degradation, and therefore, communities practice transhumant migration as a survival strategy (Farah et al. 2002). This has exacerbated the rate of land conversion as migrants clear forested areas for cultivation and then abandon these lands as they escape conflicts; however, the continuous displacement of persons has weakened their links with the land, consequently creating a reduction of incentives towards sustainable land management (Ali and Mohamed, 2014).

2.2: Causes of Land Degradation

Identification of the fundamental causes of land degradation is very important in a fragile country with an arid and semi-arid climate to control and optimally prevent the process of land degradation while at the same time stimulating the restoration and improvement of the land. In Somalia, the causes of land degradation can be categorized into two main groups: the direct and indirect causes of land degradation.

i. Direct Causes of Land Degradation

The direct causes of land degradation are due to the actions of human beings. In addition, the direct causes of land degradation included natural causes. Humans directly contribute to the land degradation process through their activities such as overgrazing by livestock, unplanned felling of trees for charcoal production and firewood, unsuitable farming practices, overexploitation of forest resources and woodlands, resettlement and urbanization. Furthermore, ploughing of sloping land for agriculture without any conservation measures and burning livestock manure and other residues from animals instead of leaving them on the field and incorporating them into the soil are some of the inappropriate agriculture practices that brought about the direct causes of land degradation. The reduction of plant cover, followed by excessive livestock grazing and droughts, are also cited as the direct causes of land degradation. Failure to practice conservation measures on croplands and uncontrolled land degradation are also direct causes of the land degradation process.

Meanwhile, overuse of vegetation (mainly for fuelwood, livestock grazing, fencing and construction materials, charcoal production, etc.) and agricultural extensification into rangelands (which were marginally suitable for farming purposes, especially if good land management

practices were implemented) were the two main direct causes of land degradation in the Northern parts of the country. The population in Somalia is increasing rapidly, thereby putting inconceivable pressure on the existing resources. This has resulted in the opening of new agricultural land, the devastation of forest resources, and the lack of enough time for the natural regeneration of soil fertility. More trees in the forest ecosystem are cut down for the production and use of charcoal and firewood. Moreover, rangelands are imperilled to overgrazing, thus leading to a decline in the productivity of rangeland resources.

Traditional biomass fuels, primarily firewood, charcoal, and other inefficient fuels, account for 82% of the total energy consumption in the country. Nomads and rural populations mostly rely on firewood and inefficient biomass stoves as a main energy source. Nearly 98% of urban inhabitants in Somalia use traditional charcoal stoves, which has contributed tremendously to the widespread deforestation in the country.

ii. Indirect Causes of Land Degradation

The most cited indirect causes of land degradation in the country were poor governance, lack of environmental and agricultural policy, high population pressure and poverty; these factors are, in turn, caused by the continuous fighting among Somalis and the absence of good governance since the collapse of the Military Government in 1990. However, the increase in livestock numbers and human population, lack of appropriate policies and enforcement, poverty and poor implementation of environmental and natural resource policies are also the main indirect causes of land degradation in Somalia. In addition, poverty is another indirect cause of land degradation. Because of the limited resource base, people demand more goods from the principal assets such as pastoralism and farming activities. Furthermore, as household incomes are very low, land users cannot make any form of investment to support sustainable

land management practices, consequently jeopardizing the land degrading process.

2.3: Effects of Land Degradation

In Somalia, land degradation negatively affects the productivity of the land resources, particularly agricultural land. Land degradation in the country has reduced agricultural land productivity through soil nutrient decline and limited crop growth and development, which consequently caused low crop yield. In addition, the increase of areas affected by invasive plant species has reduced pasture availability for livestock management. Moreover, bare ground due to limited plant growth causes soil erosion and sedimentation that affects the quality and quantity of available water for use. Lack or decline of vegetation causes dust storms that pollute the environment and, consequently, cause human health problems. In addition, the formation of Gullies has been reported to disturb the transportation systems through road destruction and the collapse of bridges. According to a report released by FAO-SWALIM 2009, land degradation negatively affected the ecosystem services. The negative effects of land degradation include impacts on the productive services of the ecosystem (such as food production systems), soil services (soil systems and soil biological diversity) and social and cultural services. The effects on the social and cultural services are increased poverty and the lack of the provision of food and livelihood security for the Somali people. In addition, the research also identified a negative impact on water bodies caused by land degradation, thus making water resources unsuitable for drinking and home consumption.

2.4: Status of Land Degradation

Land degradation in Somalia is increasing in both severity and extent in many areas. Remote sensing analysis conducted by FAO-SWALIM

(Somali Water and Land Information Management of Food and Agriculture Organization) classified roughly one-third (~31%) of the country as degraded, and only 17% of the total land area of the country is exhibiting evidence of land condition improvements. Based on the findings of the review, the status of land degradation in the country is moderate to strong. However, a study on the assessment of land degradation conducted by FAO-SWALIM (2009) indicated that Somalia has noticeable signs of land degradation. The study showed that almost 30% of the country was degraded between 1982 and 2008, with a degradation class of moderate to strong.

Furthermore, the Shebelle and Juba basins, which are the most productive areas of the country, are experiencing the highest risk of degradation because of poor cultivation practices, overgrazing, deforestation, and land fragmentation. Moreover, in 2000 and 2015 alone, the total land degradation in Somalia was about 147704 km2, equivalent to 26.7% of the total land area in the country (Federal Republic of Somalia, 2020). Somalia has suffered serious environmental problems as a result of the combination of several factors, such as biological degradation, soil erosion, gully erosion, and others.

3: Land Management Practices

The land management practices implemented in Somalia include establishing tree nurseries to improve vegetation cover, stone lines to control soil loss, traditional water harvesting, and some control measures for gully erosion. In southern Somalia, only hand-made soil bunds are practised.

In Somaliland, the most common sustainable land management practices are the construction of soil bunds, gully stabilization and water harvesting practices. Most of these practices are found around the main agro-pastoral

systems, which are the areas where topsoil loss, nutrient decline and water scarcity are the dominant land degradation types of the region. A few applications of manure are present in some other places of the region for increasing soil fertility in irrigated agriculture. Additionally, some practices for river embankments can be found in these places.

However, there is a very low adaption of sustainable land management practices in the country; approximately 83% of the country has yet to be applied to any sustainable land management practice. Less than 18% of the country's total area is implementing some sustainable land management practices with a class of very scattered few.

However, the lack of adoption of sustainable land management in Somalia is due to several factors, which include institutional and governance issues, economic factors, lack of knowledge and information, and lack of technology. Although these factors have interrelating effects on the lack of sustainable land management adoption, the first two factors (institutional and governance issues and economic factors) are the primary barriers to sustainable land management adoption. Twenty-five years of instability in Somalia have resulted in poor government, weak leadership and unclear governmental structures. Consequently, this caused a lack of adoption of sustainable land management practices in the country. Lack of institutions and poor government hindered sustainable land management adoption in the country due to a lack of policy and regulations towards the sustainable use of land resources. Furthermore, poor government is also an issue for the country's economic problems and lack of knowledge.

On the other hand, the lack of highly limited finance for smallholder farmers is another problem in adopting sustainable land management practices.

The lack of financial support and access to capital for implementing and maintaining sustainable land management practices poses a significant challenge to land users. Limited economic resources also hinder farmers' ability to acquire knowledge and technology. Individuals with restricted finances often struggle to access the necessary knowledge and technology, resulting in a lack of adoption of sustainable land management practices. Moreover, insufficient access to knowledge and information serves as a major obstacle for farmers in adopting sustainable land management practices. Various factors such as security concerns, financial constraints, and educational gaps contribute to this limitation. Additionally, the absence of appropriate technology further complicates the adoption of sustainable land management practices. For instance, the lack of conservation tillage tools and sustainable agricultural practices acts as another barrier to effective land management.

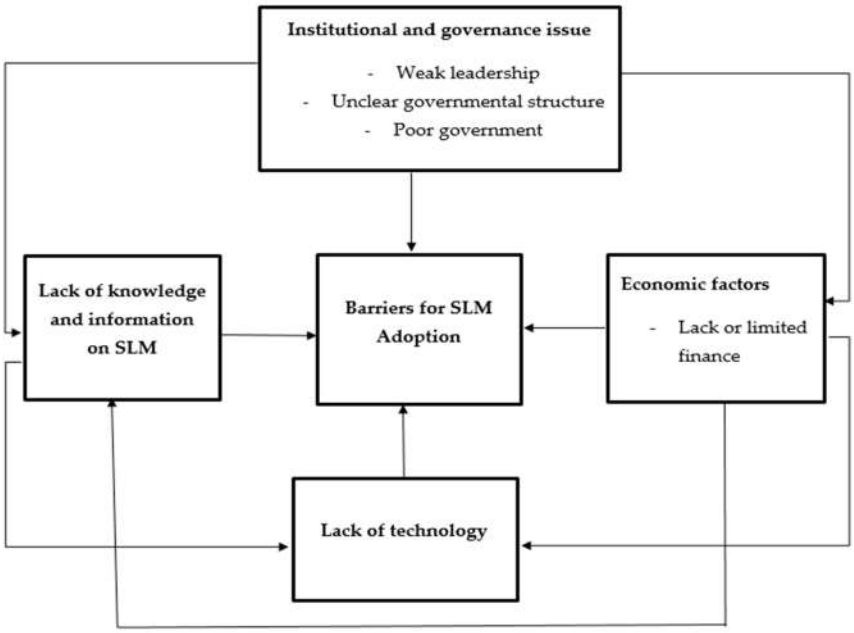

Figure 1 Conceptual framework of barriers to sustainable land management (SLM) adoption in Somalia (Source: Author's completion)

The figure above (Figure 1) shows the conceptual framework illustrating the barriers to adopting sustainable land management in Somalia.

4: Mitigation Strategies for Land Degradation in Somalia

After identifying the causes and effects and reviewing the status of land degradation in Somalia, the research provided the following recommendations as policy formulations for the Somali government or its state governments and any other institutions working on or implementing land use and land development projects for mitigating the land degradation process and improving the sustainable use and management of land resources.

4.1: Enhancing Adoption to Sustainable Land Management Practices

Sustainable land management is one of the best measures to address land degradation. It involves soil conservation, forest and water management and contributes to climate change adaption and mitigation; therefore, sustainable land management is an essential tool in agriculture, forestry, and rural development policies. Restoring land degradation and adopting sustainable land management practices are key approaches for meeting the increasing demands for land resources while addressing climate change and sustaining the various goods and services provided by healthy ecosystems.

Somalia, particularly the northern parts of the country, is severely affected by physical degradation (mainly soil erosion) and subsequently caused loss of topsoil; therefore, the study strongly recommends the implementation of sustainable land management practices in this region to reduce the land degradation process and restore the already threatened lands. Practising cover cropping (especially leguminous cover crops) or residue cover, as well as organic mulching, is the best way to quickly

restore the loss of soil fertility and protect the topsoil. Due to the heavy loss of soil fertility in this region, it may require the application of fertilizers (a combination of organic and mineral fertilizers) to supplement crop growth; hence, a soil testing program should be implemented whenever using mineral fertilizers in the application of crop plants for proper management of soil nutrients.

Meanwhile, some regions in the southern parts of Somalia have been intensively affected by the loss of soil moisture content; to restore the soil water, there should exist an adoption of sustainable land management practices such as conservation tillage, mulching, and cover cropping, among others. These practices can potentially moderate evaporation rates, store soil moisture, and increase infiltration. In addition, crop rotation, multiple cropping, crop diversity, and integrated farming are some of the ways used to maintain soil fertility and balance soil nutrients.

4.2: Establishing Afforestation, Reforestation, and Forest Management Programs

Afforestation is the planting of trees to make a forest in abandoned and degraded agricultural lands or any area that has not previously grown with any trees. In addition, reforestation is the replanting of an area that was previously growing trees and later deforested for charcoal or fuel wood production or any other purpose. Somalia's vegetation is degraded due to overgrazing, shifting cultivation and uncontrolled deforestation, mainly for illegal charcoal production and fuel wood collection. Therefore, implementing these programs in the country should be promoted to restore the degraded forests and rangelands.

As identified by this research, approximately 38% of the country is affected by biological degradation, and the vegetation in most of the southern and northern parts of the country has declined, leaving the land

without cover and consequently leading to other forms of degradation. There is a need to establish forest plantations of fast-growing tree species used for sustainable charcoal production to meet the country's energy needs. Conservation of slow-growth forests and high-value plant species such as Acacia spp should also be taken into account to aid in the recovery of the forest ecosystems.

Moreover, forest management in Somalia as a whole is very crucial to conserve and sustainably use the forest ecosystem. Forest management comprises picking trees and regenerating themselves naturally or replanting them with other trees. It encompasses the protection of the forest and the exploitation of forest products and services. Several ways can be managed to the forests with different objectives. For Somalia, there is a need for forest management to provide abundant forest products to sustainably meet the increasing needs for charcoal production for fuelwood, fodder, timber, and other forest products and services. The study highly recommends the implementation of forest management policies in Somalia as it will support the country to make the charcoal industry more sustainable.

4.3: Restoration and Management of Rangelands

Rangelands in Somalia are highly deteriorated; fifty per cent of northern rangelands in the country are degraded owing to several factors, mainly the steep topography of the region, the high deforestation rates for charcoal production and the expansion of croplands. There should be an enhancement of rangelands in the northern parts of Somalia through revegetation programs. Growing of grasses integrating with herbaceous perennials and proper management of the remaining rangelands are required to hasten the recovery of the degraded rangelands. This can be achieved by avoiding livestock enclosures and increasing the availability of woody debris and leaf litter in the spaces of rangeland plants to stop

the runoff and increase the infiltration rate. In addition, this enables the soil to store more moisture and increases the soil water holding capacity. By reducing runoff water, subsequently, minimizes the rate of soil erosion and eventually improves the productivity of the rangeland.

Furthermore, rangeland grazing management should be implemented by moving the livestock from one pasture to another in a rotational program; this gives the grass time to recover. It is recommended that rangelands not to be exploited for more than 40 to 50 percent of their annual productivity of the most palatable species (Fournier 1972, Thorsteinsson 1980a). Therefore, the vegetation should be allowed to sufficiently regenerate and provide 70% ground cover, particularly at times of high erosion. Grazing management should be focused generally in Somalia and particularly Somaliland zone.

4.4: Reclamation of Gullies

Deforestation creates an exposed soil surface, consequently increasing the chances for raindrops to strike the land surface and splash and detach the soil. If the intensity of the rainfall is increased, there is a possibility of the infiltration rate of the soil to decrease, subsequently increasing the rate of runoff, which may cause overland flow or sheet erosion. Increasing rainfall intensity with high runoff on bare soil causes the formation of small channels known as rills on the land surface and consequently to large gullies, which is very difficult to control. Generally, there is a need for reclamation of gullies in Somalia as most parts of the country, although differing in the degree, have affected gully erosion. The northern parts of the country are severely affected by gullies due to their high topography, while the central parts also have some effects of gully erosion. However, engineering structures like terraces, diversion ditches and rock check dams are some of the appropriate measures that can be used for gully reclamation in these regions. These structures should be supported with vegetation by reseeding or replanting dense growing

plants to avoid quick failure of the structures. Vegetative propagation techniques, such as using cuttings of Commiphora species, which are easily available in the country, are better ways to speed up the vegetation in the gully structures. Reclamation or stabilization of gullies supported with vegetation reduces runoff water and improves the stability and fertility of the soil.

4.5: Establishing Riparian Zones

During heavy rains in Somalia particularly in the months between April and June, some parts of the country witnesses a lot of river flooding due to lack of vegetation that would act as water-break. According to Hassan (2013), Puntland has recently witnessed a risk of flooding due to lack of natural barriers of water flow. Furthermore, high winds in the coastal areas of Gedo region in Jubbaland state of Somalia causes sandstorms that carries several tons of topsoil further increases the degradation of fragile arid ecosystems.

Flood mitigation and stabilization of sandstorms require long term plan. For example, flood mitigation requires construction of dams that require high investment and advanced engineering technology that may need several years to implement. However, establishing riparian zones in these regions as a short term plan is very essential. Riparian zones act as water- and wind-breaks thus directly act as flood mitigation measure, riverbank stabilization, sandstorm stabilization and water quality improvement. They have a big role in soil and water conservation, as they prevent or mitigate sandstorms and stream flooding; they control water and wind that would cause soil erosion. In addition, riparian vegetation in the riparian zone creates or increases surface roughness that will slowdown runoff, decrease water entering into the river, and reduce the flow rates within the river. Furthermore, it creates favorable habitats for birds, fishes and other animals living in the riparian areas.

5. Conclusion

This study has examined the issue of land degradation in Somalia, with a focus on identifying its causes, effects, and current status within the country. Our study has revealed a complex web of factors contributing to land degradation, both directly and indirectly.

Among the most cited indirect causes of land degradation in Somalia are poor governance, a lack of robust environmental and agricultural policies, high population pressure, and widespread poverty. These underlying issues have created an environment in which the direct causes of land degradation can thrive.

Human activities, including overgrazing by livestock, unplanned tree felling for charcoal production and firewood, inappropriate farming practices, overexploitation of forest and woodland resources, and rapid urbanization, have been identified as direct causes of land degradation. These activities have taken a toll on the productivity of Somalia's land, particularly in areas suitable for agricultural production.

Notably, land degradation has been on the rise in several regions. The Shebelle and Juba basins, traditionally among the most agriculturally productive areas, face a particularly high risk due to poor farming practices, overgrazing, deforestation, land fragmentation, and other factors.

Our research indicates that the overall status of land degradation in Somalia ranges from moderate to severe, with a concerning upward trend. Approximately 30% of the country's total land area experienced degradation from 1982 to 2008.

While a limited number of sustainable land management practices, such as soil bunds, gully stabilization measures, and water harvesting techniques, have been implemented, they are insufficient to act as mitigation measures

for the extensive damages caused by land degradation. The primary hindrances to the widespread adoption of such practices are the need for better governance, inadequate institutional support, knowledge gaps, financial constraints, and technological limitations.

To encourage the adoption of sustainable land management practices, especially among small-scale farmers, a robust institutional framework, including environmental policies, is imperative. This framework should encompass strengthened legislation, enforcement of responsible land resource utilization, and the establishment of dedicated commissions or government departments. These entities should guide and enforce the adoption of sustainable land management practices, monitor and evaluate land degradation, and provide regular progress reports to policymakers.

In summary, mitigating land degradation in Somalia requires comprehensive efforts, addressing both the direct and underlying causes, and establishing a supportive institutional framework for sustainable land management practices to flourish.

References

Abdi Issa Jama, final Draft, Rangeland Management Plan for Improving Natural Resource Governance in Puntland State of Somalia.

Abdi, A. A. and Ibrahim-Buffalo, R. (2014, January 25) Interview by Shallow D., Dullo, F. Environmental degradation in Somaliland. HAQSOOR.

Abdi, Omar A., et al. (2013); "Causes and Impacts of Land Degradation and Desertification: Case Study of the Sudan." International Journal of A Griculture and Forestry, vol. 3, no. 2, pp. 40–51, doi:10.5923/j.ijaf.20130302.03.

Ali, Y. Y. and Mohamed, A. M. (2014). Interview by Shallow D. and Dullo

F. Environmental degradation in the South. MURDO and CARE

Bajocco, S., De Angelis, A., Perini, L., Ferrara, A., & Salvati, L. (2012). The impact of land use/land cover changes on land degradation dynamics: A Mediterranean case study. Environmental Management, 49(5), 980–989.

Barbier, E. B. (1997). The economic determinants of land degradation in developing countries. Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences, 352 (1356), 891–899.

Chabay, Ilan. (2018). Land degradation and restoration. In book: Companion to Environmental Studies (pp.535-540).

Dregne, H. E., 1982. Desertification of Aridlands. Howard Academic Publishers, N.Y.

FAO (2009), "Rebuilding resilient and sustainable agriculture in Somali", available at: http://www.fao. org/3/I8841EN/i8841en.pdf.

FAO-SWALIM Technical Report No W-12: Muthusi F.M., Mugo M.W., Gadain H.M., and Egeh M.H. 2009. Water Sources Inventory for Northern Somalia. Nairobi, Kenya.

FAO and UNEP, 2020. The State of the World's Forests 2020. Forests, biodiversity and people. Rome. https:// doi.org/10.4060/ca8642en.

Farah, Ibrahim, Abdirashid Hussein, and Jeremy Lind (2002). "Deegaan, Politics and War in Somalia", in Jeremy Lind and Kathryn Sturman (editors), Scarcity and Surfeit: The Ecology of African Conflicts. Institute for Security Studies: South Africa.

Federal Republic of Somalia (2020): land degradation neutrality target setting process in Somalia, a country report implemented by the UNDP global policy center on resilient ecosystems and desertification (GC-RED) and UNDP Somalia.

Fournier, F. 1972. Soil conservation. Nature and Environment Series, Council of Europe.

Gretton, P. and Salma, U. (1996), Land Degradation and the Australian Agricultural Industry, Industry Commission Staff Information Paper, AGPS, Canberra.

Hassan, A. (2013, November 11). Storm kills at least 100 in Somalia's Puntland. Reuters. Retrieved from http://www.reuters.com/article/2013/11/11/us-somalia-storm-puntlandidUSBRE9AA0K420131111

Jibril, F. (2014, February 06). Interview by Shallow, D. Environmental degradation in Somalia.

Kirui Oliver, and Alisher Mirzabaev (2014). "Economics of Land Degradation in Eastern Africa." ZEF Working Paper Series, no. 128, p. 40, doi:10.1007/978-3-319-19168-3.

Lal, R., Safriel, U., & Boer, B. (2012). Zero net land degradation: A new sustainable development goal for Rio+ 20. Secretariat of the United Nations Convention to Combat Desertification (UNCCD), pp. 1–30. URL http://www.unccd.int/Lists/SiteDocumentLibrary/secretariat/2012/Zero%2020Net%2020Land%2020Degradation%2020Report%2020UNCCD%2020May%202012%202020background.pdf (Accessed 202020 August 202013).

Land Degradation in Somalia | FAO SWALIM: Somalia Water and Land Information Management." Land Forms of Somalia | FAO SWALIM: Somalia Water and Land Information Management, www.faoswalim.org/land/land-degradation.

MEA. (2005). Ecosystems and human well-being: Synthesis. Washington, DC: Island Press. Nkonya, E., Anderson, W., Kato, E., Koo, J.,

Mirzabaev, A., von Braun, J., & Meyer, S. (2014). Global cost of land degradation. Berlin, Heidelberg: Springer. (Forthcoming).

Masson SAS, 2014, pp. 34–41, doi:10.1016/S2095-6339(15)30056-3.

Mohamed, A.A. and Nageye, A.I. (2021), "Measuring the effect of land degradation and environmental changes on agricultural production in Somalia with two structural breaks", Management of Environmental Quality, Vol. 32 No. 2, pp. 160-174. https://doi.org/10.1108/MEQ-02-2020-0032

Muchiri PW. 2007. Climate of Somalia. FAO-SWALIM Technical Report No. W-01. FAO-SWALIM: Nairobi, Kenya. www.faoswalim.org

NRC, National Research Council (1994) Rangeland health: new methods to classify, inventory, and monitor rangelands. National Academy Press, Washington, DC, USA.

Oduori, S., et al. "Land Use Characterization of the Juba and Shabelle Riverine Areas in Southern Somalia." Fao-Swalim, no. L, 2007.

Omuto CT, Vargas RR, Alim MS, Ismail A, Osman A, Iman HM. 2009. Land Degradation Assessment and a Monitoring Framework in Somalia. FAO-SWALIM Technical Report No. L-14. FAO-SWALIM: Nairobi, Kenya. www.faoswalim.org

Omuto, C. T., et al. "Land Degradation Assessment and Recommendation for a Monitoring Framework in Somaliland." FAO-SWALIM Technical Report L-14,.

Omuto, C.T., Balint and Alim, M.S. (2011), "A framework for national assessment of land degradation in the drylands: a case study of Somalia", Land Degradation and Development, Vol. 25 No. 2, pp. 105-119, doi: 10.1002/ldr.1151.

Olsson, L., H. Barbosa, S. Bhadwal, et al. 2019: Land Degradation. In: Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems [P.R. Shukla, J. Skea, E. Calvo Buendia, V. Masson-Delmotte, et al., (eds.)]. In press.

Rioux, J. Laval, E., Karttunen, K., Lwakatare, et al. (2017). Climate-Smart Agriculture Guideline for the United Republic of Tanzania: A country– driven response to climate change, food and nutrition insecurity. Food and Agriculture Organization of the United Nations (FAO). Available online: http://www.fao.org/3/a-i7157e.pdf [Accessed 1 October 2023]

Sivakumar, M. V., & Ndiang'Ui, N. (2007). Climate and land degradation. Berlin, Heidelberg: Springer.

Study, A.Desk. The State of the Environment in Somalia: A Desk Study. 2005, p. 72, http://www.unep.org/disastersandconflicts/portals/155/disastersandconflicts/docs/somalia/dmb_somalia_report.pdf.

SWALIM., reomte sensing application in environmental studies. land degradation in Somalia. https://2016ict4dconference.sched.com/event/6iKD/land-degradation-in-somalia. (Attached as ppt. 7 April 2018.)

Symeonakis, E., Calvo-Cases, A., & Arnau-Rosalen, E. (2007). Land use change and land degradation in southeastern Mediterranean Spain. Environmental Management, 40(1), 80–94.

Tefo Mooketsane, Land Management For Improved Dispute Resolution And Property Tax Revenue For Local Governments : Evidence From Somalia, Un-Habitat , The United Nations Human Settlements Programme Paper Prepared For Presentation At The " 201 7 World Bank Co. 2017.

TerrAfrica. (2006). Assessment of the nature and extent of barriers and bottlenecks to scaling sustainable land management investments throughout sub-Saharan Africa. Unpublished TerrAfrica report.

Thorsteinsson, I. 1980a. Ny´ting útaga: beitarþungi. Íslenzkar Landbúna arrannsóknir 12(2): 113–22.

Unep. "Land Degradation." Kenya, 2008, pp. 120–44, doi:10.1016/j.jenvman.2007.10.012.

UNCCD, 2019. Preliminary analysis – strategic objective 1: To improve the condition of affected ecosystems, combat desertification/land degradation, promote sustainable land management and contribute to land degradation neutrality. https://www.unccd.int/official-documentscric-17-georgetown-guyana-2019/iccdcric172.

United nations Security Council. Report of the Secretary-General on the protection of Somali natural resources and waters, 25 October 2011.

Venema, J.H., 2007. Land resources assessment of Somalia. Technical Project Report L-12. FAO-SWALIM, Nairobi, Kenya.

Waswa, Boaz Shaban. Assessment of Land Degradation Patterns in Western Kenya: Implications for Restoration and Rehabilitation. 2012, http://hss.ulb.uni-bonn.de/2012/3077/3077.htm.

World Bank, 1987. Agricultural Sector Survey, Somalia. World Bank, Washington, D.C. USA.

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Somali Studies: *A Peer-Reviewed Academic Journal for Somali Studies* is a broad scope multidisciplinary academic journal specialized in Somali studies, published annually, in print and online forms, by the Institute for Somali Studies at Mogadishu University. The journal aims to promote a scholarly understanding of Somalia, the Horn of Africa and the Somali diaspora communities worldwide. It is an open access journal, and all articles are freely available to access, print and download from the website of the institute, www.isos.so.

Published by Institute for Somali Studies
Hodan District, Near Km4 Square
Website: www.isos.so
Email: isos@mu.edu.so
Tel/Fax: +252 1 858118
Mogadishu, Somalia