

SHORT COMMUNICATION

Maintaining Sustainability and Resilience in Rangeland Ecosystems

Samuel Tuffa* 

Oromia Agricultural Research Institute, P.O. Box 81265, Addis Ababa, Ethiopia

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ABSTRACT

Rangelands contribute to human well-being worldwide. However, its fragile ecosystems are threatened due to inappropriate management that has been leading to its degradation in African rangelands in general and in Ethiopian rangelands in particular. Rangeland degradation is attributable to both natural and anthropogenic causes. Restoring degraded areas by replanting using native species is one of the most promising sustainable rangeland management tools to fight the degradation in the rangelands and enhance resilience in the face of environmental shocks. Restoration improves vegetation cover and biomass yield and enhances other ecosystem services. Native drought-tolerant species have produced promising rehabilitation outcomes and have been recommended for the restoration of degraded rangeland areas. Replanting using native species remains a viable sustainable management option to enhance resilience in the face of environmental shocks. Therefore, to maintain the sustainability and resilient rangeland ecosystems, comprehensive approaches and strategies suitable for rangelands need to be revitalized, developed, strengthened and promoted.

1. Introduction

Rangelands provide important ecosystem services, which can be classified into provisioning, regulating, cultural, and supporting ^[1]. They serve as sources of feed for livestock and wild animals and source of food for humans, herbal medicine, energy, and production of gum and incense ^[2,3]. Rangelands harbor a wide range of plant and animal diversities. They are areas of large wildlife diversity, which are potential resources for tourist attractions ^[3-6]. Livestock husbandry contributes to soil nutrient

cycling through feeding on plants and depositing the residues/manure into the rangelands ^[7]. However, unmanaged grazing or complete exclusion from grazing often leads to rangeland degradation and loss of biodiversity ^[8]. Rangelands can store carbon that helps in partially stabilizing the climate. Rangeland vegetation help to purify air and water, facilitates infiltration of water into the soil and mitigates droughts and floods, helps in soil formation and maintenance of soil fertility, maintains air humidity, and reduces soil erosion by wind and water. Rangeland ecosystems contribute to cultural identity and diversity, cultural

*Corresponding Author:

Samuel Tuffa,

Oromia Agricultural Research Institute, P.O. Box 81265, Addis Ababa, Ethiopia;

Email: satukada@gmail.com

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landscapes, heritage values, and spiritual services^[9-12]. The objective of this article is to document the major causes of Ethiopian rangelands degradation.

2. Materials and Methods

Many research works have been conducted and published results on the current trends of the African rangelands in general and the Ethiopian rangelands in particular. This communication article was compiled through a secondary source, which is available on the internet, to analyze and discuss the conclusions in the relevant papers. After reviewing relevant papers on the current state of understanding on the Ethiopian rangelands, the findings were summarized in the result sections.

3. Results and Discussion

3.1 Trends in the Ethiopian Rangelands

The land use and land cover change analysis in most parts of Ethiopia showed that the rangelands had undergone substantial changes since the 1960s. The pastoral areas are showing gradual changes such as the establishment of fenced rangeland or grazing enclosures leading to increased privatization of the traditional communal grazing lands^[13-16]. The expansion of various forms of enclosures and associated land-use changes are causing a gradual curtailment of seasonal mobility between wet and dry season grazing areas, which has led to continuous grazing of the wet season grazing areas throughout the year resulting in loss of vegetation cover and soil erosion^[17-21]. The loss of important vegetation from the rangelands by natural and/or anthropogenic causes can lead to poor resilience of rangelands during environmental shocks and that

questions its sustainability. Therefore, such downward trends must be curbed to sustain the rangelands ecosystem services in the face of climate change and population pressure. Restoration of the rangelands using native vegetation has paramount importance; the native species has the capacity to perform better due to its better adaptation in its natural habitat than an introduced exotic species. In addition to improving the productivity of the rangelands, restoration enhances the carbon sequestration in the rangelands that mitigate climate change effects.

3.2 Causes of Changes in Ethiopian Rangeland Ecosystem Services

Several anthropogenic pressures, under the changing climate and global warming, have led to the deterioration of the ecosystem, increasing soil erosion, loss of palatable grasses, and increased bush encroachment^[22,23]. Besides, the growing shift toward sedentarization and crop cultivation and privatization of the communal rangelands in pastoral areas are triggering conflict over grazing and watering resources and boundary claims^[24,25]. The major direct drivers of changes in rangeland biodiversity and ecosystem services in Ethiopia are climate change and variability, fire ban, inappropriate rangeland management, land-use change, overexploitation, inappropriate extension service, privatization, and/or sedentarization, encroachment by native and invasive species^[17,24,26-31]. Encroachment by native species is leading to the loss of important species. For instance, rangelands in southern Ethiopia have been undergoing a rapid regime shift from herbaceous to woody plant dominance in the past decades (Figure 1), reducing indigenous plant biodiversity, altering ecosystem function and threatening subsistence pastoral-

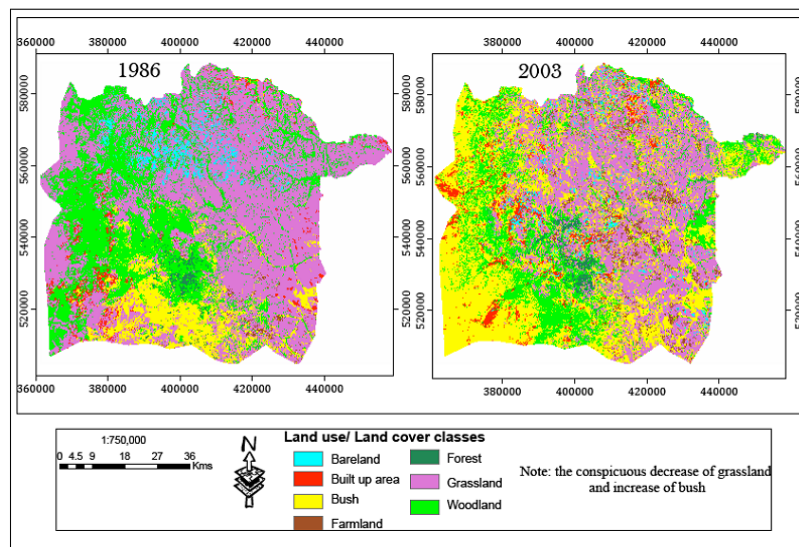


Figure 1. Land use/land cover change in Yabello district, between 1986 and 2003^[34]

ism^[32]. Some of the important contributing factors to bush encroachment in Ethiopian rangelands are overgrazing, expansion of cultivation and reduced mobility of livestock due to the settlement of the pastoralists in the communal land^[33].

Some of the direct drivers, such as land-use change, privatization, sedentarization, and encroachment by native and invasive species, lead to constrained mobility and population pressure which in turn negatively affect the rangeland biodiversity and ecosystem services. In addition, policy, governance systems, and institutions indirectly contribute to the weakening of customary institutes leading to changes in rangeland biodiversity and ecosystem services^[35-38]. Generally, as a consequence, the Ethiopian rangeland biodiversity and ecosystem services have been degrading at an alarming rate which in turn led to the extent where the ecosystem services could not support the livelihoods of communities dependent on rangeland resources.

3.3 Suggested Solutions for the Sustainable Rangeland Use in Ethiopia

Many factors play a great role in maintaining the sustainability and resilience of the rangeland ecosystem.

Policy perspective: Policies should recognize the role and authorities of the customary institution in governing resources, managing and resolving conflicts and administering traditional social protection facilities. Considering cultural and historical aspects when designing policies to revitalize rangelands that are Pastoral friendly and facilitate improved and resilient pastoral and agro-pastoral livelihoods from that ecosystem is important.

Institutional arrangement perspective: Rangeland development should have its institution (most preferred) or if this is not possible it should be aligned with a ministry that is close to it in terms of function.

Knowledge perspective: Adequate research that examines the effectiveness of policies, governances and institutional arrangements in place taking into account different needs of the local and international communities is needed.

Community perspective: Recognition and use of indigenous knowledge must be an integral part of the development of policy relating to rangeland engaging and empowering communities in monitoring and evaluation. Further, ensure inclusive, equitable and transparent participation in consultations and negotiations processes; also strengthen the capability of local organizations, social networks and the institutional space for the sustainability of any development endeavor for resilient rangeland ecosystems. In addition, participating in rangeland governance,

developing accountability in decision-making and effective representation and fostering collaborative learning are decisive in the sustainability of the rangeland ecosystem.

Science-policy-conservation-development perspective: The prevailing policy and governance systems in poverty reduction and development efforts focusing on resource extraction for short-term gains at the expense of long-term biodiversity conservation and sustainability should be curbed. In general, developing modality and policy for ecosystem service payment from the rangelands could contribute to its sustainable use in the face of climate change and increasing human population increase. Therefore, any development interventions in the rangelands should be carefully planned in a manner that does not disrupt the rangeland ecosystem services and biodiversity.

4. Conclusions

The Ethiopian rangelands have been going under different pressures which led to loss of important rangeland vegetation. The causes of degradation have led to the loss of perennial, palatable and productive grasses, which are important for the production of livestock and wild animals in the rangelands. Further, the causes of rangeland degradation destroyed habitats of many wild animals resulting in rangeland biodiversity loss. If this trend continues, the rangeland will become a difficult place for dwellers to the extent that it will not support the life of the people who depend on the rangeland resources for their livelihood. Unless the ongoing trend is curbed, rangeland biodiversity will be lost and rangeland ecosystem services will decrease under the ongoing degradation. Therefore, to make the rangelands sustainable, particularly in the face of climate change, its resilient capacity should be restored through restoration activities and proper managements afterwards. Finally, there should be a clear rangeland use policy that safeguards rangeland resources by integrating the scientific and indigenous local knowledge for sustainable rangeland resources use while maintaining the natural resource base.

Conflict of Interest

There is no conflict of interest.

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