

# SCIENCE POLICY BRIEF

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## Climate Change, Biodiversity Conservation and Livelihoods: Assessing Local Adaptation and Policy Responses in Geed Deeble Forest, Somaliland

### Overview

This policy brief presents key findings from a study conducted in Geed Deeble Forest, Somaliland, examining the impacts of climate change on local livelihoods and biodiversity. The study highlights how rising temperatures, prolonged droughts, erratic rainfall patterns, and increasing environmental degradation are affecting the ecological integrity of the forest and the well-being of communities that depend on its resources. The brief outlines the major environmental and socioeconomic challenges facing the area, and also identifies gaps in existing policies, institutional capacities, and adaptation initiatives that limit the effectiveness of climate resilience efforts, as well as provided effective management options.

### Introduction

Geed Deeble Forest Reserve (Figure 1), located approximately 25 km north of Hargeisa in the semi-arid central highlands of northern Somaliland, covers about 5,868 hectares and constitutes a critical water catchment area and biodiversity hotspot. The forest supports the livelihoods of agro-pastoral communities, farmers, and daily laborers, who depend directly on its ecosystem services for livelihood needs.

This study employed a mixed-methods approach to examine the impacts of climate change on forest biodiversity and indigenous livelihoods in Geed Deeble, while also assessing local adaptation strategies and community perceptions of existing policy interventions. The ecological component of the study involved a 24-year Normalized Difference Vegetation Index (NDVI) analysis using Landsat satellite imagery to evaluate land-cover dynamics and vegetation change across four time points: 2000, 2008, 2016, and 2024.

### Key recommendations

- Promote community-based adaptation by combining local knowledge and traditional conservation practices with scientific approaches to strengthen resilience.
- Improve access to climate information and provide training on climate-smart agriculture and sustainable natural resource management.
- Strengthen traditional conservation systems, including *seero* (protected community areas), and integrate them into formal governance frameworks.
- Prioritize the control of invasive species, particularly *Prosopis juliflora*, and support the restoration of native vegetation.
- Expand long-term ecological and socio-economic monitoring, including the use of remote sensing, to assess climate impacts and adaptation effectiveness.

Based on NDVI values, the landscape was classified into different vegetation conditions, ranging from bare or degraded land, sparse to dense vegetation. These findings were complemented by socio-economic data collected through a cross-sectional household ( $n=130$ ) survey using multistage stratified random sampling across three livelihood strata: pastoralists ( $n=26$ ), agro-pastoralists ( $n=48$ ), and sedentary households ( $n=56$ ). Additional qualitative data were gathered through four focus group discussions and six key informant interviews with government officials, including those from the water agency, Ministry of environment and climate change, community leaders, and NGO representatives.

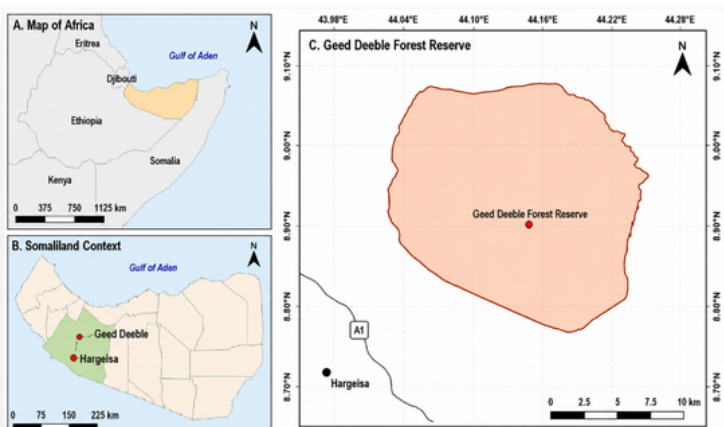
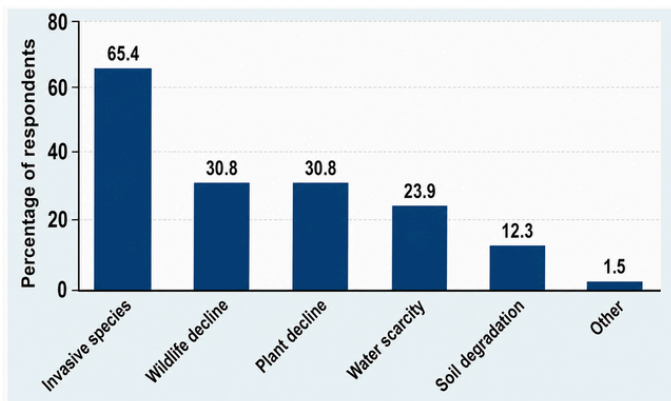


Figure 1: Map of Somaliland showing the Geed-deeble forest

## Key Findings

Ecological analysis indicates a substantial increase in vegetation greenness across Geed Deeble Forest over the past 24 years, with mean NDVI values rising from 0.113 in 2000 to 0.201 in 2024. During the same period, the proportion of bare or degraded land declined dramatically from 93.89% to 10.75%, while areas classified as very sparse vegetation expanded from 5.07% to 76.19% of the landscape. These changes suggest significant recovery of vegetation cover and dryland greening across the forest area. However, moderate and dense vegetation remained limited, accounting for only 3.34% of the landscape in 2024, indicating that the observed improvements reflect sparse vegetation recovery rather than full forest regeneration. These findings should be interpreted with caution, as NDVI measures vegetation greenness but does not distinguish between native and invasive species. Part of the observed increase may be attributable to the spread of *Prosopis juliflora*, an invasive species that can increase NDVI values while reducing native biodiversity. In addition, the analysis was based solely on NDVI-derived assessments from Landsat satellite imagery (2000, 2008, 2016, and 2024), as no independent land-use change dataset was available to verify the drivers of vegetation change.

The socio-economic survey highlighted several impacts of climate change on the forest biodiversity (Figure 2).



**Figure 2:** Perceived impacts of climate change on biodiversity of the Geed Deeble forest

Climate impacts varied across livelihood groups. Agro-pastoralists experienced the highest rates of crop failure (40.8%) due to erratic rainfall, increasing food insecurity and reliance on markets. Pastoralists suffered the most severe livestock losses (39.2%;  $\chi^2 = 16.58, p < 0.001$ ), with drought-driven

herd depletion and forced mobility reducing household incomes. Sedentary households faced indirect pressures, including rising food prices, declining groundwater availability, and reduced access to firewood. Across all groups, 73.1% of respondents reported declining forest-based livelihood resources, while 36.9% resorted to migration as a coping strategy.

Furthermore, respondents perceived existing environmental and climate-related policy support on forest protection, water resource management, and sustainable natural resource use in the Geed Deeble Forest area as limited and ineffective. Nearly half (48.46%) reported no conservation policy interventions in their communities. Among those who identified existing measures, 30% cited government-led (Ministry of Environment & Rural Development) initiatives, including environmental protection regulations, water resource management programmes, and awareness campaigns on sustainable forest use, while 22.31% reported community-based approaches such as the traditional "seero" (sacred community-protected area) conservation system, informal restrictions on tree cutting and charcoal production, and seasonal grazing controls. Overall, 69.23% of respondents rated current interventions as having low or very low effectiveness. The main constraints to effective climate adaptation and biodiversity conservation identified were limited community participation (36.15%), inadequate financial resources (20%), and weak institutional awareness and capacity (18.46%). Youth engagement was particularly low, with 76.92% of respondents reporting no youth involvement in environmental decision-making, highlighting a significant gap in inclusive environmental governance.

## Conclusion

Climate resilience and biodiversity conservation in Geed Deeble Forest require stronger policy implementation, greater community participation, and sustainable resource management. Although vegetation cover has improved, biodiversity threats, livelihood vulnerabilities, and weak governance remain significant challenges. Strengthening community-led conservation and climate adaptation efforts will be critical to protecting both ecosystems and local livelihoods.

## SOURCES CITED

- Tenaw, Z. T. (2021). Climate change, pastoral livelihood vulnerability and adaptation strategies: a case study of sitti zone, Somali regional state in Eastern Ethiopia. SIGNATURE. <https://core.ac.uk/download/pdf/491366684.pdf>
- Bile, M. S., & Limbu, P. T. S. (2022). Spatiotemporal variability of drought and its relationships to ENSO and IOD indices in Somaliland. Tanzania Journal of Science, 48(4), 816–831. <https://doi.org/10.4314/tjs.v48i4.9>
- Omer, M. A. (2024). Climate variability and livelihood in Somaliland: a review of the impacts, gaps, and ways forward. Cogent Social Sciences, 10(1), 2299108



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