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“Reconcile land system changes  
with planetary health”

## Carbon stocks, species diversity, and sustainability prospects of exclosures in the dry lands of Tigray, northern Ethiopia

MENGESTEAB HAILU UBUY<sup>1</sup>, TRON EID<sup>2</sup>, EMIRU BIRHANE<sup>1</sup>

<sup>1</sup>*Mekelle University, College of Agriculture and Natural Resource Management (CoANR), Land Resource Management and Environmental Protection (LaRMEP), Ethiopia*

<sup>2</sup>*Norwegian University of Life Sciences (NMBU), Fac. of Environmental Sciences and Natural Resource Management, Norway*

### Abstract

In Ethiopia, exclosures have been established over large areas to restore deforested and degraded lands. Many knowledge gaps exist on the restoration effects, and future management faces many challenges. The main objective of this study was to enrich the knowledge base for managing exclosures in Tigray, northern Ethiopia. To enrich the knowledge base for a sustainable management of exclosures, we have employed an approach with multiple indicators including quantified illegal harvests to assess the status and prospects of exclosures. We first presented results for forest parameters based on systematic sample plot inventories from six selected exclosures. Secondly, we applied stocking, biodiversity, diameter distributions, regeneration, and harvest to assess and describe the present general status of the exclosures. Finally, we discussed the status and sustainability prospects for the exclosures based on their historical background and prevailing management. The amount of aboveground carbon varied from 4.0 to 9.0 Mg ha<sup>-1</sup> while the Shannon diversity index changed from 1.3 to 2.7 among the exclosures. The status of the exclosures is appropriate, although it varies significantly between them. A main threat to the future development of exclosures is illegal harvesting. In a short-term perspective, a higher and temporarily stable guard density would possibly improve the situation while the objective in a long-term perspective should be to secure sustainability by implementing management with controlled harvest activities aiming for balance between growth and harvest. A viable policy for reinforcing the existing community bylaws is also important to deal with restricting illegal harvests and managing exclosures sustainably.

**Keywords:** Degradation, harvest, regeneration, restoration, richness, stocking