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## Economic Valuation of Land Restoration: The Case of Exclosures Established on Communal Grazing Lands in Tigray, Ethiopia

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### Abstract

Converting degraded grazing lands into exclosures is one option to restore soil nutrients and to sequester carbon from the atmosphere. We estimate the economic value of such a conversion and assess the perception of local communities concerning exclosures in the highlands of Tigray, Ethiopia. Our research combines a soil and vegetation study with a socio-economic survey, and a financial analysis. Over a period of 30 years, sequestered carbon dioxide was  $246 \text{ Mg ha}^{-1}$ , total soil nitrogen increased by  $7.9 \text{ Mg ha}^{-1}$  and additional available phosphorous stocks amounted to  $40 \text{ Kg ha}^{-1}$ . The Net Present Value of exclosure's ecosystem services under consideration was about 28% (837 US \$) higher than alternative wheat production. Carbon revenues alone added up to only about 44% of the net revenues of wheat production. This indicates that **(i)** carbon market revenues only, would not generate sufficient incentives to establish additional exclosures, and **(ii)** if all benefits are taken into account and financially rewarded, exclosures are competitive to alternatives land uses. We also identified substantial opportunities to mobilise the local communities in efforts to establish exclosures, given that more than 75% had a positive view on exclosures effectiveness to restore degraded soils and vegetation. We conclude that a comprehensive analysis is necessary to consider the ecological as well as economic and social impacts of exclosures. Our findings are important information for local decision makers and may provide incentives for the establishment of further exclosures in the northern highlands of Ethiopia, thereby contributing to a sustainable local development process.

**Keywords:** Carbon revenues, carbon sequestration, crop production, economic valuation, local communities, rehabilitation of degraded areas, soil nutrients stock.