

Assessing land degradation neutrality in data scarce semi-arid drylands agroecosystems to improve land resources management: a case study in Matabeleland North Province of Zimbabwe

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Abstract:

Semi-arid agroecosystems have a crucial function in supplying food and ecosystem services. However, these ecosystems are under severe threat due to land degradation. To enhance our understanding of environmental trends and their causes and to identify more sustainable land management techniques, it is important to track land degradation in space and time. This study uses land cover, soil organic carbon, and land productivity dynamics maps to evaluate land degradation neutrality (as per Sustainable Development Goal 15, indicator 15.3.1). In this regard, we employed the trends.earth tool in QGIS 3.3, utilising the European Space Agency Climate Change Initiative (ESA CCI) classified LULC maps for 1992, 2000, 2010, and 2020 to assess land degradation. Additionally, we predicted 2050 LULC maps using the MOLUSCE plugin in QGIS, which integrates an artificial neural network (ANN) in cellular automata (CA) modeling (CA-ANN) based on the 2015 LULC map and independent variables such as digital elevation model (DEM) and slope. Our results indicated a significant decrease in bare areas (71%) and an increase in settlements (built-up areas) (163%) between 1992 and 2020. Furthermore, the predicted land cover map shows a significant increase in bare land (238%) and settlements (72%), accompanied by a decrease in water bodies (23%) and forested areas (3.5%). In terms of land degradation, approximately 26.46% of the province exhibited degraded land, accounting for approximately 20,146.35 km, while approximately 59.55% (45,337.84 km) of the land remained stable. Land cover conversions, particularly from forests to grasslands and settlements, are among the potential drivers of land degradation. Identifying land cover transitions and assessing land degradation is paramount for effective monitoring and planning. By understanding these dynamics, targeted interventions can be developed to mitigate land degradation and promote sustainable land use practices in semi-arid agroecosystems.

Under Review

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