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Monitoring forest loss in tropical dry forests of central Colombia: Global datasets vs. satellite imagery

Sabine Schweitzer[1], Markus Immitzer[2], Michael Lechner[3], Andreas Melcher[4]

[1]*BOKU University, Austria*
[2]*BOKU University, Institute of Geomatics,*
[3]*BOKU University, Institute of Geomatics,*
[4]*BOKU University, Inst. and Cluster for Development Research, Austria*

Abstract

Tropical dry forests are crucial for biodiversity, water regulation, and carbon sequestration but are increasingly threatened by agricultural expansion. Accurate forest loss monitoring is essential for their protection and sustainable management. In regions with restricted access due to terrain, conflict or security concerns, remote sensing plays a key role. Global forest datasets are commonly used because of their broad availability and ease of use. However, the applicability of these global products for detecting forest loss in small-scale, fragmented tropical dry forest landscapes remains poorly understood. This study aims to evaluate the suitability of global forest datasets for monitoring forest loss in the tropical dry forests of Central Colombia by comparing them with a forest loss assessment based on high-resolution Sentinel^{-2} and PlanetScope imagery.

Specifically, two widely used global datasets are assessed: the Global Forest Change (GFC) dataset by Hansen et al. (2013) and the Tropical Moist Forest (TMF) dataset by the European Commission Joint Research Centre, both based on Landsat imagery. The analysis focuses on the Las Mercedes Reserve in the Upper Magdalena Valley, a fragmented landscape dominated by cattle ranching. The forest loss assessment was conducted using Sentinel^{-2} and PlanetScope imagery from 2018 to 2024, with a Random Forest Model trained on spectral bands and vegetation indices to predict land cover classes. Yearly change detection was performed using both land cover classifications and selected vegetation indices.

Results show that GFC detects major forest loss areas, while TMF fails to capture significant forest dynamics. Change detection using Random Forest classification showed medium accuracy, while vegetation index-based detection yielded more reliable results. The analysis highlights the limitations of global datasets in their suitability to tropical dry forests. In contrast, the Sentinel^{-2} and PlanetScope-based forest loss assessment is better suited to local conditions and offers potential for refinement.

These findings suggest that while global datasets are valuable, their regional relevance should be evaluated. Combining them with high-resolution, site-specific remote sensing can improve forest monitoring, especially in diverse landscapes, like Central Colombia.

Keywords: Change detection, Colombia, forest loss, forest monitoring, remote sensing, satellite imagery, tropical dry forest, vegetation indices

Contact Address: Sabine Schweitzer, BOKU University, Lienfeldergasse 73/6, 1160 Vienna, Austria, e-mail: sabine.schweitzer@boku.ac.at