A FRAMEWORK FOR MONITORING NET CHANGES IN TROPICAL FOREST COVER USING LANDSAT TIME SERIES

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ABSTRACT:

Tropical deforestation is recognized as a key contributor to global greenhouse gas emissions. The Reducing Emissions from Deforestation and Degradation (REDD+) framework was formulated to help mitigate against climate change effects of tropical deforestation. A key requirement of REDD+ is the robust monitoring of changes in forest area. The opening of the Landsat archive in recent years has led to the development of a large range of forest change detection methods. Furthermore, recent developments in remote sensing time series have allowed for tracking of forest disturbances at high temporal resolution, including for near real-time applications. Despite these advances, quantifying net change in tropical regions remains a challenge due to frequent cloud cover and gaps in the Landsat archive. In this study, we demonstrate a framework for monitoring net changes in a study area in Madre de Dios, Peru. Using all available Landsat, we tracked forest disturbances by applying the BFAST Monitor algorithm over sequentially defined 1-year monitoring periods on pixel time series. For all pixels where breakpoints were detected, we compared post-disturbance temporal trajectories with the history period to test for post-disturbance regrowth. Using a combination of Landsat image subsets over the entire time period, RapidEye data from 2011-2013 and GoogleEarth imagery, we estimated a total accuracy of 91% for disturbance detection, with associated user's and producer's accuracies of 91% and 97% respectively, indicating that BFAST Monitor is an appropriate method for estimating area change in our study area. For tracking post-disturbance regrowth, we found that metrics derived from the SWIR bands were most appropriate for distinguishing forest regrowth from other post-disturbance land use classes. By combining disturbance and regrowth detection methods into one framework, we were able to account for net changes in forest cover over the landscape.

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