Multi-stage approach to estimate forest biomass in degraded area by fire and selective logging

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The Amazon forest has been the target of several threats throughout the years. Anthropogenic disturbances in the region can significantly alter this environment, affecting directly the dynamics and structure of tropical forests. Monitoring these threats of forest degradation across the Amazon is of paramount to understand the impacts of disturbances in the tropics. With the advance of new technologies such as Light Detection and Ranging (LiDAR) the quantification and development of methodologies to monitor forest degradation in the Amazon is possible and may bring considerable contributions to this topic. The objective of this study was to use remote sensing data to assess and estimate the aboveground biomass (AGB) across different levels of degradation (fire and selective logging) using multi-stage approach between airborne LiDAR and orbital image. The study area is in the northern part of the state of Mato Grosso, Brazil. It is predominantly characterized by agricultural land and remnants of the Amazon Forest intact and degraded by either anthropic or natural reasons (selective logging and/or fire). More specifically, the study area corresponds to path/row 226/69 of OLI/Landsat 8 image. With a forest mask generated from the multi-resolution segmentation, agriculture and forest areas, forest biomass was calculated from LiDAR data and correlated with texture images, vegetation indices and fraction images by Linear Spectral Unmixing of OLI/Landsat 8 image and extrapolated to the entire scene 226/69 and validated with field inventories. The results showed that there is a moderate to strong correlation between forest biomass and texture data, vegetation indices and fraction images. With that, it is possible to extract biomass information and create maps using optical data, specifically by combining vegetation indices, which contain forest greening information with texture data that contains forest structure information. Then it was possible to extrapolate the biomass to the entire scene (226/69) from the optical data and to obtain an overview of the biomass distribution throughout the area.

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