Estimation of Tree Height, Biomass, and Standing Carbon in Miombo Woodlands Using Radar Interferometry

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Introduction Miombo woodlands cover about two thirds of Mozambique and estimation of its productivity is critical because it provides food , fiber , and fuel to 39 million rural and 15 million urban communities in southern Africa . However due to rough terrain , these landscapes are usually inaccessible and satellite data has proven invaluable in deriving biomass at this scale , the intent of this study . A jackknife stepwise regression model was previously used with RADARSAT and Landsat Normalized Difference Vegetation Index (NDVI) to estimate aboveground peak biomass at 18 kgm-2 (Ribeiro et al . in press b) and this study intends to compare these results to a radar interferometric method .

Approach A digital terrain model (DTM) that was derived from Shuttle Radar Topography Mission (SRTM) C-band interferometric data was used to estimate tree height in the 42000 km2 Niassa Reserve in northern Mozambique . The Reserve is 72% Miombo woodlands that are subject to anthropogenic fires , elephant herbivory , and climatic control (Ribeiro et al . in press a) . Tree heights are estimated by simply subtracting a base-level digital elevation model (DEM) from a calibrated SRTM DTM . Allometric equations that were developed from canopy dominants are used to estimate aboveground savanna biomass and carbon . Due to C-band canopy penetration , underestimates of tree height results thus field plot data was used to calibrate the DTM to average tree height . However , base DEMs in developing countries , particularly Africa , are not usually available , thus we explored the use of 1) archived topographic maps , 2) a land cover bare-ground binary mask DEM , 3) use of the 1-km global DEM (GTOPO30) and 4) the newly-available SRTM C-band backscatter data . The mask DEM is generated by overlay of the bare-ground binary mask against the SRTM to derive ground elevations from the SRTM . The resulting point map of elevations was spatially interpolated using thin plate spines with tension to derive a base-level DEM . The best DEM for this use is the SRTM backscatter data . SRTM estimates of biomass will probably be less than the regression model estimate because it does not include grass biomass .

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