

## Use of LiDAR data to support retrieval of savanna biomass and structure from SAR

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### Abstract

For retrieval of forest biomass and structure, LiDAR and Synthetic Aperture Radar (SAR) have each been used separately and largely through the use of empirical relationships established with ground data. However, synergistic combinations of data from these sensors can lead to improvements in retrieval through a) using LiDAR to generate biomass/structural estimates over a wide area which can then be exploited to better formulate empirical relationships with SAR data, b) combining height or other structural variables derived from LiDAR with SAR intensity data in the formulation of empirical (e.g., multiple regression-type) relationships or other retrieval algorithms, or c) using LiDAR to parameterise SAR backscatter models that increase understanding of the interaction of microwaves with different components of the forest volume, thereby leading to a better understanding of how biomass and structural attributes might be retrieved. In each case, LiDAR data or derived products (e.g., biomass) can be used for validation purposes although errors associated with these data themselves need to be considered. Although in the early stages of development, terrestrial laser scans of forests potentially provide such options for validation.

Focusing on wooded savannas, examples of the synergistic use of LiDAR and SAR for biomass and structural retrieval are presented. Demonstrated benefits include a better understanding of the influence of SAR parameters (incidence angle, frequency, polarisation) on the capacity to retrieve biomass and structural attributes, an increase in the diversity of approaches to retrieval (e.g., estimation/inversion algorithms), and enhanced knowledge (through modelling) of the scattering mechanisms occurring and their relationships with biomass and structure. Particularly emphasis is placed on the use of data from multi-frequency polarimetric airborne SAR (AIRSAR) and the Advanced Land Observing Satellite (ALOS) Phased Arrayed L-band SAR for scaling biomass and structural estimates to local sites and regions respectively.