# SYNERGISTIC USE OF SAR AND OPTICAL DATASETS FOR FOREST BIOMASS RETRIEVAL AND CHARACTERIZATION OF FORESTS IN TEMPERATE ZONE – A NATIONAL CASE STUDY POLAND

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## Abstract

Assessment of forest above-ground woody biomass is essential for national and regional forest carbon stocks and carbon stock changes estimation and reporting. The use of remotely sensed data supports countries in advancing approaches to forest monitoring and management. It helps to obtain accurate data on the status of forest resources and forest carbon stocks and support implementation of national and international policies. The aim of this research is to develop methodology for the forest above-ground woody biomass retrieval at the temperate forest, based on remotely sensed data. The biomass assessment was conducted in the framework of the European Space Agency (ESA) funded GlobBiomass project, which aims to better characterize and to reduce uncertainties of above ground biomass estimates by developing an innovative synergistic mapping approach in five regional sites (Sweden, Poland, Borneo, Mexico, South Africa) for the epochs 2005, 2010 and 2015 and one global map for the year 2010. The authors present the approach for the biomass retrieval at the national level over Poland – temperate forest. A synergy of radar ALOS PALSAR (L-band) and optical Landsat missions data have been used to derive forest above-ground woody biomass at the national level. The backscattering at HH and HV polarization, texture and ratios have been tested. The National Inventory of Forest Condition (inventory plots) has been used as the reference data for the biomass retrieval. The growing stock volume was converted into woody biomass using the IPCC approach based on biomass expansion factors (BEFs) and wood density following IPCC guidelines. The method used for biomass estimation in Poland was based on a machine-learning Random Forest regression. The Random Forest models were calibrated separately for coniferous and deciduous forest using a

set of training plots located over the entire forested area except steep slopes in the mountains. The overall accuracy of the biomass retrieval is around 50 tons per hectares; the accuracy of coniferous is better than for broadleaf forest. The information on the spatial distribution of forest biomass was then related to the forest parameters (tree species, type of forest site, forest composition) described by vegetation spectral indices derived from high-resolution Landsat and SPOT5 images. The aim of this analysis was to examine the relationship between forest biomass and various features characterizing forest canopies within the selected area of interest. Remotely sensed forest parameters were determined within WICLAP project, conducted within Polish-Norwegian Research Programme, financed by the National Centre for Research and Development.