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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FOREST BIOMASS RETRIEVAL

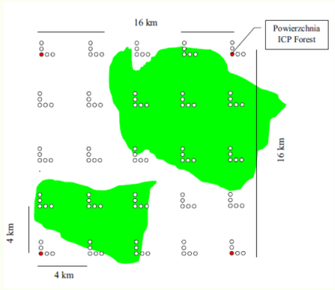
Forest above-ground woody biomass is a fundamental biophysical variable describing the amount of woody matter within a forest. Assessment of forest above-ground woody biomass (AGB) is essential for national and regional forest carbon stocks and carbon stock changes estimation and reporting. The authors present the first forest biomass map over Poland, which was obtained in the framework of the **ESA GlobBiomass** project. The main purpose of the ESA GlobBiomass project is to better characterize and to reduce uncertainties of AGB 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. More on: **www.globbiomass.org**

REFERENCE DATA

National Inventory of Forest Condition

location of plots corresponds to ICP Forests Network

- Systematic 16x16 km grid – inside 25 L-shaped group of sampling plots concisting of 5 plots located 200 m apart
- Circular plot size ~0.05 ha (~11.28 m radius)
- Convertion GSV to AGB



From GSV to AGB:

DBH, height and number of trees,

growing stock volume

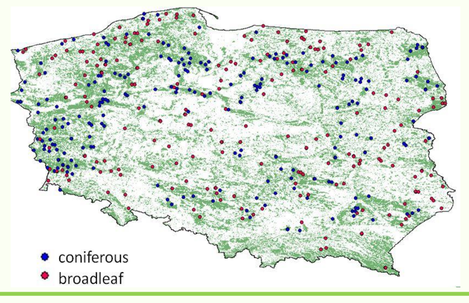
GSV

biomass expansion factors (BEFs) (IPCC, 2006)
+
wood density (WD) following IPCC guidelines
National Center for Emission Management

Biomass

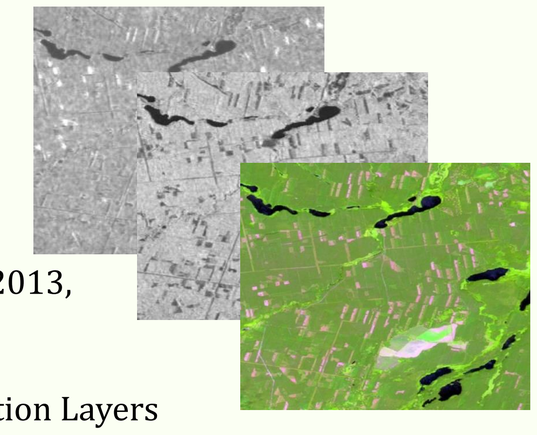
Forest biomass [t/ha]

In Poland, forest covers almost 92000 km^2 (29,4 % of the country)



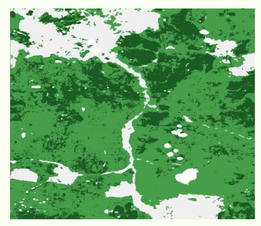
REMOTE SENSED DATA

- **ALOS PALSAR mosaic for 2009 & 2010**
  - 25 m spatial resolution
  - HH, HV polarisation



- **Landsat 5/7 Surface Reflectance mosaic** (Hansen et al., 2013), Reference years 2010-2013,
  - 30 m spatial resolution, Bands 3,4,5 and 7

- **Forest type map** – Copernicus High Resolution Layers
  - Reference year 2012
  - 20 m spatial resolution

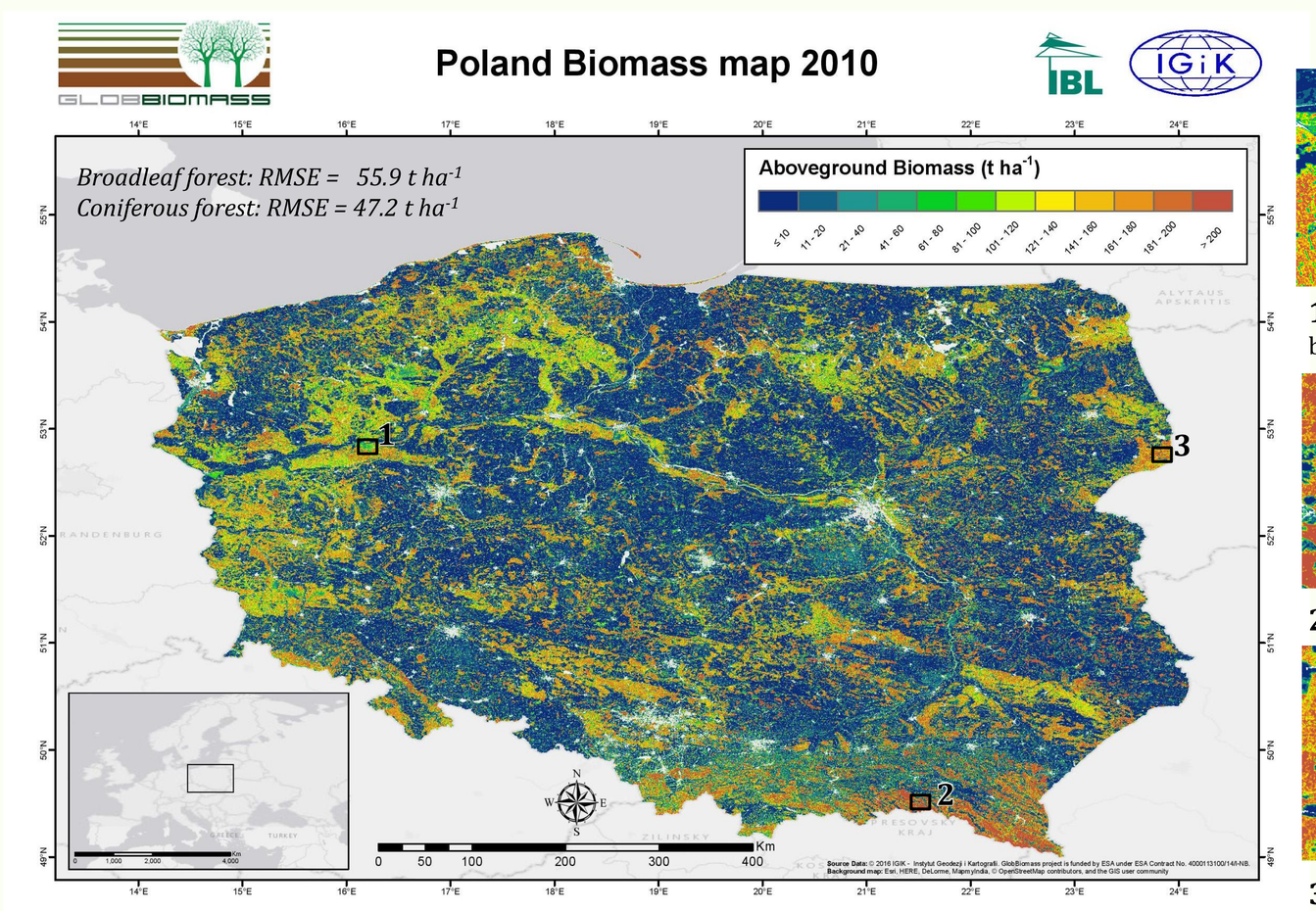


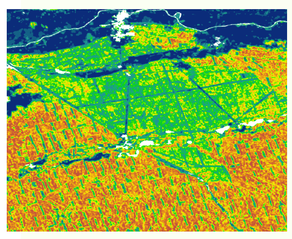
METHODOLOGY

Random Forest Regression

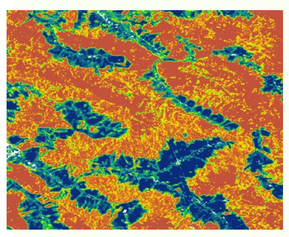
Separate Model for coniferous and broadleaf forest

Training (70% plots) & Accuracy assessment (30% plots)

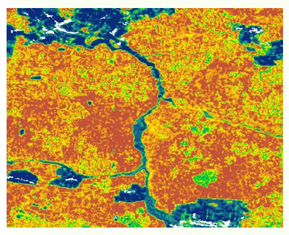




1. Puszcza Notecka burn scar from 1992



2. Beskid Niski mountains

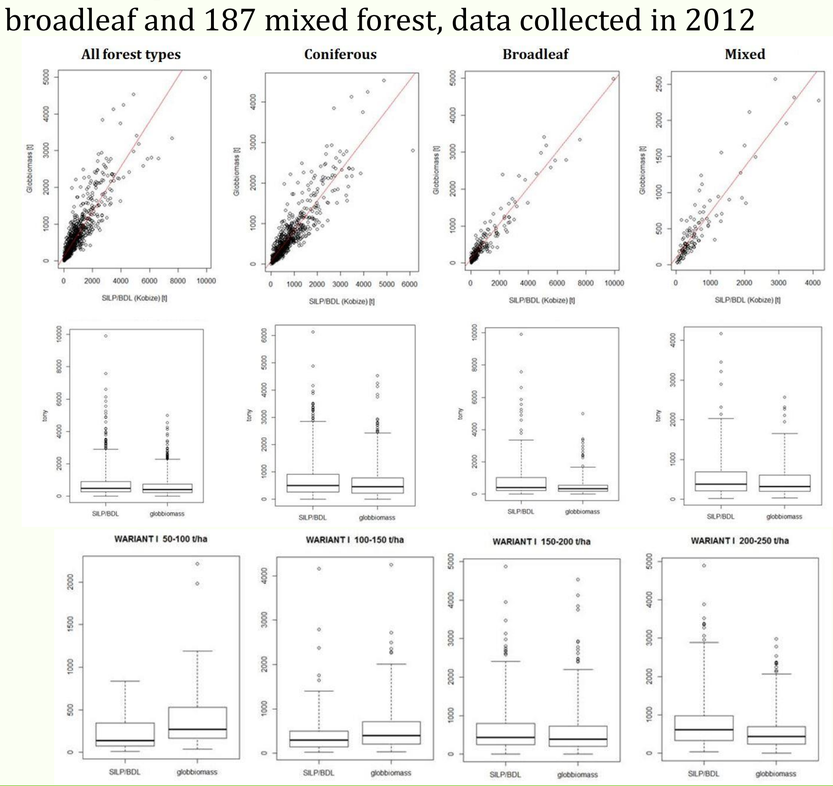


3. Białowieża NP

ACCURACY ASSESSMENT

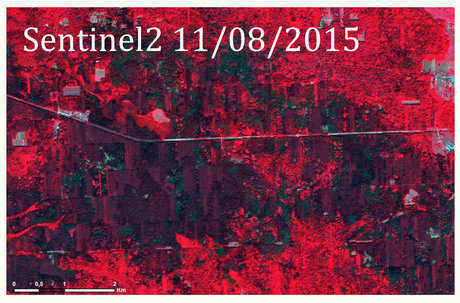
Independent validation at forest stand level

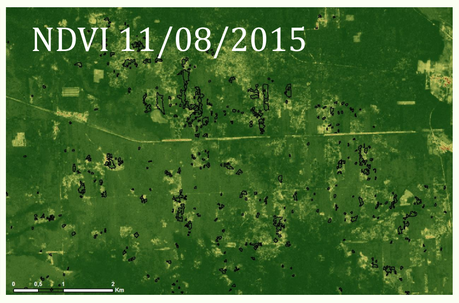
Validation performed at 1146 stands: 743 coniferous, 236 broadleaf and 187 mixed forest, data collected in 2012

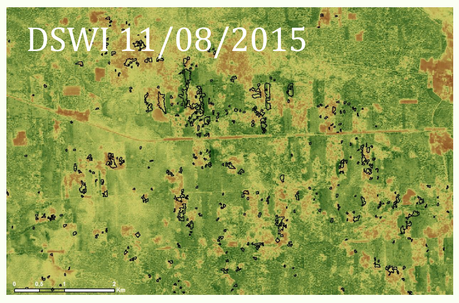


FOREST CHARACTERISTICS

3. Białowieża National Park bark beetle outbreak

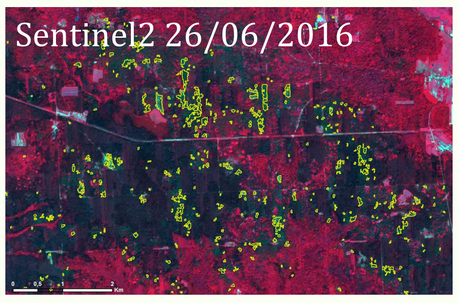


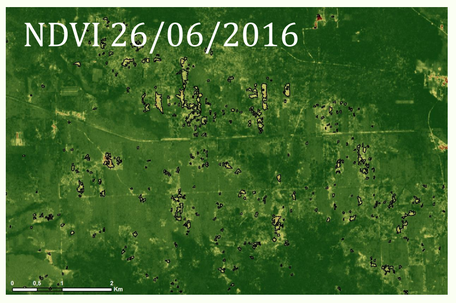


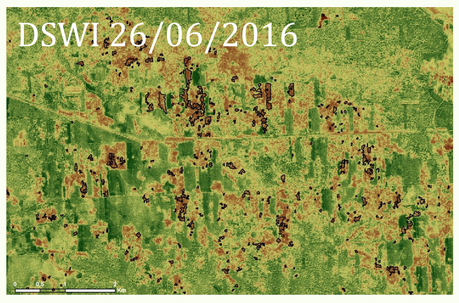


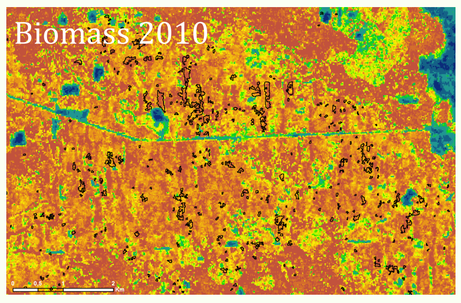
Normalized Difference Vegetation Index – NDVI
NDVI = (NIR – RED) / (NIR + RED)
characterizing general vegetation condition

Disease Water Stress Index – DSWI
DSWI = (NIR – GREEN) / (SWIR1 + RED)
sensitive to stress due to water shortage and plant damage









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The random forest regression was run using the EnMAP-Box 2.2.