A new 1 km Pan-European Map of Above Ground Forest Biomass

Forestry Program / International Institute for Applied Systems Analysis

WFC 2009
XIII[th] World Forestry Congress
Buenos Aires | Argentina
18 - 23 OCTOBER 2009

www.iiasa.ac.at/Research/FOR

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Abstract

We present a new 1 km pan-European map of above ground forest biomass. The map is composed using a satellite derived NPP map and relating NPP to biomass per ha for different species. A high resolution forest map was used to delineate forest areas. At regional level biomass values were scaled to average biomass from forest inventories per region. The map was validated for the region of Vorarlberg (Austria) against aggregated data from a Lidar flight campaign.

The new biomass map can be used for various applications:

- Initialization of spatially-explicit forestry models
- As potential biomass supply map for spatial bioenergy models
- As input to land use optimization models
- For modelling of emissions from forest disturbances

Methodology

The method used three subsequent steps (cf. Fig. 1):

1) Biomass per ha and species

- NPP of forests was extracted from a global NPP map using grids with high tree cover (>=90%, MODIS Continuous Fields Tree Cover) to calibrate
- a simple species-specific NPP model based on climate (average temperature and precipitation) and soil data.
- Species specific relations of NPP and growing stock based on yield tables were used to derive per ha biomass values.

2) Biomass per grid

- A detailed European forest cover map was used to clip out forest area.
- Biomass values were summed up over species per grid cell.

3) Biomass per region

- Estimated biomass per grid cell was scaled to match the reported average biomass per ha for each region as recorded in forest inventories.

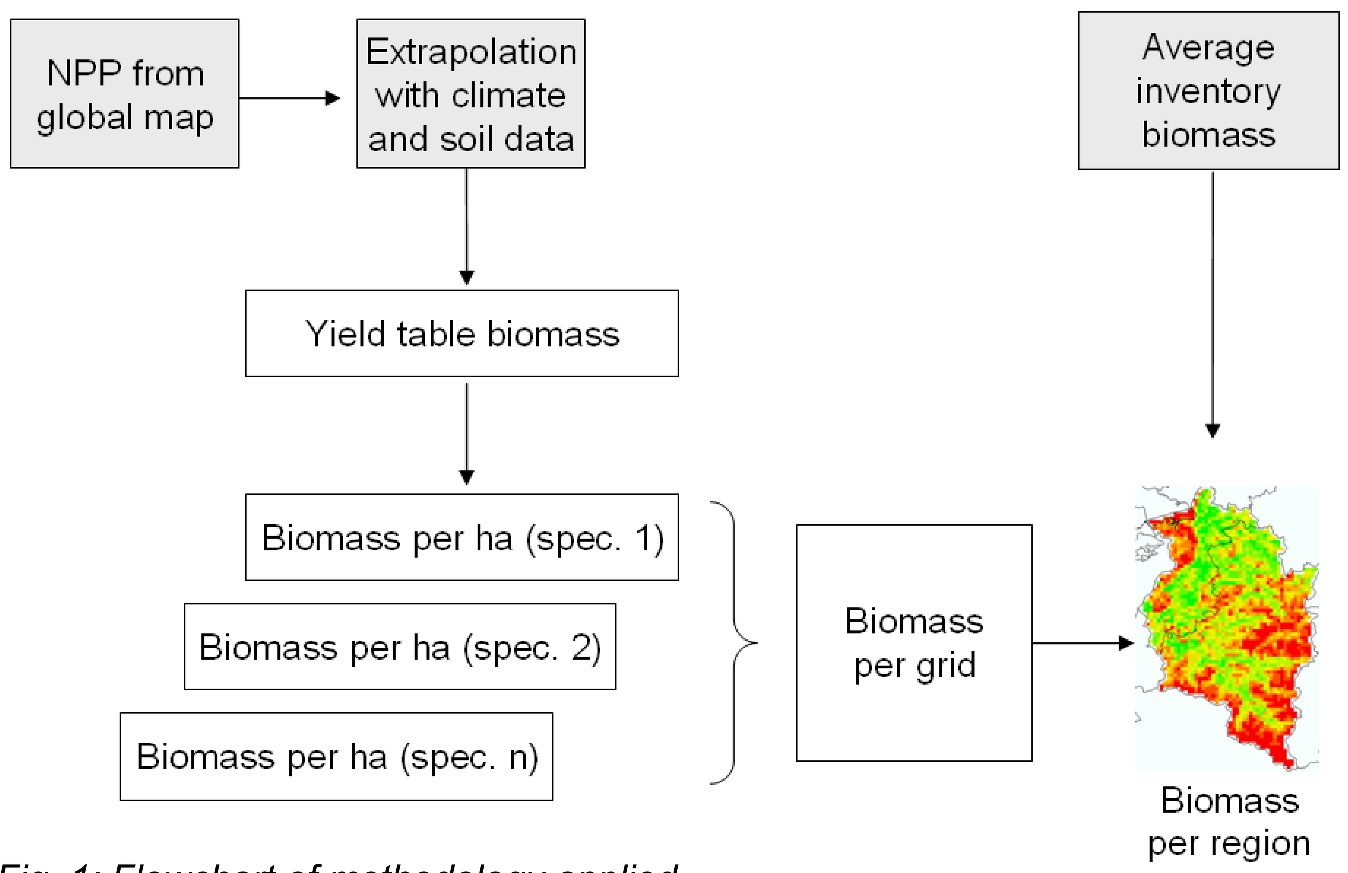

Fig. 1: Flowchart of methodology applied.

Data

The new European aboveground biomass map is based on these data layers:

- Forest cover: Recently released European Forest Cover Map for EU25 (30m)
- Land cover: GLOBCOVER v.2.1 (300m) for areas outside EU-27
- Global NPP map: MODIS from Running et al. 2004
- Temperature and precipitation: Worldclim
- Soil map: IIASA - Harmonized World Soil Database, soil types are merged according to their abundance into 14 groups
- Forest biomass: forest biomass per region for broadleaved and coniferous as used in Päivinen et al. 2009
- Slope: NASA-SRTM-Map, GTOPO30
- Forest species map: the 116 Species maps are merged to the species groups Betula, Fagus, Quercus, Picea, Pinus, Larix and Abies from JRC

Results

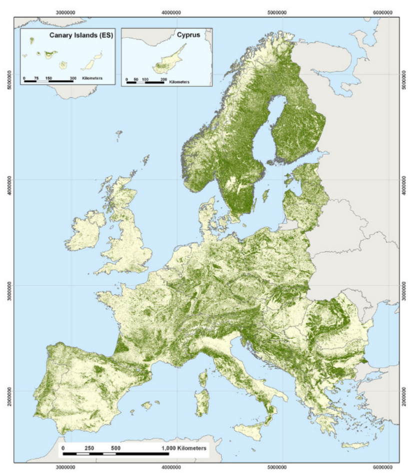

Fig. 2: European forest map.

Input

Fig. 2 shows one of the input maps, a recently released map of European forests. The map has a 30 m resolution and covers EU27 states, Norway and Switzerland.

Biomass map

The biomass map (Fig. 3) was produced with different land cover products (here CORINE, covering only EU countries), which are available upon request from the authors.

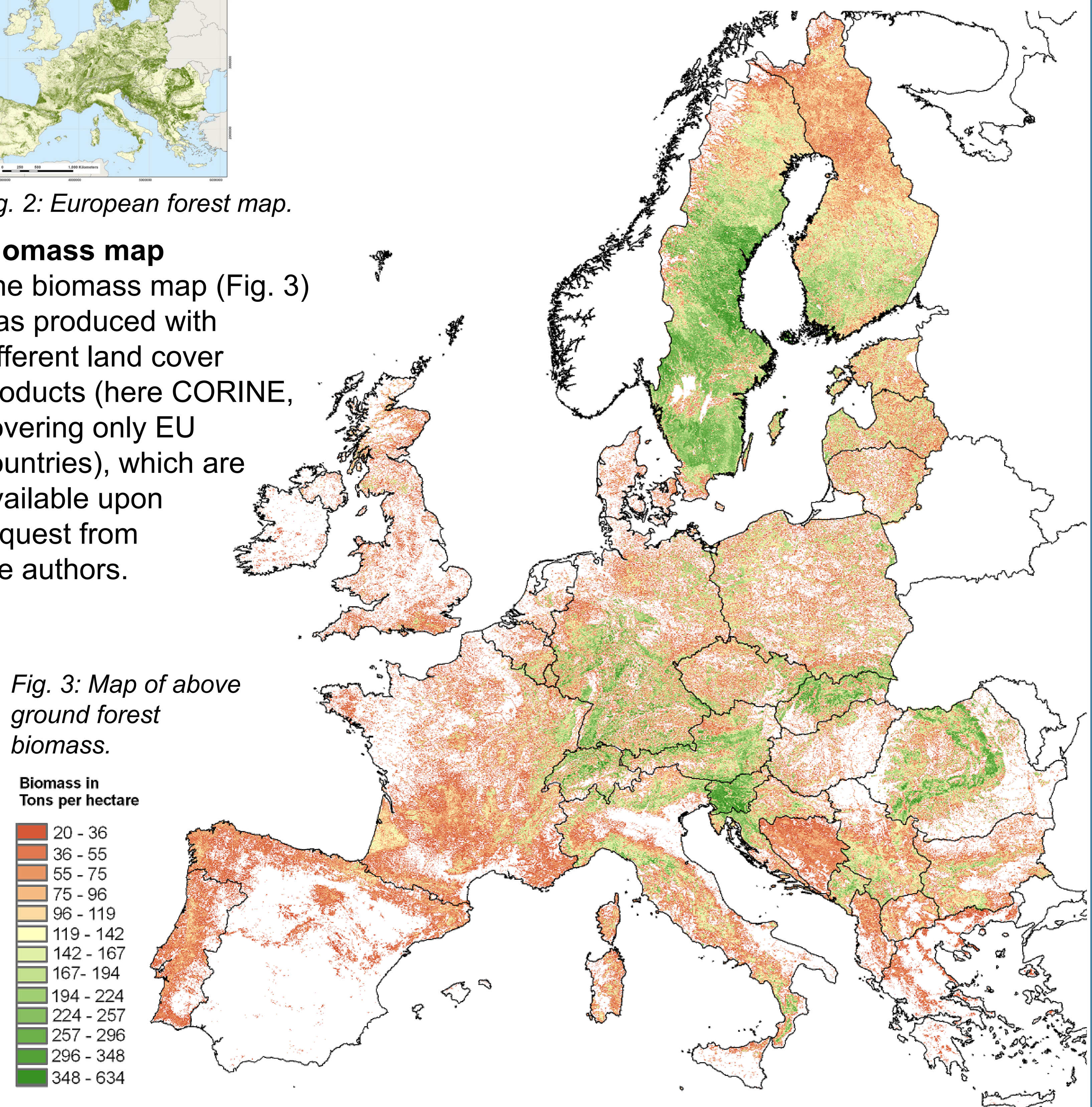

Fig. 3: Map of above ground forest biomass.

Validation

Laser scanner data for the region of Vorarlberg (Austria) were compared to the modeled values of the biomass map. We found a satisfying correlation of r = 0.81 for comparison at grid level (Fig. 4). Modeled biomass per ha was less correlated to laser scanner derived estimates when comparing only grids where forest share was larger than 20% (r = 0.60).

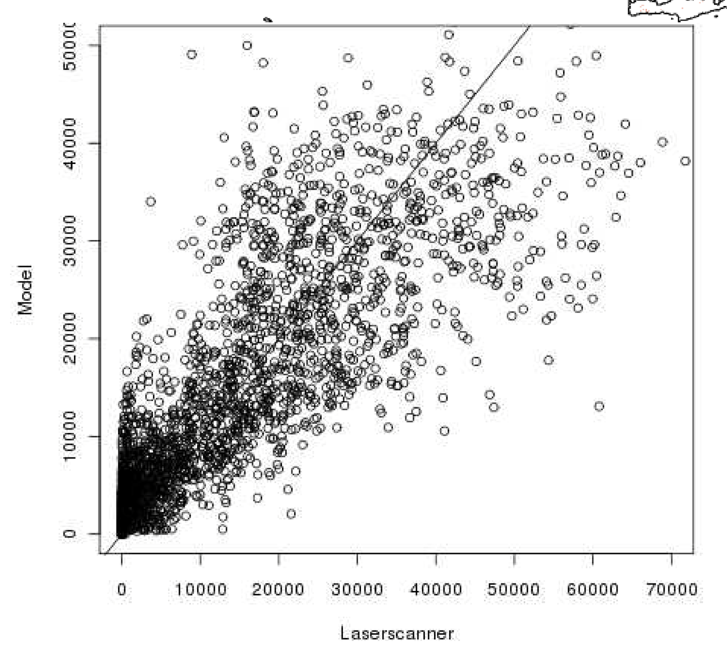

Fig. 4: Comparison of laser scanner data and modeled biomass at grid level.

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