The e-forest system: the ENFIN forest information system

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23rd November 2018, meeting of the FAO/UNECE ToS on monitoring SFM, BOKU, Vienna
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Objectives of the e-forest system

- establish an internet platform which provides
  - harmonised forest information
  - from national forest inventories
  - aggregated to arbitrary trans-national regions
  - to the public and on demand of international agencies and sector policies
  - on a timely and short-term basis

Constraints and challenges: huge amount of data (around half a million NFI plots over Europe), confidentiality of national data, data validation and harmonisation, ease of data provisioning, intuitiveness and acceptance of data flows and resulting estimates, joint treatment of data from different national survey systems
Context of e-forest development

- e-forest system development in co-operation between the EU and the European national forest inventories network (ENFIN)
  - JRC: e-forest development (has been) is part of 3 framework contracts for the provision of forest data and services in support to the European Forest Data Centre (2008-2019)
  - H2020: e-forest development is part of the Diabolo project (2015-2019)
- technical specification and implementation of the software mainly at IGN (France), UHUL (Czech Republic) and WSL (Switzerland), with strong support from METLA (Finland), Thünen (Germany), BFW (Austria) and JRC (Italy), and various countries and all colleagues participating in several demonstration and case studies (21 countries)
Demonstration and case studies

- occurrence of tree species (JRC tree atlas)
- evaluation of JRC forest maps
- basal area by tree species
- harmonised biomass by tree species
- harmonised forest land available for wood supply

Output: INSPIRE grid aligned plot data, smoothing (inverse distance weighting), design-based estimation at country, NUTS 2/3 and INSPIRE grid cell (50km by 50km and 100km by 100km) levels
Design-based estimates of the average harmonised above-ground biomass per ha forest land in 50km by 50km grids INSPIRE grids, and participating countries in the first (blue) and second round (pink) of the demonstration project.
Harmonised biomass (smoothing)

Smoothing algorithm: harmonised above-ground biomass over all trees and for *Picea*. 
Difference between harmonised and national above-ground biomass

Comparison of design-based above-ground biomass estimates per country according to national an harmonised definitions of (single tree) biomass.
Database and software (open source)

- **back-office**: database and software for NFI data upload in CSV format, data verification (and data harmonisation)
- **front-office**: data aggregation (estimation and smoothing), and data dissemination
Diabolo developments

- regression estimation to improve the precision of field survey based estimates with target variables related (remotely sensed) spatial auxiliary data (design-based, model-assisted estimation procedures)
- imputation and updating techniques for the provisioning of timed forest information
  - inter- and extrapolation
  - two-phase estimation procedure (first phase: previous measurement on entire sample, second phase: measurements on annual sample)
- definition of the database to hold NFI plot data from successive inventories
Efficiency gain with auxiliary data

Auxiliary data: Copernicus forest type (broadleaves, conifers) and tree cover density maps. Target variable: total above-ground biomass.
Conclusions

Why this presentation and lessons learnt from e-forest

- there is a strong commitment of European NFIs to provide and improve regional (common) forest information
- NFIs are willing and capable and “speak the same language” with regards to data management and data interoperability and information provisioning (IT technology and mathematical statistics)
- the plot level approach is for the (however, eventually not so far) future: advantages are transparency and harmonisation, ease of data provisioning and data updating, flexibility in provisioning of information at short notice
- common database needs close cooperation and strict rules between data providers (data formats, data use, data confidentiality)