

ENFIN NETWORK:
MONITORING, HARMONISING, REPORTING AND RESEARCH
TO OBTAIN RELIABLE FOREST INFORMATION FOR THE EU

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1 ENFIN network. Context

2. NFIs data availability in EU

3. Framework for handling and sharing NFI data in Europe

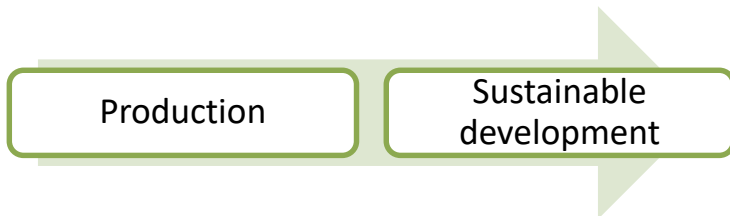
4. Combination of NFIs and Remote sensing data

5. Harmonisation process: current state, futures perspectives and challenges

6. ENFIN vision



1. EUROPEAN NATIONAL FOREST INVENTORY NETWORK. CONTEXT

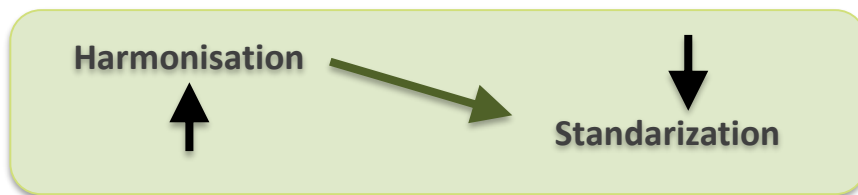
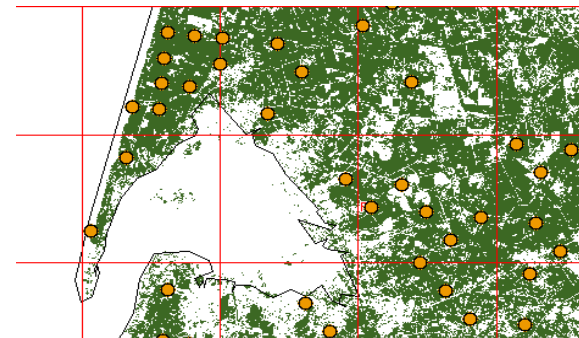


CHANGING INFORMATION REQUIREMENTS

EU data obtained as the sum of national reports/data

Comparable?

Variety in sampling designs (0.5x1 km in Belgium-Wallonia to 5x5km Estonia); data collection methodologies, definitions and estimates



1. EUROPEAN NATIONAL FOREST INVENTORY NETWORK. CONTEXT



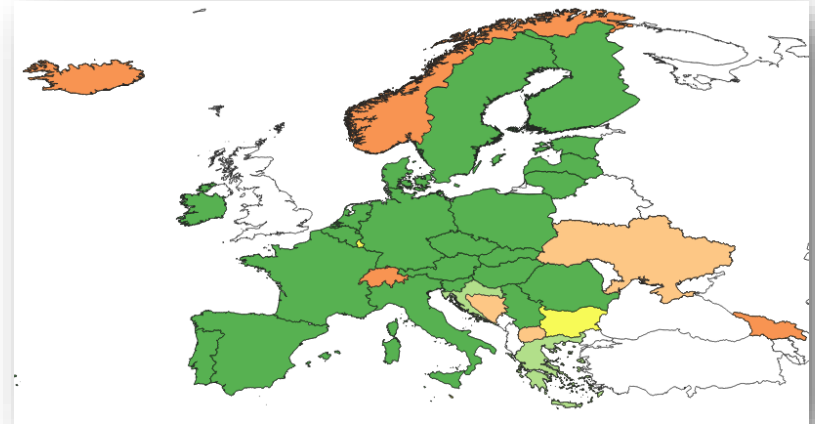
- Approx. 500 000 plots
- 34 institutions in 31 countries



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2. NATIONAL FOREST INVENTORIES DATA AVAILABILITY (EU)

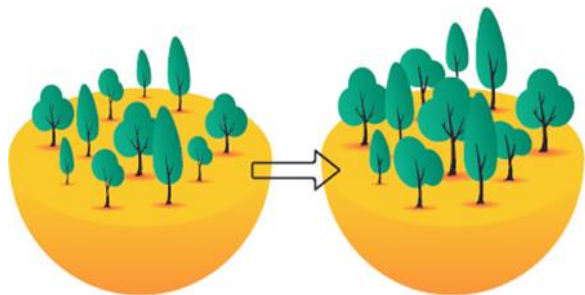
23/27 EU Member States have National Forest Inventory (NFI), **21** ongoing
+7 countries within the pan-European region are also ENFIN members, **4/7** having ongoing NFIs



They all supply forest data and information at national and sub-national levels since up to 100 years.

Monitored area: **Forest**, and increasingly number of countries **OWL** (approx. 50%)

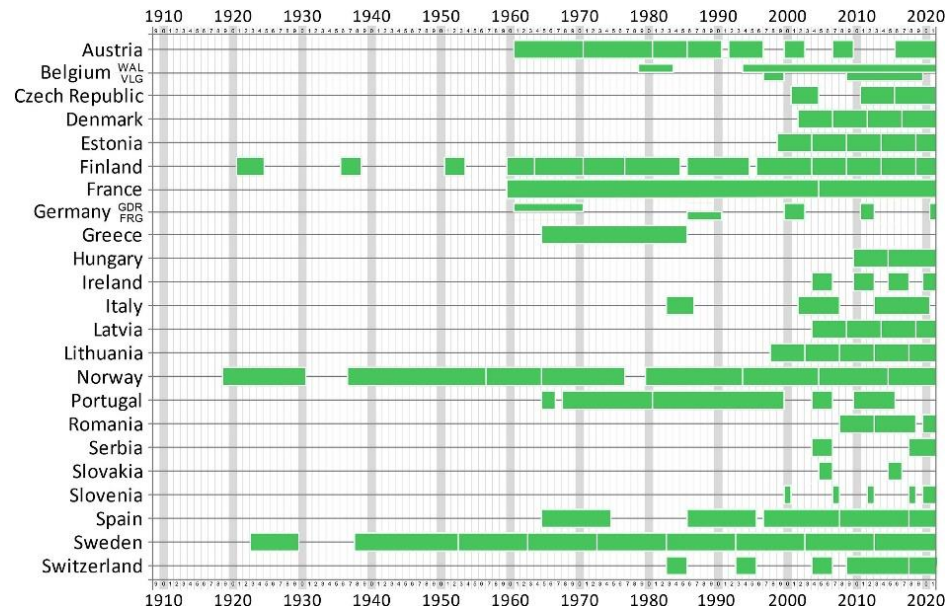
2. NATIONAL FOREST INVENTORIES DATA AVAILABILITY (EU)



Different NFI cycles (n years). (*Tomppo et al. 2010; Vidal et al. 2018; Gschwantner et al. 2022*)

Predominantly:

- 5 years period
- (1/n) annual plots monitored

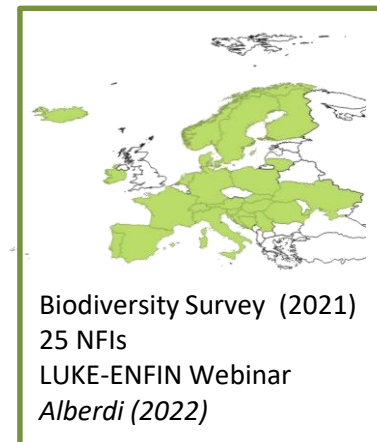
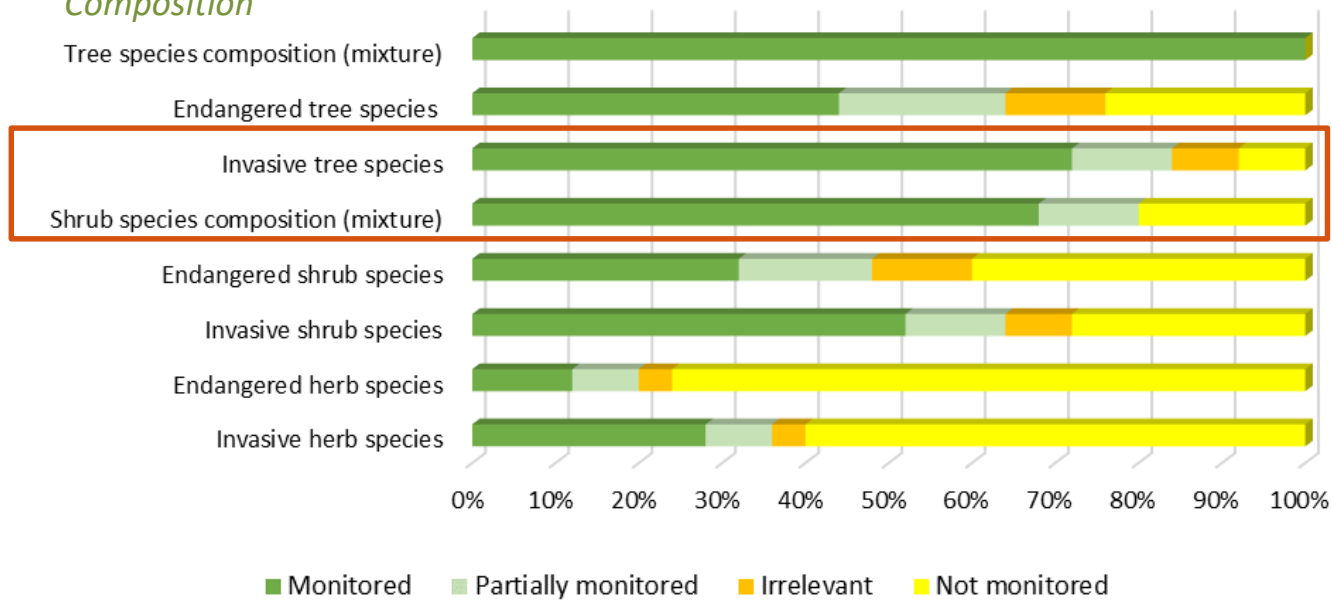


Gschwantner et al. 2022

2. NATIONAL FOREST INVENTORIES DATA AVAILABILITY (EU)

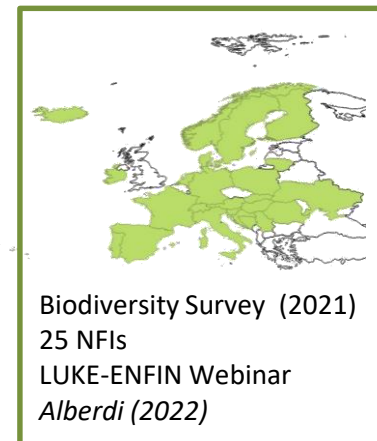
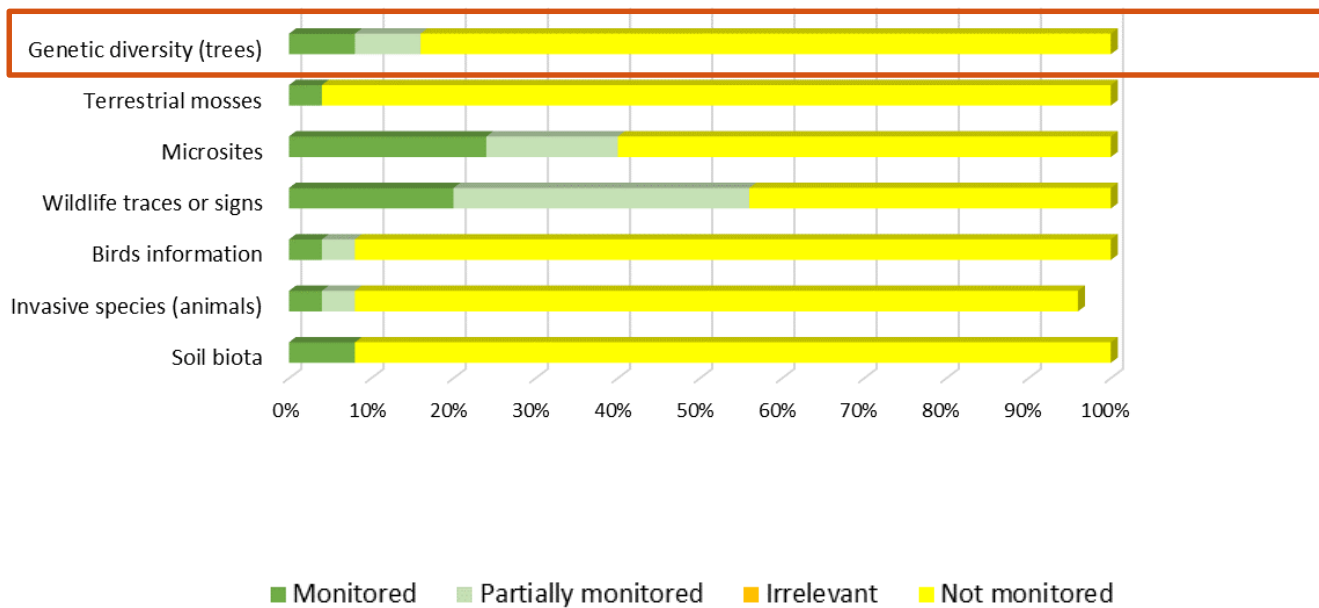
MULTI-OBJECTIVE

Composition



2. NATIONAL FOREST INVENTORIES DATA AVAILABILITY (EU)

MULTI-OBJECTIVE



2. NATIONAL FOREST INVENTORIES DATA AVAILABILITY (EU)

- **Intra-cycles estimates often used for backwards reporting:**
 - ✓ Statistical
 - ✓ Modeling
- **Temporal reporting capacity:**
 - ✓ Country dependent
(at least 5 years, SoEF-FRA)
- **Annual updates** (*no detailed questionnaire results so far*):
 - ✓ Based on a specific sampling design used by several NFIs (e.g. Finland, Sweden, Austria, ...)
 - ✓ Based on updates with Remote Sensing (methods in development)



3. FRAMEWORK FOR HANDLING AND SHARING NFI DATA IN EUROPE

- **Specific national data policies**

- ✓ Aggregated data
- ✓ Raw data - Limitation: exact plot location



A comprehensive solution is important for the near future

- **EU NFI Data-base**

- ✓ Specific national variable definitions and data base structure
- ✓ Many efforts done up to now: reference definitions/key indicators
FWC JRC //DIABOLO // Action COST
- ✓ PATHFINDER (Horizon Europe): nFIESTA (statistically-sound estimates - different sampling design)

3. FRAMEWORK FOR HANDLING AND SHARING NFI DATA IN EUROPE

- **Starting requirements**
 - ✓ Need for a legal basis
 - ✓ Continuous EU funding
- **Establish a formal institutionalised ENFIN office coordinating NFI institutions**
 - ✓ Involvement of all NFIs from data collection to reporting
 - ✓ Use existing quality control systems and expanding to European level
- **Develop governance structure with EC, JRC, EEA, ...**

4. COMBINATION OF NFIS AND REMOTE SENSING DATA

2D REMOTE SENSING DATA

- ✓ **Most of the NFIs:**
 - ❑ for planning fieldwork,
 - ❑ for stratification of the field samples, or
 - ❑ for measurement of forest area (orthophotos or satellite images)
- ✓ The operational **integration of digital remote sensing data with NFI field plots** for improved estimation of statistics for small areas was pioneered by *Erkki Tomppo* (Finnish NFI around 1990; 2D satellite -kNN imputation)
 - ❑ Bosnia Herzegovina



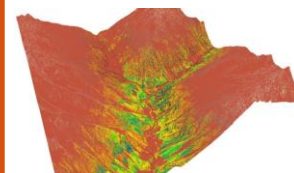
Remote Sensing Survey
(2021) - 21 NFIs

*SILVILASER,
Olsson & Nilsson (2021)*

4. COMBINATION OF NFIS AND REMOTE SENSING DATA

3D REMOTE SENSING DATA

- ✓ Germany, Austria, Switzerland, and Czech Republic; Denmark, Sweden, Finland-FMI and Norway (**8 countries**): **operationally** (airborne laser scanning or point clouds or surface models from digital photogrammetry)
- ✓ Italy, Portugal, Netherlands and France + Spain (**5 countries**) : **ongoing pilot or development projects** with the aim of preparing for future more operational use of 3D remote sensing data



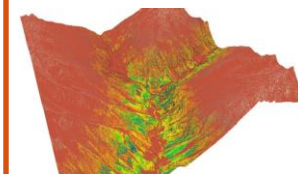
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4. COMBINATION OF NFIS AND REMOTE SENSING DATA

3D REMOTE SENSING DATA

FOREST VARIABLES PREDICTED AS RASTER MAPS	Volume	Biomass	Basal area	Stand height	Diameter	Tree species/ Forest type	Forest area/ Crown cover	Change/Harvest	Damages/Health	Site index	Stand age	Stem number
Germany (parts)	X	X	X	X	X	X	X	X				X
Austria	X					X	X	X	X			
Switzerland	X	X	X			X	X					
Czech Republic				X		X	X	X	X			
Denmark	X	X		X			X					
Norway	X	X	X	X	X	X	X	X		X	X	X
Sweden	X	X	X	X	X	x						
Finland (FMI)	X			X	X	X					X	x



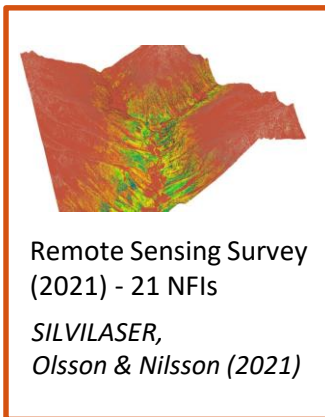
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4. COMBINATION OF NFIS AND REMOTE SENSING DATA

3D REMOTE SENSING DATA

Challenges:

- ✓ Lack of long-term ALS data acquisition suited for forestry needs (CH and DK)
- ✓ Some problems with data policy that restricts access to data and data distribution
- ✓ Limited accuracy in certain nature types (alpine treeline; rich broadleaved forests)



Visions expressed for the future:

- Regular national data acquisition campaigns targeted for the need of the forest sector
- Ground measurements of tree stems using terrestrial laser scanning
- Model-assisted estimators used routinely by the NFI

5. HARMONIZATION PROCESS

INDICATORS ALREADY HARMONIZED

- Reference definitions
 - Forest area (*Vidal et al. 2008*)
- Selection of harmonizable indicators
 - Wood quality (*Bosela et al. 2015*)
- Harmonised estimations
 - Growing stock (*Vidal et al. 2008; Tomter et al. 2012; Gschwantner et al. 2022*)
 - Volume increment (*Gschwantner et al. under preparation*)
 - ABG Biomass (tree)
 - FAWS (area and biomass) (*Alberdi et al. 2020*)

INDICATORS COULD BE HARMONIZED

- Reference definition:
 - Forest types
 - Site index
 - Salvage logging
- Harmonised estimations
 - Harvest and mortality estimates
 - Forest damages
 - Biomass: BGB; Shrubs, SOC

5. HARMONIZATION PROCESS

INDICATORS ALREADY HARMONIZED

- Reference definitions
 - Dead Wood (*Rondeux et al. 2012*)
 - Forest age (*Chirici et al. 2011*)
- Selection of harmonizable indicators
 - Stand structure (*Chirici et al. 2012*)
 - Ground vegetation (*Alberdi et al. 2018*)
- Harmonised estimations
 - Structure and function indicators (*Gasparini et al*)

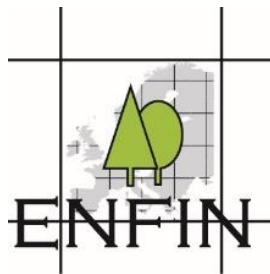
INDICATORS COULD BE HARMONIZED

- Reference definition:
 - Old growth forests
 - Regeneration
- Selection of indicators
 - Rarely sampled variables
- Harmonised estimations
 - European scale

* *OTHERS: Services (recreation) // NWFP // Disturbances*

6. ENFIN vision

- ✓ **Full coverage** of EU MS with continuous NFI
- ✓ Harmonised **NFI & remote sensing based annual estimates** for key forest information
- ✓ **Harmonised map products** including reliability information
- ✓ **Continuation** of the **harmonisation process** of all relevant forest information
- ✓ **Access to all information** through one WEB-Portal based on a co-operation between ENFIN and a European organisation
- ✓ **Access** to NFI data for the scientific community
- ✓ **Governance** - constant funding for European cooperation of NFIs



Thank you!

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On behalf of ENFIN network

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