ForestNavigator

D2.2 Dataset and report on reconciled EU forest carbon stocks status/change

20 years of forest change

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Abstract

This report describes the European Forests Database (EUFo) and its methodology delivered in D2.2, which presents the collection of original sub-national information on forest area, harvest, biomass stock and increment from National Forest Inventories and other forest-related data sources. In addition, EUFo also includes a harmonized annual database on these same indicators based on a modelling approach to consistently assess Europe's forest carbon status and change. Furthermore, the database contains data on international trade of wood products.

Keywords

Forest indicator database, forest area, forest biomass stock, forestry harvest, sub-national

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Table of Contents

List of Figures

List of Tables

Abbreviations

C	Carbon
CRAFT	CaRbon Accumulation in ForesT model
EC	European Commission
ENFIN	European National Forest Inventory Network
EO	Earth Observation
ESDAC	European Soil Data Centre
EU	European Union
EUFo	Database of European Forests
FAO	Food and Agriculture Organization of the United Nations
FISE	Forest Information System for Europe
FRA	Global Forest Resource Assessment
HANPP	Human Appropriation of NPP
ICP Forests	International Cooperative Programme on Assessment and Monitoring of Air Pollution Effects on Forests
MtC	Mega tonnes Carbon (10^6 metric tonnes Carbon)
NFI	National Forest Inventory / National Forestry Inventories
NPP	Net Primary Production
NUTS	Nomenclature of territorial units for statistics
NUTS+	Nomenclature of territorial units for statistics plus added national-specific region classifications
SoEF	State of Europe's Forests
SOC	Soil organic carbon
WP	Work Package

Executive summary

This report presents the main output of Task 2.2. (WP2) of the ForestNavigator project aimed to collect and reconcile various available datasets to assess European forest carbon stocks and their changes over the period 2000-2022 at the sub-national level. We compiled data on forest area, biomass stocks, harvest, and increment from National Forest Inventories and national census reports, as well as from pan-European and global assessments of forest resources. The Database of European Forests (EUFo) consists of two parts: (i) "EUFo-reported" covers 39 European countries with over 200 individual regions and includes 40 NFI reporting periods between 2000 and 2022. We documented the inconsistencies and wide variety of definitions and terms used in NFIs and other datasets to describe key forest indicators and suggested an approach to reconcile available datasets. The (ii) database "EUFo-harmonized" is constructed along one common definition per indicator and ensures consistency of biomass stocks, increment, and harvest flows. Furthermore, the database contains data on international trade of wood products to provide a starting point for modelling wood consumption trajectories, for example, in Work Package 7 of ForestNavigator.

The resulting annual database documents an overall increase in forest area (+6%), biomass stocks (+19%), and harvest (+21%) between 2000 and 2022 in the EU-27. However, the annual carbon sink in forests has declined from ca. 100 Mega tonnes Carbon/year (MtC/yr) in the early 2000s to ca. 65 MtC/yr around 2020. Decreasing annual C-sinks in forest biomass are present in Sweden, Poland, Romania, Germany, and the Czech Republic, where this even leads to an overall decline in forest biomass stocks. The database allows for sub-national analyses on various measures, e.g. forest-use intensity and biomass carbon dynamics, or to identify critical regions and inform sub-national forest management strategies.

The EUFo database will first be made available to the ForestNavigator consortium, then published on the ForestNavigator Portal and presented in a database-focused publication.

1. Introduction

Monitoring carbon stocks and flows in European forests is crucial for mitigating climate change, as forests store vast amounts of carbon in biomass and soils. Accurate data on how much carbon is stored and how this has changed over the recent past is vital to assess patterns and ongoing dynamics, ensuring compliance with international climate goals. It also informs sustainable forest management strategies, balancing carbon sequestration with biodiversity and economic uses. Moreover, monitoring aids in assessing forest resilience to climate impacts, such as drought or pests, and supports restoration efforts to enhance carbon storage capacity.

Existing data on key forest characteristics needs to be more consistent across European countries. Comparability and straightforward analysis are hindered because data on forests are often collected at the national level, applying different methodologies, assessment periods, definitions of individual biomass pools, and spatial scales (Avitabile et al., 2024). Although the EU Forest Strategy 2030 aims to provide detailed, accurate, regular, and timely information on the state and management of European forests, our research has shown that consistent forest data at the sub-national level are not existent or easily accessible. Access to data in the National Forest Inventories (NFIs) is challenging because data compilation follows national frameworks and definitions, and there is a lack of consistent methods and definitions across European countries (Alberdi et al., 2020; Gschwantner et al., 2022; Tomppo et al., 2009).

This report aims to narrow this research and data gap. It presents a database on European forests, the EUFo database, for 39 European countries and 218 subnational units (NUTS2 and NUTS3 according to availability) from 2000 to 2022. It includes data on area, harvest, biomass stock and increment collected from NFIs and census statistics, as well as a complete timeseries on the annual dynamics of these indicators based on modelling results. Using this consistent database, biomass stocks, wood harvest and increment in European forests and their dynamics can be traced over 20 years, allowing for various analyses, e.g. of changes in various indicators for use intensity (e.g. harvest per area), their drivers and impacts, such as alterations in biomass carbon storage. Furthermore, the database contains data on international trade with wood products to provide a starting point for modelling of wood consumption trajectories in other Work Packages of Forest Navigator. The EUFo database consists of two subparts: (i) “EUFo-reported”, assembling the original data, while (ii) “EUFo-harmonized” is constructed along one common definition per indicator and ensures consistency of biomass stocks, increment and harvest flows.

2. Sub-national database of European Forests-EUFo

During the second year of the ForestNavigator project we completed the screening and collection of sub-national forest inventory data for the period 2000-2022 at European level and established the EUFo database as the main result of our efforts in Task 2.2. The workflow followed four main steps, namely the collection of primary data, the integration of these datasets into a database, the harmonization of primary data to a common definition per indicator, and the gap-filling and modeling of years without primary data (see Figure 1).

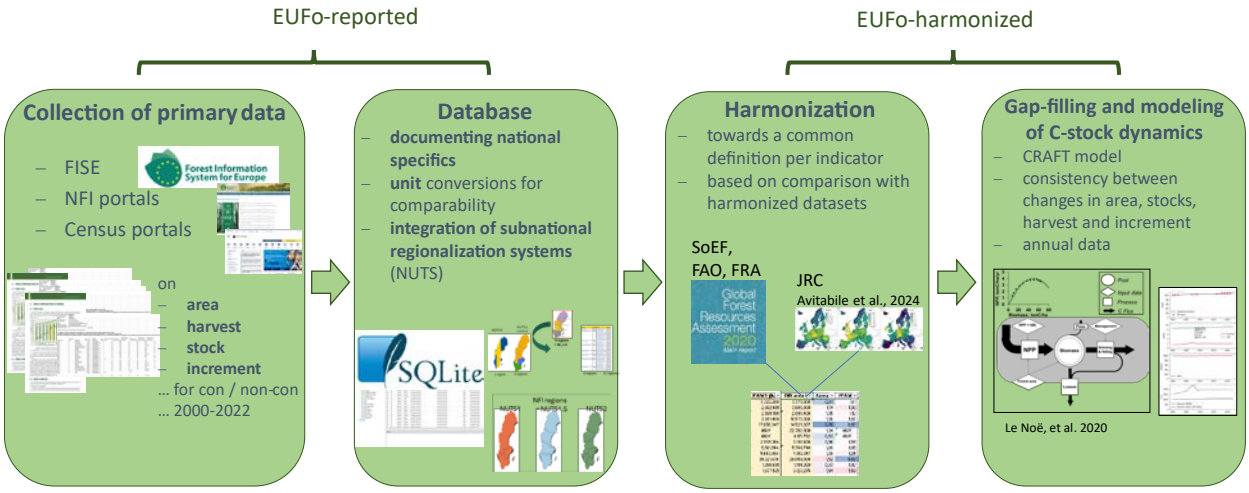

Figure 1: Overview of the EUFo database collection, harmonization and modelling efforts and the interlinkage of the two subparts of the database, EUFo-reported and EUFo-harmonized.

2.1. Database of reported forest indicators (EUFo-reported)

2.1.1. Data collection

This database uses a combination of data from the National Forest Inventory (NFI), and research and institutional publications on forest indicators at the pan-European or international level. Of particular value for our aim were the publications of (Avitabile et al., 2024), the State of Europe's Forests (SoEF) (Forest Europe, 2020), and FAO-Global Forest Resources Assessments (FRA) reports (FAO et al., 2024).

As described in Deliverable D2.1, several relevant data sources for European forest data exist, most importantly the datasets from various National Forest Inventory entities (NFI). In our experience, NFI data vary greatly from region to region due to the federal system, usually cover different years and are structurally heterogeneous. All these issues required not only a data collection process, but also a subsequent harmonization process.

The European Forest Institute (EFI) made a first attempt to create a unified forest data source with the EFISCEN database (Schelhaas et al., 2006), which contains (sub)national data sets for 32 European countries. Unfortunately, the database only contains data up to 2001. As our aim was to also collect data for more recent time periods, i.e. 2000-2020, we turned to the Forest Information System (FISE, 2023) data catalogue, which provides access to collected NFI reports and data tables of 34 European countries, and provides forest information data at different regional levels (country, NUTS1-3 and LAU1-2). This data can be accessed and processed with a code that allowed us to

batch download all files and resolution levels per country. In addition, FISE provided refined information on the NFI reports, such as PDF tables converted into easily editable xlsx spreadsheets, sometimes even with proof-checked indicator updates. However, we found two drawbacks to the FISE data repository. Firstly, the reports presented here are subject to time lags and often the latest NFI reports/data were not yet linked or published on the site. Second, although the FISE database stores a large number of datasets locally, many are only available by linking to the original source, which often led to dead ends due to no longer existing websites. In order to access missing and/or most recent data, we obtained them directly at the NFI and statistical offices.

In addition to reported NFI data, we also used research and institutional publications on forest indicators at the pan-European or international level. Avitabile et al. (2024) provide a European dataset for 38 European countries on forest biomass for the year 2020, including maps of forest area, biomass stocks and wood supply. They also include volume increments for the decade leading up to 2020. This dataset is particularly valuable because it is based on a joint effort by the Joint Research Centre (JRC), the European National Forest Inventory Network (ENFIN) and the European Commission to harmonize the different NFI data of all included countries to a common standard.

Forest Europe, a pan-European consortium, publishes SoEF reports every five years for 45 European countries and the European Union (EU) as a supranational entity. The international cooperation project links policy and research efforts with the aim of establishing processes for the protection and sustainable management of forests in Europe. The SoEF database provides a comprehensive overview of characteristic aspects of forests, their functions and their use by society. This harmonized catalogue of forest characteristics is an important tool to provide relevant indicators for sustainable forest management, especially for countries without available NFI data (see Table 1).

Finally, we also used global assessments such as the FAO's-FRA for data checks and cross-checks. These reports include more than 60 forest-related variables for 236 different countries and regions for the period 1990-2020. Although the FAO-FRA data are collected using commonly agreed terms/definitions, they are not fully aligned with the NFI standards, resulting in significant differences in reported values for certain indicators.

2.1.2. Soils and international trade with wood products

International trade of wood products is documented in the FAO database on forestry (https://www.fao.org/faostat/en/#data/FO). This database includes detailed information on trade of various wood products such as sawnwood, wood-based panels, paper, and pulp and fuel wood. The database covers all European countries and trading partners of European countries. It contains annual production and trade data back to 1987 for each EU country, allowing to move beyond the data compiled in the forestry databased and to analyze long-term trends in consumption of wood products (link to WP7 in Forest Navigator). The data was compiled at the national level and accompanies the subnational data on forest area, harvest, increment and stocks presented in the EUFo database.

Several initiatives monitor soil organic carbon (SOC) across Europe, such as the International Co-operative Programme (ICP) Forests (http://icp-forests.net/) or the European Soil Data Centre (ESDAC; https://esdac.jrc.ec.europa.eu/) with the LUCAS module (Orgiazzi et al., 2018). Furthermore, gridded datasets of soil properties are being produced and undergo continuous

development, such as the Harmonized World Soil Database (HWSD) and the ISRIC SoilGrids. These products, however, still show shortcomings with regards to forest soils. As part of WP 3 efforts, partners compared these soil data with ground data, e.g. the ICP network soil information. These comparisons show only a weak agreement between the gridded products and the ground data for important soil parameters, such as the carbon content, available soil water and soil texture. Hence, we opted to omit soil information in our current assessment, due to the large uncertainties entailed in the datasets. To complement our assessment of biomass carbon stock status and changes, and for better understanding soil carbon status and recent stock changes, we will consult the work being conducted in the sister project PathFinder (https://pathfinder-heu.eu/wp-content/uploads/2024/09/PathFinder_D3.3.pdf) and in the Horizon EU project HoliSoils (https://holisoils.eu/wp-content/uploads/2024/03/Deliverable-3.4-Open-access-harmonised-soil-database.pdf)

2.1.3. Database characteristics

For the EUFo database we collected data on the key forestry indicators forest area, biomass stock, increment and harvest with species information for 39 European countries for the period 2000 to 2022. These include the EU-27 (excluding Malta), eight European EU candidate countries and four non-EU countries (see Table 1). The database covers 93% of the forest area in the EU-27 with NFI and census data from 18 countries, 16 of them at the subnational level (88% of forest area in EU-27). We excluded Malta and Kosovo because of poor data coverage. Over the period of 2000-2022 the total number of NFI periods collected was 40 plus the census entries that came in an annual resolution. Not all four indicators were always available for each year. Figure 2 provides an overview of which indicator is available for which year for the 18 countries where NFI and census data was collected. Non-EU member countries, countries in which no NFIs are conducted, smaller countries and countries with little forest cover were supplemented by SoEF data at national level (28 countries). In the SoEF database area, stock and increment are usually available for the years 2000, 2005, 2010, 2015 and 2020 and harvest annually until 2017. Tables 6-13 in the Annexes provide a comprehensive overview of all data sources, indicators and years covered per country.

Table 1: Overview over the 39 European countries included in the database.

EU membership	EUFo countries with NUTS IDs
EU27	Austria (**AT**), Belgium (BE), Bulgaria (BG), Cyprus (CY), Czech (**CZ**), Germany (**DE**), Denmark (DK), Estonia (**EE**), Spain (**ES**), Finland (**FI**), France (**FR**), Greece (GR), Croatia (HR), Hungary (**HU**), Ireland (**IE**), Italy (**IT**), Lithuania (**LT**), Luxembourg (LU), Latvia (**LV**), Netherlands (NL), Poland (**PL**), Portugal (PT), Romania (**RO**), Sweden (**SE**), Slovenia (**SI**), Slovakia (**SK**)
EU candidate	Albania (AL), Bosnia Hercegovina (BA), Moldavia (MD), Montenegro (ME), North Macedonia (MK), Serbia (RS), Turkey (TR), Ukraine (UK)
non EU	Belarus (BY), Switzerland (CH), Norway (NO), United Kingdom (GB)

It covers 26 EU member states, 8 EU candidates and 4 non-EU countries. For countries with a bold ID, we collected NFI and/or census data; for the other countries, we collected national data from SoEF. Kosovo and the European microstates (Liechtenstein, Malta, Monaco, San Marino and Vatican City) are not included due to the absence of forests or poor data coverage.

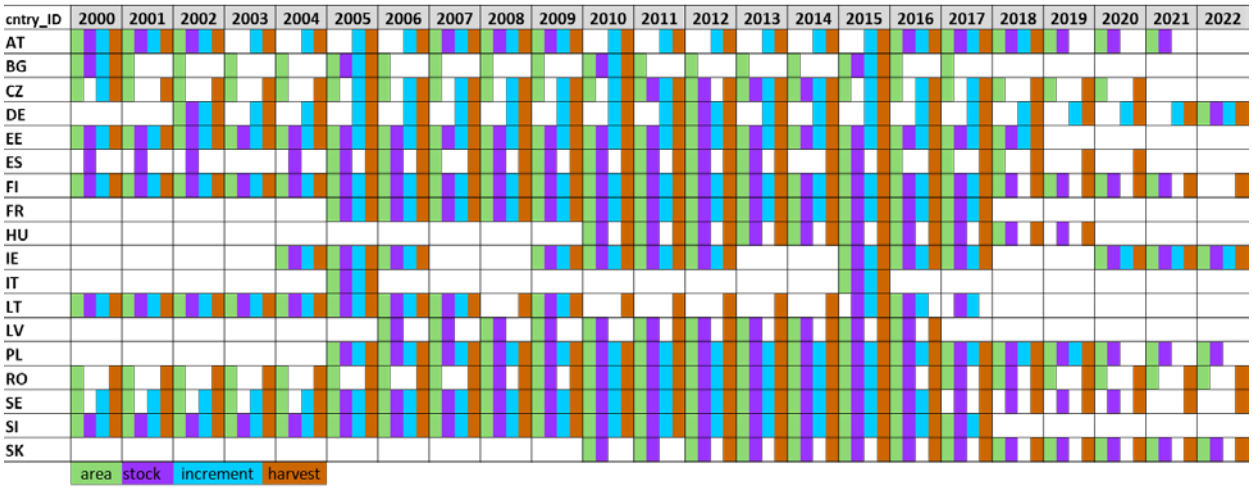

Figure 2. Overview of forest indicators (area, stock, increment, harvest) included in EUFo-reported per year for countries where NFIs and census data was collected.

The spatial resolution of the EUFo database ranges from NUTS0 (national) to below NUTS3 level, varying across the indicators. An overview of spatial resolution in terms of NUTS level per indicator for NFI and census data can be found in Table 2. Most of the collected data points were consistent with the NUTS 2021 version we used, but individual regions had to be adjusted, as they were reported in country- specific regional classifications (in Sweden and Romania) or below NUTS3 level (in Ireland and Estonia). To keep the regional classification consistent and to be able to perform aggregate calculations, intermediate levels were added to the NUTS classification, as shown for the example of Sweden in Figure 3. We reference to this extended NUTS classification as NUTS+. An overview of the spatial resolutions in the form of NUTS+ levels and the temporal resolution in the form of NFIs within the period 2000-2022 can be seen in Figure 4.

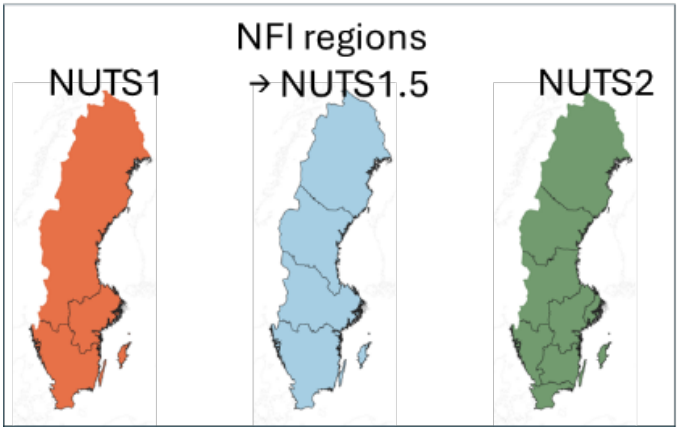

Figure 3. NUTS regions of Sweden with added NUTS+ level for specific regions from Swedish NFI

Table 2. Highest spatial resolution of collected subnational NFI and census data per country for each indicator.

indicator/ NUTS+ level	area	biomass/growing stock	increment	harvest
0	BG, LV	BG, LV	BG	BG, IE, LV
1	DE	DE	DE	DE
1.5		RO	RO	SE
2	AT, ES, FR, IT, PL	AT, ES, FR, IT, PL	AT, FR, IT, PL	AT, ES, FR, IT, PL
3	CZ, FI, HU, LT, RO, SE, SI, SK	CZ, FI, HU, LT, SE, SI, SK	CZ, FI, LT, SE, SI	CZ, FI, HU, LT, RO, SI, SK
3.5	EE, IE	EE, IE	EE, IE	EE

Countries that do not use NUTS regions for their forest inventory data (e.g. Sweden, Romania) were assigned additional NUTS levels that fall between existing levels, for example 1.5 for Romanian regions. We refer to this extended NUTS classification as NUTS+.

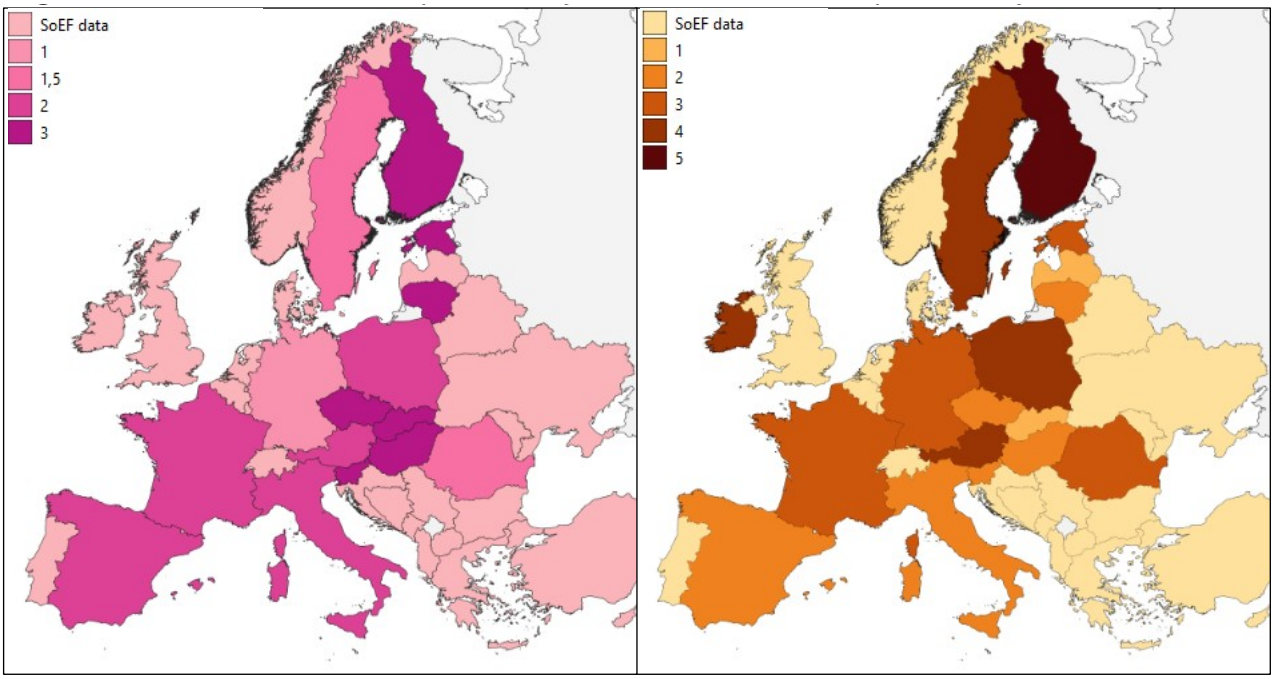

Figure 4: Overview of spatial and temporal resolution represented in the EUFo-reported database.

The left map shows the spatial resolution/NUTS+ level for which all four indicators (area, biomass stocks, increment, harvest) are available for each country. The right map shows the amount of NFIs that were collected for the period 2000-20022 per country. Added SoEF data at the national level are shown in a pale color.

Per indicator, we collected additional information on species whenever possible. We were able to collect species or species class (i.e. coniferous or non-coniferous) information for all countries and all indicators except for BA, EL, LU, MT, RS, SI (area), for BG, ES, MT (stock), for BY, DK, EE, HR, NL, NO, TR, UK, UKR (increment) and for BG, EE, IT (harvest).

The EUFo-reported database contains the original information reported by the NFIs, the national statistical agencies and the SoEF, applying only minor processing steps of the collected data (e.g. conversion from Mio m^3 to 1000 m^3). This version is not harmonized and contains the original data

sources and is thus not consistent in terms of overarching terms and definitions (see section 2.3.1.) or discrepancies between the calculated aggregate of subcategories (e.g. all species) and the reported entry for the total. Table 3 describes the used keys and information available for each entry and gives an example entry for illustrative purposes.

All data were collected in a spreadsheet programme (Excel) and then subsequentially processed in an SQLite database. The created SQLite database contains: 36.110 entries for area, 24.838 entries for biomass stock, 37.036 entries for harvest and 21.7280 entries for increment. It should be noted here that the periodic execution of the NFIs and their temporal referencing to those periods results in many duplicate entries, since values were always entered for all years of the NFI reference period (e.g. if the NFI period covers 2004-2008, the reported forest area value was entered into the database for each year from 2004 to 2008).

The EUFo-reported database consists of 369, 297, 221 and 291 regions for area, stock, increment and harvest, respectively.

The key specifics of this database are:

- Data for area, stock, increment and harvest from NFIs, census and SoEF.
- English translation of original area and harvest definitions are included.
- Units are converted to 1,000 ha for area and 1,000 m3 for stock, increment & harvest.
- Functional NUTS+ classification is included that allows for further regional aggregation.

Table 3. Description of keys used in the EUFo-reported database illustrated with an example entry.

key	Description	example
cntry_ID	ISO-2 Country identifier	AT
cntry_group	Is either: EU, EUcandidate, nonEU	
NUTS_ID	NUTS2021 with added NUTS_IDs for country-specific region systems that lie between the original NUTS levels = NUTS+.	AT11
NUTS_num	NUTS+ level: 0, 0.5, 1, 1.5, 2, 2.5, 3, 3.5	2
forest_area_orig	Original term/definition for reported forest area	
forest_area_engl	English translation of forest area term/definition from original source	forest area under use
harvest_cat_orig	Original term/definition for reported harvest	
harvest_cat _engl	English translation of forestry harvest term/definition from original source	
indicator	Is either: **area**, **stock**, **increment** or **harvest**	area
species_engl	English translation of reported species type	spruce
species_class	Added species class information: **con:** coniferous tree species **noncon:** non-coniferous tree species **unstocked:** unstocked forest area **unknown:** unknown tree species Added totals within a category/region: **con-total:** sum of con at unique NUTS_ID, year, forest_area, (harvest_cat) **noncon-total:** sum of noncon at unique NUTS_ID, year, forest_area, (harvest_cat) **total-con_ncon:** sum of con-total and noncon-total at unique NUTS_ID, year, forest_area, (harvest_cat) **total-allclass:** sum of con-total, noncon-total, unknown and unstocked.	con
year	Reference year	2000
source_type	Is either: NFI, census or SoEF.	NFI
unit	1000ha for area 1000m3 for stock, increment, harvest	1000ha
value	value entry	20
NUTS0	Functional NUTS+ mapping. It can be used to aggregate from this entry to larger spatial NUTS units. In this case from NUTS2 to NUTS1 and NUT0.	AT
NUTS0.5		
NUTS1		AT1
NUTS1.5		
NUTS2		AT11
NUTS2.5		
NUTS3		
NUTS3.5		

2.1.4. Definition variety of NFIs and census

Although NFIs generally report on the same forest indicators, there are significant differences in the exact definitions of these indicators, as mentioned above. To illustrate this, we show all the forest area definitions and terms we have collected from NFIs and census reports (and, where necessary, translated into English) in a word cloud in Figure 5, and do the same for harvest categories in Figure 6. With area definitions such as 'forest area', it is not clear whether, for example, unstocked areas are included in these areas and clarifying information about this was not always available in the NFI documentation. For the harvest categories, the definitions in general

gave a better indication. Still, it was sometimes unclear what was exactly meant by terms like “harvest” or “felling” i.e. whether residues or bark were included or not.

Figure 5: Word cloud of translated forest area terms from NFIs and census.

Figure 6: Word cloud of translated harvest categories from NFIs and census.

For the EUFo-reported database we collected either total forest or stocked forest area for each country. Additional data points like unstocked or unused forest areas are available for individual countries (e.g. for AT, EE, LT). For each country, we collected at least industrial roundwood or a harvest category that represents the entire ‘harvest’ of the forest and if possible, both (e.g. in CZ, SE) or more (for example wood fuel in ES, SE). Data included from SoEF and FRA follows the definitions of these databases.

2.2. Constructing a consistent annual database 2000-2022 (EUFo-harmonized)

To arrive at a stock-flow consistent, annual database for forest carbon stocks in Europe that aims for consistent definitions of the included forest indicators (area, harvest, biomass stock) across all countries various steps of harmonization and gap-filling are necessary.

One requirement is that the same regions are used across all three indicators. In Romania, for example, harvest was reported at the NUTS3-level, while area and stock were only reported at NUTS1.5-level. We hence aggregated harvest to NUTS1.5-level and ensured stock-flow consistency at this spatial resolution. This procedure results in 217 individual regions, of which 192 are subnational, and 25 are on the national level.

For the harmonized version of the database (EUFo-harmonized) we focused on total forest and hence aggregated all entries for available subcategories of an indicator (such as tree species, unstocked and unknown areas) (see Table 2) within each region, if no original entry for this aggregate was available.

2.2.1. Harmonization

The dataset published by Avitabile et al. (2024) resulted from a collaboration of several European NFIs to produce harmonized data across Europe. The NFIs adjusted their definitions for forest area, biomass stocks and increment towards a common definition and supplied harmonized data for at least one NFI period between 2000 and 2020. In Avitabile et al. (2024) this data was then updated to 2020 with an empirical forest model (Carbon Budget Model) and downscaled to create maps at 100m resolution. For our harmonization effort for ForestNavigator, the harmonized NFI input data supplied from the NFIs is a highly relevant datapoint to derive the deviation of the reported NFI data collected in the EUFo-reported database from the common definition used in Avitabile et al. (2024).

For the EUFo-harmonized version of the database we hence followed the definitions applied in Avitabile et al. (2024), and first derived adjustment factors for the NFI reports based on the one year or NFI period for which harmonized information was available in Avitabile et al. (2024). These adjustment factors were then applied to all data points of forest area and biomass stock available in the EUFo-reported database for the period 2000 to 2020.

Forest area

The definition of forest area used in Avitabile et al. (2024) is very similar to the one in the SoEF and refers to “land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use.” The two sources hence report very similar values for most countries. However, for some countries the national definition of forest was preferred by Avitabile et al. (2024) as it was assumed to be more fitting, which results in larger deviations in these countries (CH, CZ, DE, HR, HU, RS, SK).

As shown in Figure 5, many different terms and definitions are used across Europe’s NFIs. If various entries concerning area were available for one region (e.g. forest area and used forest), we had to select one for the basis of the adjustment to Avitabile et al. (2024). Our approach was to use the category for which values matched best and were available for the most years.

The adjustment factor between forest area reported in official NFI reports and forest area supplied for the harmonized definition of Avitabile et al. (2024) generally is above 1, indicating a more inclusive definition of forest area in Avitabile et al. (2024), with some exceptions (e.g. Germany, Portugal). The interquartile range of adjustment factors is 1.0 to 1.09. The maximum adjustment factor was 2.2 for Bacs-Kiskun county in Hungary (HU331).

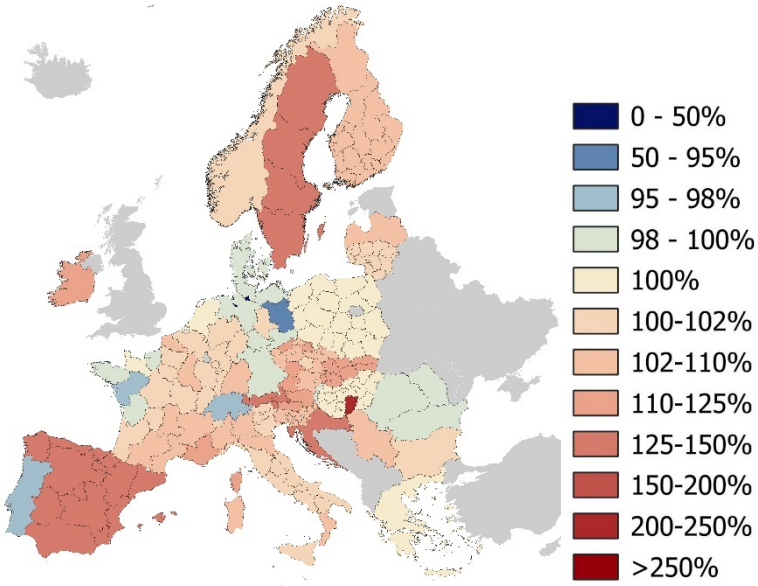

Figure 7: Deviation between forest area officially reported by NFIs and harmonized forest area supplied to Avitabile et al. (2024) (shown as ratio reported/harmonized value).

Forest biomass stock

The biomass stock data collected in Avitabile et al. (2024) includes the aboveground biomass of all living trees, including the stump, stem, branches, and foliage.

The official NFI reports we collected for 2000 to 2020 may differ from this definition regarding which parts of the tree are included in their data. In many cases, NFIs only report "growing stock", which generally does not include branches. Furthermore, NFIs report their stock data in m^3 (over bark), while Avitabile et al. (2024) present the values already converted to tons dry matter (t DM). Presumably, the collaborating NFIs applied their individual conversion factors (from m^3 to t DM), which are not presented in the publication. To compare the data we collected from NFIs with the input in Avitabile et al. (2024) we applied an average European factor of 0.49 (FAO et al., 2020) to convert m^3 reported by NFIs to t DM.

Across all considered regions this results in an interquartile range of adjustment factors between 1.26 and 1.69, in line with the more complete account of biomass stocks aimed for in Avitabile et al. (2024). Some regions in Germany and Romania present adjustment factors below 1, while the highest factors can be found in France.

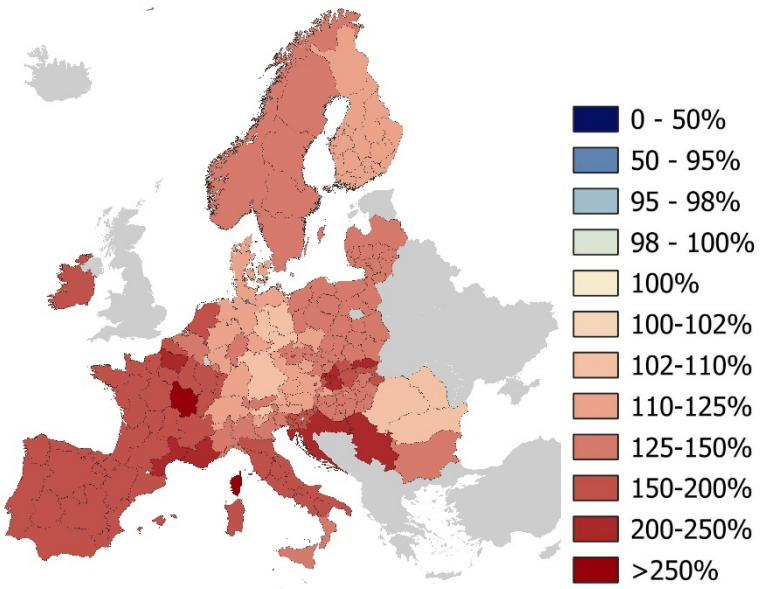

Figure 8: Deviation between forest biomass stocks based on official reports by NFIs and harmonized forest biomass stocks supplied to Avitabile et al. (2024) (shown as ratio reported/harmonized value).

Forestry harvest

We aggregated the available harvest subcategories (across species and categories such as industrial roundwood and wood fuel) from the EUFo-reported database. As harvest data are not included in the harmonization efforts of Avitabile et al. (2024) we used the combination of two data sources to arrive at a probable value with uncertainty information.

The SoEF database reports annual removals in cubic meters solid volume under bark from 1988 to 2022 at the national level and uses a standardized questionnaire to ensure consistency across countries. The national values were distributed sub-nationally based on the NFI data, where available.

The harvest data reported by countries' NFIs and collected in the EUFo-reported database differs regarding the inclusion of bark. For countries reporting removals over bark, we applied national factors for the proportion of bark (derived from the Global Forest Resources Assessment 2000) to estimate the removals under bark. The harvest reports of NFIs also differ regarding the inclusion of logging residues, which is apparent in Figure 6, where inconsistent and unclear terms (such as "felling-wood removed from forest") are present. Since most countries do not offer easily accessible clarification regarding the inclusion of logging residues, we chose to create an upper range of harvest by assuming that logging/harvest residues are generally not included in the data and using extrapolation factors to include them in a second step.

We therefore applied factors to both sets of harvest data to also account for harvest residues, i.e., tree top, branches, stumps, roots. The harvest levels derived from SoEF, where logging residues and bark are definitely not included in the original reports, represented the lower range of harvest levels, in contrast to the NFI-derived value. We used the mean between these two datasets for modeling the annual development of biomass stocks.

2.2.2. Data-gap filling with additional data sources and CRAFT modelling

The CaRbon Accumulation in ForesT (CRAFT) model (Le Noë et al., 2021, 2020) allows to reconstruct long-term changes in carbon stocks and flows in forest ecosystems based on parsimonious input and calibration data and the establishment of a place and time-specific relationship between biomass C stocks and Net Primary Production (NPP). Required input data are annual forest area and harvest plus factors on other losses (e.g. mortality, fire) if no specific data is available. For calibrating the growth parameters r and K of the biomass growth function (Eq. 1) some observed values of biomass stock within the modeling period are necessary as well. The growth parameters are then optimized to produce an annual time-series of biomass stock development (Eq. 2) that best matches these observed biomass stock values. The assessment of model success uses the RMSE between the modeled biomass stock values and the observed biomass stock values. The constraining ranges for the optimization are 0.03 - 0.21 for r, and 100 – 720 tC/ha for K. To represent possible variability of r over time, the additional parameter α was introduced as a linear change factor for r and optimized between 0.8 and 1.2. This allows for a ±20% change of r over the modeling period.

Biomass growth function: $NPP = B_t * r * (1 - {}^{B_t}/_{K})$ with NPP…Net Primary Production B…living biomass stock t…point in time, based on annual steps r…forest growth rate per year K…theoretical maximum carrying capacity	Eq. 1
$B_{t+1} = B_t + NPP - H - m$ with H…harvest including losses (i.e. logging residues) m…natural losses (e.g. mortality, fires, pests,…)	Eq. 2

Gaps in the input data for forest area and harvest were filled with linear interpolation between values and by applying the trend of national statistics on forest area and forestry harvest from the FRA (FAO et al., 2024; FAOSTAT, 2024) before the first and after the last datapoints. Different approaches, using for instance trends derived from remote sensing products are possible.

Table 4: Specifications of forest indicators included in the EUFo-harmonized database.

Indicator	Definition	unit
Forest biomass stock	biomass of all living trees, including the stump, stem, branches, and foliage (aboveground) and roots (belowground)	MtC
Forest area	"land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use" (FAO et al., 2024)	Mha
Forest harvest incl. residues	removed roundwood over bark and harvest/logging residues (above- and belowground, i.e., tree top, branches, stumps, roots)	MtC/yr

2.2.3. Uncertainty assessment for forest indicators

Assessing the status and change of European forest carbon stocks involves several sources of uncertainty:

1) **Data source**: Reporting organizations have different rationales and foci for data collection and preparation. The decision on which data source is most appropriate to rely on to some degree depends on the purpose of the database. In this case, the national NFIs are in principle the best sources for data on the development of forest carbon stocks in Europe. However, their incomparability and partial incompleteness makes the inclusion of other data sources, that might be suboptimal (such as census information on forestry harvest) necessary. We use the deviation between available data sources on a given indicator to quantify uncertainties associated with the estimate.
2) **Expansion factors to include all biomass compartments**: Reported data do often not include all forest biomass compartments. "Growing stock", for instance, does not include branches, and the aboveground biomass data reported in Avitabile et al. (2024) does not include belowground biomass. To assess the total biomass stock in European forests, expansion factors have to be used to account for biomass compartments not reported in available datasets. These factors are derived from case studies, previous datasets or literature and might lead to uncertainties when applied to the wide range of European forests.
3) **Density factors to derive carbon stocks**: The factors used to convert values reported in m^3 fresh weight to tC depend on various characteristics of forests (e.g. species) that are often not reported. General factors are hence applied and might contribute to the uncertainty of the final assessment.
4) **CRAFT model parameters**: The constraints for the optimization of the growth parameters r, K and α (see 2.2.2) are based on a meta-analysis of case studies and literature (Le Noë et al., 2021), but the underlying databases could be expanded when more data become available and further adapted to the European cases. Also, a general factor is used to account for natural mortality as no comprehensive dataset is available to better depict this parameter. It is important to note, however, that for the purpose of this study these parameters are only of secondary interest, while the primary focus lies on the annual biomass stock result.
5) **CRAFT model success**: The CRAFT model does not always manage to match the reported biomass stock values within the constraints of inputs for forest area and harvest and the model parameters. Such cases hint at the possibility of erroneous input or calibration data, as stock-flow consistency cannot be established. This deviation of the model results for biomass stocks from the reported biomass stock values (RMSE) can also be interpreted as a validation measure.

All these factors contribute to the overall uncertainty of the assessment of biomass stocks of European forests. While the uncertainty at the European aggregate level is rather low for all three indicators, certain regions in Spain, France and Hungary show rather high values.

Table 5: Assessment of uncertainties associated with forest indicators of the EUFO-harmonized database.

Forest indicator	Influencing factors	**Uncertainty** for European aggregate
Forest area	• Deviation between harmonized datasets: Avitabile et al. (2024) VS. SoEF	<1% (excluding selected countries with adapted definitions)
Forestry harvest	• Deviation between data sources: SoEF/FAO VS. NFI • Application and accuracy of expansion and density factors	±4%
Forest biomass stock (EUFo-harmonized)	• Uncertainties of input data and model parameters • Model success	±5%

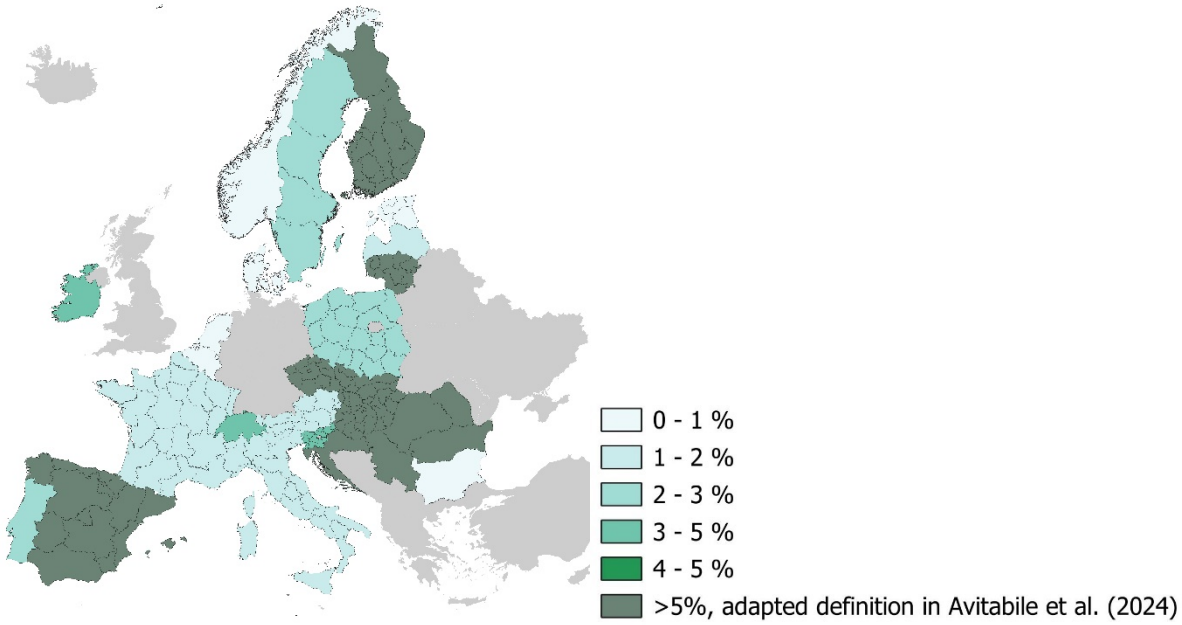

Figure 9: Uncertainty of forest area values, derived from the deviation between data reported in Avitabile et al. (2024) and in SoEF.

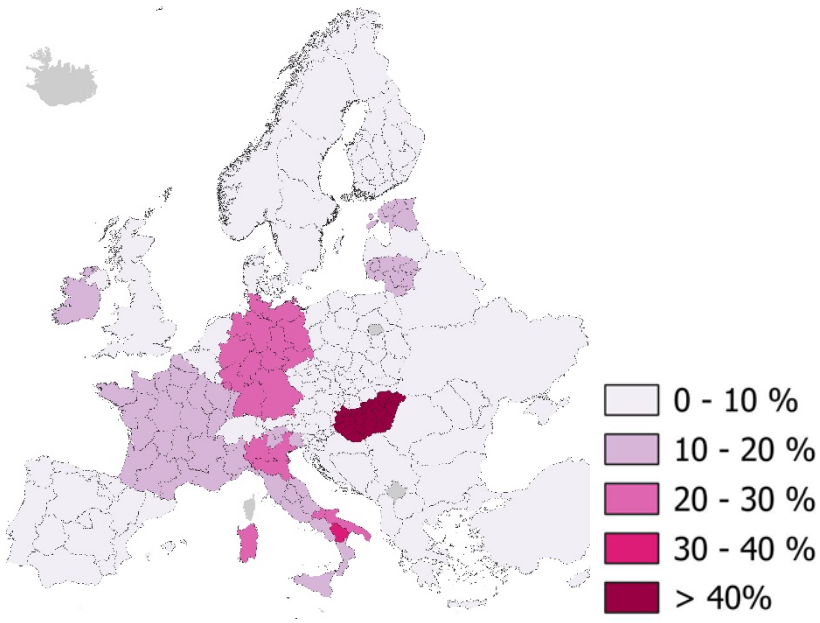

Figure 10: Uncertainty of forestry harvest (right), derived from the deviation between data reported in Avitabile et al. (2024) and in SoEF.

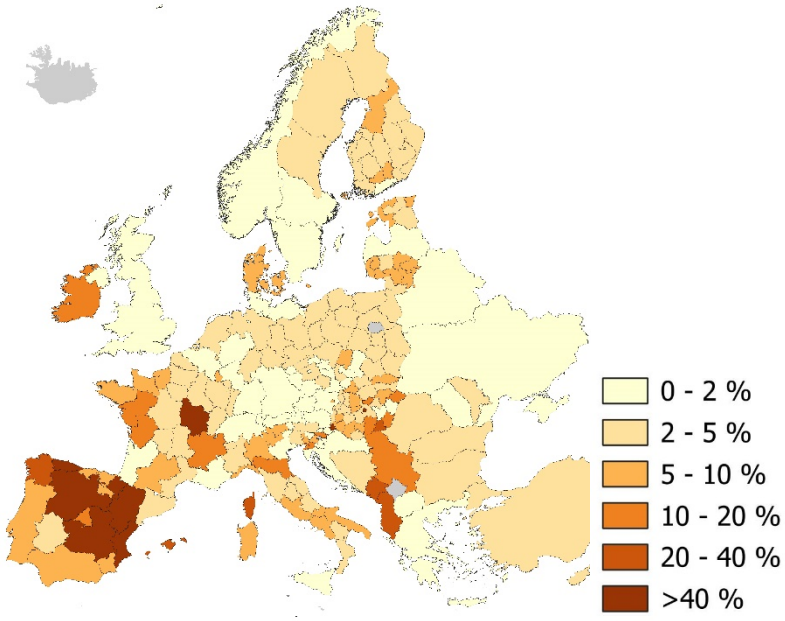

Figure 11: Uncertainty of estimate for forest biomass stock 2000-2020, derived from uncertainty of input data and model success.

Validation of the EUFo database

The EUFo database at sub-national region-level cannot be directly validated against ground measurements; however, several validation methods can be considered, some of which have been (partially) implemented.

1) **Validation through internal consistency**: when creating the EUFo-harmonized database, we acknowledged and operationalized the internal stock-flow consistency of stocks-harvest-increment as a biophysical requirement. Discrepancies within and between reported datasets indicate issues with data collection or a corrupt database and lower the confidence in the obtained results.

2) **Validation through regional experts and stakeholders**: feedback on the robustness of various data sources and an assessment of the plausibility of modeled trajectories have been collected within the ForestNavigator consortium and will be continuously integrated and updated to improve later versions of the database.

3) **Validation through comparison with EO-based products**: the Forest Datacube (Forest Navigator WP2) offers various products with which indicators of the EUFo database can be compared regarding sub-national totals, spatial distribution across Europe and change trajectories. Although these comparisons are not straightforward, as differences in definitions once again become relevant, they are planned in next research steps because they are expected to provide a general assessment of areas of agreement and disagreement.

2.3. Exemplary Results: forest carbon dynamics 2000-2022

Understanding the evolution of biomass stocks at the country level is crucial for capturing dynamic phenomena. This subchapter exemplarily presents some key results for the European aggregate. As significant variations related to forest dynamics prevail within the EU, reflecting e.g. diverse ecological, economic, and policy-driven factors, we also present some interesting country-level results, aiming to document the potential use of the EUFo-database.

The presented annual, consistent database on forest biomass carbon stocks and flows allows to track and compare changes across European regions during the period 2000-2022. In 2022, the EU-27 had a forest area of 166Mha, harvest levels of 210 MtC/yr, and forest biomass stocks of 12.12 GtC. Between 2000 and 2022 forest area increased by 6%, harvest increased by 21% and biomass stocks increased by 19%.

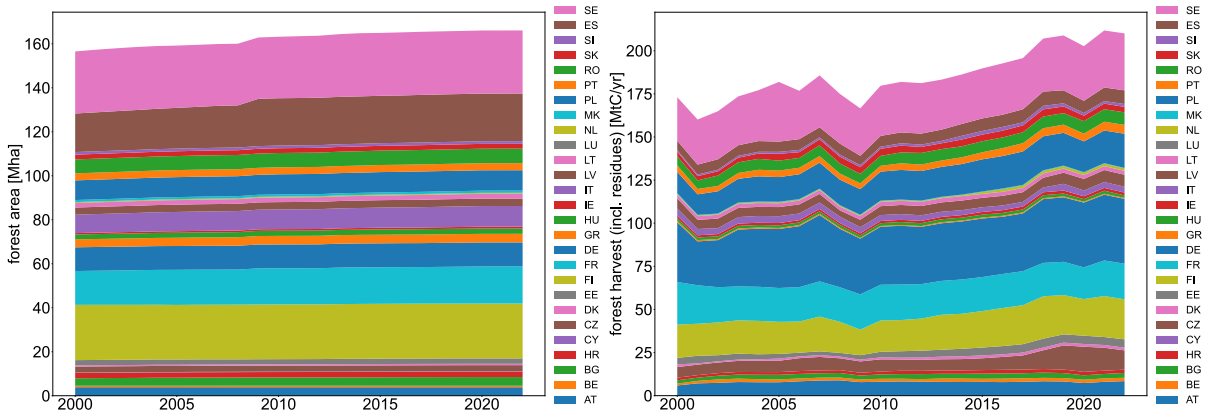

Figure 12: Forest area and harvest of EU-27 (excluding Malta). Note that the forest area increase in Spain (ES) from 2008 to 2009 is due to changes in definition.

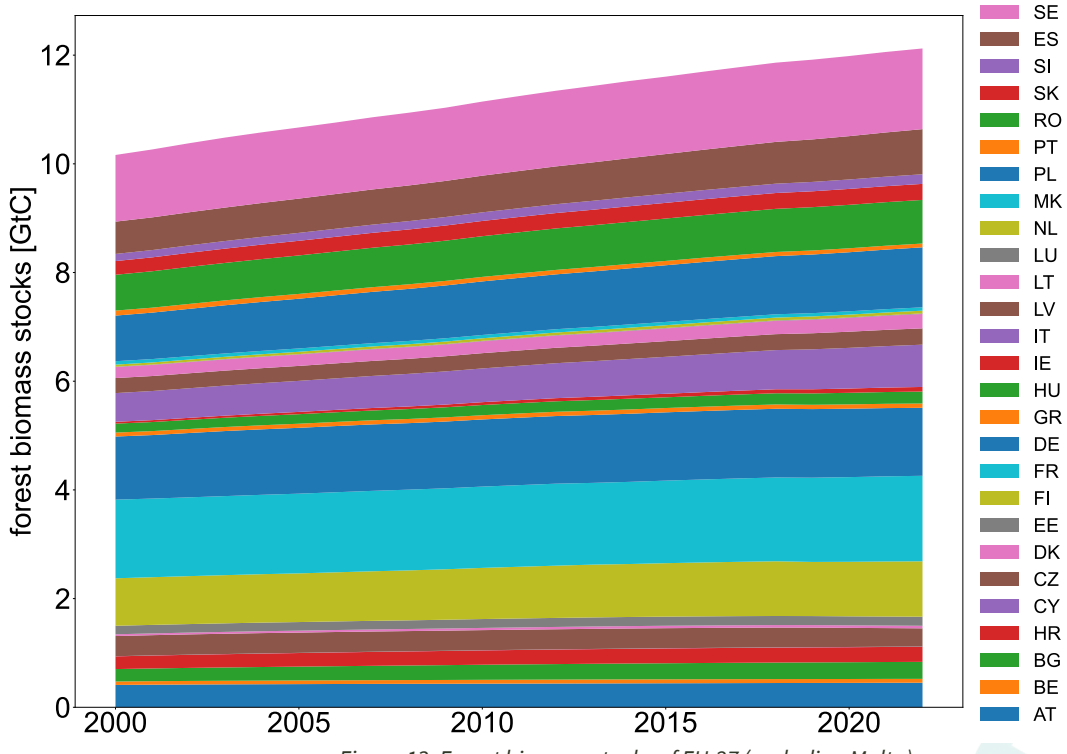

Figure 13: Forest biomass stocks of EU-27 (excluding Malta).

On a national level we find the highest increase in forest biomass stocks in Italy, Spain (Figure 15), Poland, and Sweden (Figure 16).

However, the growth of forest biomass stocks in the EU-27 has slowed down over the period 2000-2022, with the annual C-sink decreasing from ca.100 MtC/yr in the early 2000s to ca.65 MtC/yr around 2020. Considerable decreases in annual C-sinks are found in Sweden, Poland, Romania, Germany, and the Czech Republic (Figure 14A). For the latter two, we even find decreasing forest biomass stocks over the second half of the study period, i.e. the forest acts as a source of carbon (Figure 17). Continued growth of forest biomass stocks seems to be compromised by continuously high and increasing harvest levels and the increasing frequency of natural disturbances (Patacca et al., 2023). In other countries, a general trend of increasing annual C-sinks is found, e.g. in Spain, Italy, France and Lithuania (Figure 14B).

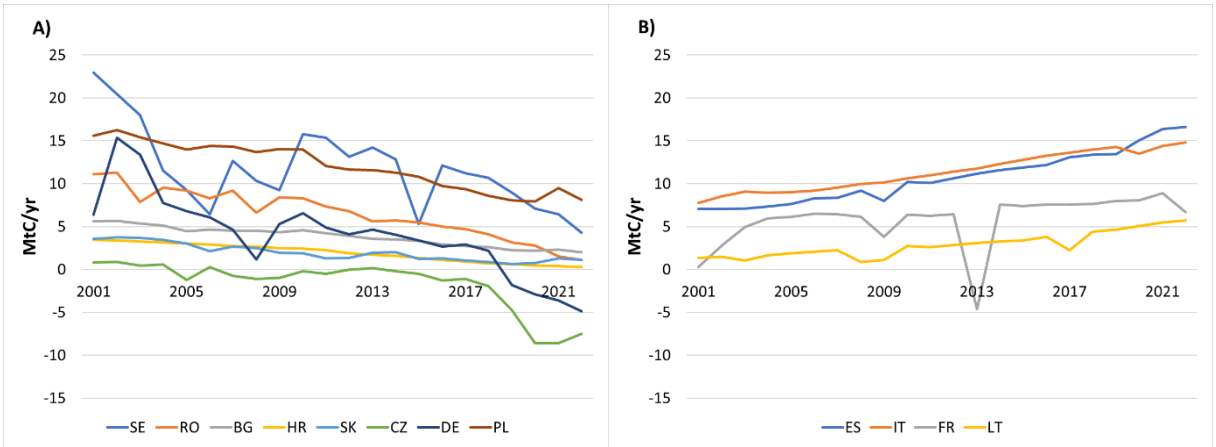

Figure 14: Development of annual C-sinks in forest biomass stocks, for countries showing a decreasing trajectory (A) and countries with an increasing trajectory (B).

Figure 15 shows the aggregate and subnational trends in biomass stocks for Italy, Spain, France and Lithuania, revealing similarities, but also differences at the subnational level. Figure 16 shows the same for Sweden, Poland and Romania.

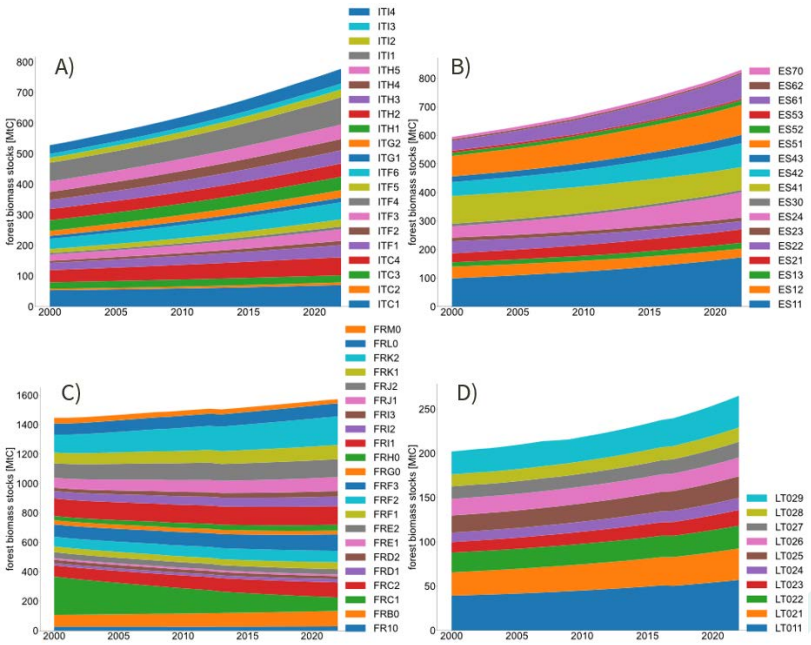

Figure 15: Development of forest biomass stocks in Italy (A), Spain (B), France (C)and Lithuania (D).

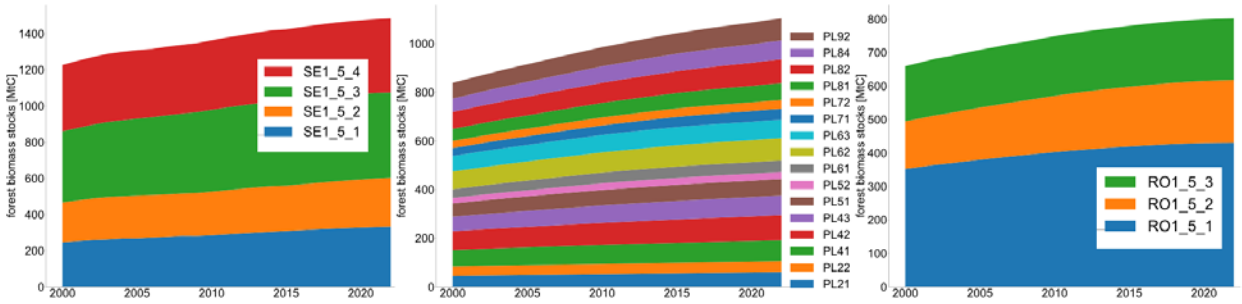

Figure 16: Development of forest biomass stocks in Sweden, Poland, and Romania (panels from left to right).

The sub-national assessment also allows to identify specific sub-national characteristics, for instance in the case of the Czech Republic (CZ) (Figure 16). Here we find that a third of the decline in biomass stock occurred in the southern district of Vysočina (CZ063), while in many other districts the biomass stock remained rather stable over the period (e.g. in Královéhradecký (CZ052)).

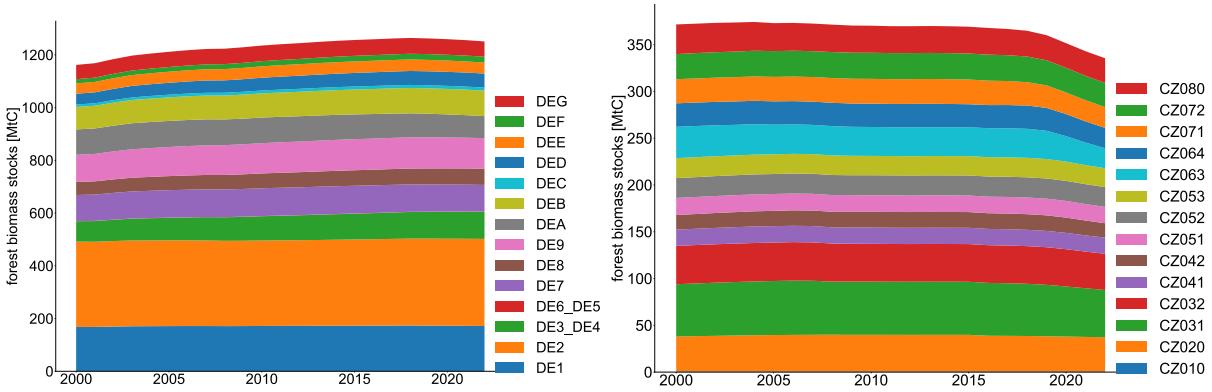

Figure 17: Development of forest biomass stocks in Germany (left) and the Czech Republic (right).

Furthermore, contrasts between sub-national and national trends can be seen, such as in Nordrhein-Westfalen (DEA) in Germany (Figure 17), which is the only sub-national region in Germany to show a decrease (around 13%) in biomass stocks over the period, while overall country level biomass stocks increased slightly (by 8%). Other examples of similar trends at national and regional level can be found in Annex 5.3. Such analyses can help to identify critical regions and inform sub-national forest management strategies.

The EUFo Database is aimed to contribute to further research, both within ForestNavigator and beyond, e.g. in attempts to scrutinize these dynamics, the underlying processes and their ultimate drivers. Of particular interest, besides increasing the capacity for near real-time monitoring (WP2.3), is the need to deepen our understanding of the interplay between natural and anthropogenic disturbances. This includes examining the role of climate change in shaping carbon stocks in European forests, and how past land-use decisions continue to influence current trajectories and define the option spaces for sustainable forest management. Advancing methods to quantify and predict feedback loops between forest dynamics and climate change represents a key research frontier.

Additionally, it will be vital to contrast the option space for forest management or restoration in local and regional contexts with their impacts on ecosystem services. This includes developing an improved understanding of the role wood can play in society, acknowledging limits of sustainable wood provisioning. Strategies aimed at reducing material consumption without jeopardizing human wellbeing will also need to be explored. Together, these efforts will enhance our

understanding of sustainable forestry and its potential role in addressing the grand land-use related challenges of climate change and biodiversity loss. Modeling approaches that integrate socio-economic factors with biophysical processes are planned in WP7 of Forest Navigator which will address these challenges.

3. Conclusion and Outlook

The EUFo database offers a comprehensive collection of data on important forest indicators at the sub-national level. It combines information from NFIs with pan-European and global forest resource assessments, enabling a thorough evaluation of European forest carbon stocks and their trends since 2000. A key advantage of this database is consistency in time, which allows for novel analyses and new insights into recent trends, dynamics and the socioeconomic and natural factors driving them.

However, certain issues pertaining to differences in definition, data-related uncertainties, density and expansion factors, and other inconsistencies in European NFI reporting remain. With the EUFo-harmonized version of the database, we presented one approach for harmonizing European forest data to ensure consistency and comparability across countries. Other approaches are possible and should be developed based on research interest. By quantifying the uncertainty of regional results based on discrepancies between input data, this database represents a basis and potential first step to analyze and eventually overcome inconsistencies. Further comparisons with various other databases, such as EO-derived estimates on, for instance, forest biomass stocks, offer the opportunity for a more complete assessment of future uncertainties as well as informing statistical offices and other monitoring agencies on prioritizing pending improvement steps.

In terms of next steps, the harvest trajectories in the database combined with EO-derived data on forest disturbances (e.g. Viana-Soto and Senf, 2024) are highly relevant for Task 2.3 and will inform the estimation of near-real-time updates of plausible ranges of forestry harvest across Europe. Working towards T7.5, the data collected on international wood supply chains will be linked to scenarios and option spaces for wood extraction compatible with safeguarding carbon sinks in forests.

The EUFo database is first made available to the consortium to gather feedback from regional experts and stakeholders, which can serve as validation and help continually improve and update the database. The database will also be presented in a data-focused publication. Additionally, a publication presenting an analysis of subnational patterns and trajectories of forest use intensity in Europe is planned in 2025.

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5. Annexes

5.1. EUFo-reported: overview of data entries and sources

ID	indicator(s)	source type	authorities responsible for original data	name of original dataset	link to original data	accessed
AT	area, stock, increment, harvest	NFIs 2-4	Bundes Forschungs Zentrum für Wald (BFW)	Waldinventur	https://www.waldinventur.at/	23.08.2023
BG	area, stock, increment, harvest	census*	Executive Forest Agency (EFA)	Sredni_pokazateli_do_2015	http://www.iag.bg/	23.08.2023
CZ	area	NFIs 1&2, census	Forest Management Institute (FMI), Ministry of Agriculture of the Czech Republic	Národní inventarizace lesů, český statistický úřad	https://nil.uhul.cz/en/ /	03.08.2023
	stock, increment	NFI 2	Forest Management Institute (FMI)	Národní inventarizace lesů	https://nil.uhul.cz/en/	03.08.2023
	harvest	NFI2, census	Forest Management Institute (FMI), Ministry of Agriculture of the Czech Republic	Národní inventarizace lesů, český statistický úřad	https://csu.gov.cz/home	03.08.2023
DE	area, stock, increment, harvest	NFIs 3&4	Thünen-Institut	Bundeswaldinventur	https://bwi.info/	20.11.2024
EE	area, stock, increment	census (based on NFIs)	Statistics Estonia	Environment / Natural resources and their use/Forest resources	https://andmed.stat.ee/	24.07.2024
	harvest	census (based on NFIs)	Statistics Estonia	Economy / Forestry	https://andmed.stat.ee/	24.07.2024
ES	area, stock	NFIs 3&4	Ministerio para la Transición Ecológica y el Reto Demográfico	Inventario Forestal Nacional	https://www.miteco.gob.es/	29.08.2023
	harvest	census	Ministerio para la Transición Ecológica y el Reto Demográfico	Anuarios de Estadística Forestal	https://www.miteco.gob.es/	29.08.2023
FI	area, stock, increment	NFIs 9-12 & intermediate to 13	Luke - Natural Resources Institute Finland	Forest statistics / Forest resources	https://www.luke.fi/	04.07.2023
	harvest	census	Luke - Natural Resources Institute Finland	Forest statistics / Structure and production	https://www.luke.fi/	04.07.2023
FR	area, stock, increment, harvest	NFIs 2005-2009, 2009-2014 & 2013-2017	Institut national de l'information géographique et forestière	IGN – Inventaire forestier	https://inventaire-forestier.ign.fr/	28.03.2023
HU	area, stock, harvest	NFIs* 1&2	NFK Forestry Department	Hungarian NFI-1/ NFI-2 Results tables	https://portal.nebih.gov.hu/	20.09.2023
IE	area, stock, increment, harvest	NFIs 1, 2, 3*, 4	Department of Agriculture, Food and the Marine	Ireland's National Forest Inventory	https://www.gov.ie//	22.08.2023
IT	area, stock, increment, harvest	NFIs 2 & 3	Inventario Nazionale delle Foreste e dei serbatoi forestali di Carbonio - INFC	Inventario forestale nazionale italioano	https://www.inventarioforestale.org/	23.08.2023
LT	area, stock, increment, harvest	NFIs* 1 & 2, census*	Valstybinė miškų tarnyba	Lithuanian National Forest Inventory, Lithuanian Statistical Yearbook of Forestry	https://amvmt.lrv.lt/	08.08.2024
LV	area, stock, harvest	census (based on NFIs 1-3)*	Latvijas Valsts mežzinātnes institūts "Silava"	I, II un III cikla kopsavilkumi pa tekošajām piecgadēm (2018. gads) / Summaries of cycles I, II and III running 5 years (2018)	https://www.silava.lv/_	13.04.2023
PL	area, stock, increment, harvest	NFIs 1-3 & intermediate to 4	Biuro Urządzania Lasu i Geodezji Leśnej	Wielkoobszarowa Inwentaryzacja Stanu Lasów	https://www.bdl.lasy.gov.pl/	17.10.2023
RO	area	NFIs 1&2, census*	Centrala Institutului Național de Cercetare-Dezvoltare în Silvicultură (INCDS) , Institutul Național de Statistică	Inventarul forestier național (IFN), TEMPO_AGR	https://roifn.ro/site/ https://insse.ro/	13.04.2023
	stock, increment	NFIs 1&2	Centrala Institutului Național de Cercetare-Dezvoltare în Silvicultură (INCDS)	Inventarul forestier național (IFN)	https://roifn.ro/	13.07.2023
	harvest	census*	Institutul Național de Statistică	TEMPO_AGR	https://insse.ro/	13.04.2023
SE	area, stock, increment, harvest	NFI annually 2000-2016	Riksskogstaxeringen, SLU	Riksskogstaxeringen Officiell statistik om de svenska skogarna	https://skogsstatistik.slu.se/	23.08.2023
SI	area, stock, increment, harvest	NFIs* annually 2004-2017 (without 2010), census*	Zavod za gozdove Slovenije, Republic of Slovenia Statistical Office (SiStat)	Annual Report of the Slovenian Forest Service, Environment/Environmental accounts/ Forest accounts	http://www.zgs.si/ https://pxweb.stat.si/SiStat/sl	13.04.2023

SK	area, stock, harvest	census	Národné lesnicke centrum (NLCSK)	Údaje o lesnom hospodárstve	https://gis.nlcsk.org/	24.07.2024

Table 6: Overview of data entries and sources for forest area, 2000-2010.

cntry_ID		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
AL	id	2000					2005					2010
AL	source type	SoEF					SoEF					SoEF
AT	id	00/02	00/02	00/02					07/09	07/09	07/09	
AT	source type	NFI	NFI	NFI					NFI	NFI	NFI	
BA	id	2000					2005					2010
BA	source type	SoEF					SoEF					SoEF
BE	id	2000					2005					2010
BE	source type	SoEF					SoEF					SoEF
BG	id	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
BG	source type	census	census	census	census	census	census	census	census	census	census	census
BY	id	2000					2005					2010
BY	source type	SoEF					SoEF					SoEF
CH	id	2000					2005					2010
CH	source type	SoEF					SoEF					SoEF
CY	id	2000					2005					2010
CY	source type	SoEF					SoEF					SoEF
CZ	id	2000	2001, NFI I	2002, NFI I	2003, NFI I	2004, NFI I	2005	2006	2007	2008	2009	2010
CZ	source type	census	census, NFI	census, NFI	census, NFI	census, NFI	census, NFI	census	census	census	census	census
DE	id			2								
DE	source type			NFI								
DK	id	2000					2005					2010
DK	source type	SoEF					SoEF					SoEF
EE	id	KK51	KK51	KK51	KK51	KK51	KK51	KK51	KK51	KK51	KK51	KK51
EE	source type	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI
ES	id						2005	2006	2007	2008	2009	2010
ES	source type						NFI	NFI	NFI	NFI	NFI	NFI
FI	id	9	9	9	9	10	10	10	10	10	11	11
FI	source type	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI
FR	id						2005-2009	2005-2009	2005-2009	2005-2009	/2005-2009/2009-2013	2009-2014
FR	source type						NFI	NFI	NFI	NFI	NFI	NFI
GR	id	2000					2005					2010
GR	source type	SoEF					SoEF					SoEF
HR	id	2000					2005					2010
HR	source type	SoEF					SoEF					SoEF
HU	id											Cycle I
HU	source type											NFI
IE	id					NFI1	NFI1	NFI1			NFI2	NFI2
IE	source type					NFI	NFI	NFI			NFI	NFI
IT	id						2005					
IT	source type						NFI					
LT	id	NFI I	NFI I	NFI I	NFI II	NFI II	NFI II	NFI II			2009	
LT	source type	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI		census	
LU	id	2000					2005					2010
LU	source type	SoEF					SoEF					SoEF
LV	id							2006	2007	2008	2009	2010
LV	source type							census	census	census	census	NFI
MD	id	2000					2005					2010
MD	source type	SoEF					SoEF					SoEF
ME	id	2000					2005					2010
ME	source type	SoEF					SoEF					SoEF
MK	id	2000					2005					2010
MK	source type	SoEF					SoEF					SoEF
MT	id	2000					2005					2010
MT	source type	SoEF					SoEF					SoEF
NL	id	2000					2005					2010
NL	source type	SoEF					SoEF					SoEF
NO	id	2000					2005					2010
NO	source type	SoEF					SoEF					SoEF
PL	id						I	I	I	I	I	II
PL	source type						NFI	NFI	NFI	NFI	NFI	NFI
PT	id	2000					2005					2010
PT	source type	SoEF					SoEF					SoEF
RO	id	2000	2001	2002	2003	2004	2005	2006	2007	2008, Cycle I	2009, Cycle I	2010, Cycle I
RO	source type	census	census	census	census	census	census	census	census	census, NFI	census, NFI	census, NFI
RS	id	2000					2005					2010
RS	source type	SoEF					SoEF					SoEF
RU	id	2000					2005					2010
RU	source type	SoEF					SoEF					SoEF
SE	id	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
SE	source type	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI
SI	id	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
SI	source type	census	census	census	census	NFI	NFI	NFI	NFI	NFI	NFI	census
SK	id											2010
SK	source type											census
TR	id	2000					2005					2010
TR	source type	SoEF					SoEF					SoEF
GB	id	2000					2005					2010
GB	source type	SoEF					SoEF					SoEF
UK	id	2000					2005					2010
UK	source type	SoEF					SoEF					SoEF

Table 7: Overview of data entries and sources for forest area, 2011-2022.

cntry_ID		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
AL	id					2015					2020		
AL	source type					SoEF					SoEF		
AT	id						16/21	16/21	16/21	16/21	16/21	16/21	
AT	source type						NFI	NFI	NFI	NFI	NFI	NFI	
BA	id					2015					2020		
BA	source type					SoEF					SoEF		
BE	id					2015					2020		
BE	source type					SoEF					SoEF		
BG	id	2011	2012	2013	2014	2015	2016	2017					
BG	source type	census	census	census	census	census	census	census					
BY	id					2015					2020		
BY	source type					SoEF					SoEF		
CH	id					2015					2020		
CH	source type					SoEF					SoEF		
CY	id					2015					2020		
CY	source type					SoEF					SoEF		
CZ	id	2011, NFI II	2012, NFI II	2013, NFI II	2014, NFI II	2015, NFI II	2016	2017	2018	2019	2020		
CZ	source type	census, NFI	census, NFI	census, NFI	census, NFI	census, NFI	census	census	census	census	census		
DE	id		3										4
DE	source type		NFI										NFI
DK	id					2015					2020		
DK	source type					SoEF					SoEF		
EE	id	KK51	KK51	KK51	KK51	KK51	KK51	KK51	KK51				
EE	source type	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI				
ES	id	2011	2012	2013		2015	2016	2017	2018				
ES	source type	NFI	NFI	NFI		NFI	NFI	NFI	NFI				
FI	id	11	11	11	12	12	12	12	12	12/13	12/13	12/13	
FI	source type	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	
FR	id	2009-2015	2009-2016	2013-2017	2013-2017	2013-2017	2013-2017	2013-2017					
FR	source type	NFI	NFI	NFI	NFI	NFI	NFI	NFI					
GR	id					2015					2020		
GR	source type					SoEF					SoEF		
HR	id					2015					2020		
HR	source type					SoEF					SoEF		
HU	id	Cycle I	Cycle I	Cycle I	Cycle I	Cycle II	Cycle II	Cycle II	Cycle II	Cycle II			
HU	source type	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI				
IE	id	NFI2	NFI2			NFI3	NFI3	NFI3			NFI4	NFI4	NFI4
IE	source type	NFI	NFI			NFI	NFI	NFI			NFI	NFI	NFI
IT	id					2015							
IT	source type					NFI							
LT	id						2016						
LT	source type						census						
LU	id					2015					2020		
LU	source type					SoEF					SoEF		
LV	id	2011	2012	2013	2014	2015	2016						
LV	source type	NFI	NFI	NFI	NFI	NFI	NFI						
MD	id					2015					2020		
MD	source type					SoEF					SoEF		
ME	id					2015					2020		
ME	source type					SoEF					SoEF		
MK	id					2015					2020		
MK	source type					SoEF					SoEF		
MT	id					2015					2020		
MT	source type					SoEF					SoEF		
NL	id					2015					2020		
NL	source type					SoEF					SoEF		
NO	id					2015					2020		
NO	source type					SoEF					SoEF		
PL	id	II	II	II	II	III	III	III	III	III	WISL 2018 - 2022	WISL 2018 - 2022	WISL 2018 - 2022
PL	source type	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI
PT	id					2015					2020		
PT	source type					SoEF					SoEF		
RO	id	2011, Cycle I	2012, Cycle I	2013, Cycle II	2014, Cycle II	2015, Cycle II	2016, Cycle II	2017, Cycle II	2018, Cycle II	2019, Cycle III	2020, Cycle III	2021, Cycle III	2022, Cycle III
RO	source type	census, NFI	census, NFI	census, NFI	census, NFI	census, NFI	census, NFI	census, NFI	census, NFI	census, NFI	census, NFI	census, NFI	census, NFI
RS	id					2015					2020		
RS	source type					SoEF					SoEF		
RU	id					2015					2020		
RU	source type					SoEF					SoEF		
SE	id	2011	2012	2013	2014	2015	2016						
SE	source type	NFI	NFI	NFI	NFI	NFI	NFI						
SI	id	2011	2012	2013	2014	2015	2016	2017					
SI	source type	NFI	NFI	NFI	NFI	NFI	NFI	NFI					
SK	id	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
SK	source type	census	census	census	census	census	census	census	census	census	census	census	census
TR	id					2015					2020		
TR	source type					SoEF					SoEF		
GB	id					2015					2020		
GB	source type					SoEF					SoEF		
UK	id					2015					2020		
UK	source type					SoEF					SoEF		

Table 8: Overview of data entries and sources for forest biomass stock, 2000-2010.

cntry_ID		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2002	2003	2004	2005	2006	2007	2008	2009	2010
AL	id	1990									2000					2005					2010
AL	source type	SoEF									SoEF					SoEF					SoEF
AT	id		92/96	92/96	92/96	92/96	92/96				00/02	00/02	00/02					07/09	07/09	07/09	
AT	source type		NFI	NFI	NFI	NFI	NFI				NFI	NFI	NFI					NFI	NFI	NFI	
BA	id	1990									2000					2005					2010
BA	source type	SoEF									SoEF					SoEF					SoEF
BE	id	1990									2000					2005					2010
BE	source type	SoEF									SoEF					SoEF					SoEF
BG	id	1990				1995					2000					2005					2010
BG	source type	census				census					census					census					census
BY	id	1990									2000					2005					2010
BY	source type	SoEF									SoEF					SoEF					SoEF
CH	id	1990									2000					2005					2010
CH	source type	SoEF									SoEF					SoEF					SoEF
CY	id	1990									2000					2005					2010
CY	source type	SoEF									SoEF					SoEF					SoEF
CZ	id																				
CZ	source type																				
DE	id												2								
DE	source type												NFI								
DK	id	1990									2000					2005					2010
DK	source type	SoEF									SoEF					SoEF					SoEF
EE	id									KK51	KK51	KK51	KK51	KK51	KK51	KK51	KK51	KK51	KK51	KK51	KK51
EE	source type									NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI
ES	id	1990	1991	1992	1993	1994	1996	1997	1998	1999	2000	2001	2002	2004		2005	2006	2008	2009		2010
ES	source type	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI		NFI	NFI	NFI	NFI		NFI
FI	id	8	8	8	8	8	9	9	9	9	9	9	9	9	10	10	10	10	10	11	11
FI	source type	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI
FR	id															2005-2009	2005-2009	2005-2009	2005-2009	2005-2009/2009-2013	2009-2014
FR	source type															NFI	NFI	NFI	NFI	NFI	NFI
GR	id	1990									2000					2005					2010
GR	source type	SoEF									SoEF					SoEF					SoEF
HR	id	1990									2000					2005					2010
HR	source type	SoEF									SoEF					SoEF					SoEF
HU	id																				Cycle I
HU	source type																				NFI
IE	id														NFI1	NFI1	NFI1			NFI2	NFI2
IE	source type														NFI	NFI	NFI			NFI	NFI
IT	id															2005					
IT	source type															NFI					
LT	id								NFI I	NFI I	NFI I	NFI I	NFI I	NFI II	NFI II	NFI II	NFI II	NFI II		2009	
LT	source type								NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI		census	
LU	id	1990									2000					2005					2010
LU	source type	SoEF									SoEF					SoEF					SoEF
LV	id																2006	2007	2008	2009	2010
LV	source type																census	census	census	census	NFI
MD	id	1990									2000					2005					2010
MD	source type	SoEF									SoEF					SoEF					SoEF
ME	id	1990									2000					2005					2010
ME	source type	SoEF									SoEF					SoEF					SoEF
MK	id	1990									2000					2005					2010
MK	source type	SoEF									SoEF					SoEF					SoEF
MT	id	1990									2000					2005					2010
MT	source type	SoEF									SoEF					SoEF					SoEF
NL	id	1990									2000					2005					2010
NL	source type	SoEF									SoEF					SoEF					SoEF
NO	id	1990									2000					2005					2010
NO	source type	SoEF									SoEF					SoEF					SoEF
PL	id															I	I	I	I	I	II
PL	source type															NFI	NFI	NFI	NFI	NFI	NFI
PT	id	1990									2000					2005					2010
PT	source type	SoEF									SoEF					SoEF					SoEF
RO	id																		Cycle I	Cycle I	Cycle I
RO	source type																		NFI	NFI	NFI
RS	id	1990									2000					2005					2010
RS	source type	SoEF									SoEF					SoEF					SoEF
RU	id	1990									2000					2005					2010
RU	source type	SoEF									SoEF					SoEF					SoEF
SE	id															2005	2006	2007	2008	2009	2010
SE	source type															NFI	NFI	NFI	NFI	NFI	NFI
SI	id				1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
SI	source type				census	census	census	census	census	census	census	census	census	census	NFI	NFI	NFI	NFI	NFI	NFI	census
SK	id																				2010
SK	source type																				census
TR	id	1990									2000					2005					2010
TR	source type	SoEF									SoEF					SoEF					SoEF
GB	id	1990									2000					2005					2010
GB	source type	SoEF									SoEF					SoEF					SoEF
UK	id	1990									2000					2005					2010
UK	source type	SoEF									SoEF					SoEF					SoEF

Table 9: Overview of data entries and sources for forest biomass stock, 2011-2022.

cntry_ID		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
AL	id					2015							
AL	source type					SoEF							
AT	id						16/21	16/21	16/21	16/21	16/21	16/21	
AT	source type						NFI	NFI	NFI	NFI	NFI	NFI	
BA	id					2015					2020		
BA	source type					SoEF					SoEF		
BE	id					2015					2020		
BE	source type					SoEF					SoEF		
BG	id					2015							
BG	source type					census							
BY	id					2015					2020		
BY	source type					SoEF					SoEF		
CH	id					2015					2020		
CH	source type					SoEF					SoEF		
CY	id					2015							
CY	source type					SoEF							
CZ	id	NFI II	NFI II	NFI II	NFI II								
CZ	source type	NFI	NFI	NFI	NFI								
DE	id		3										4
DE	source type		NFI										NFI
DK	id					2015					2020		
DK	source type					SoEF					SoEF		
EE	id	KK51	KK51	KK51	KK51	KK51	KK51	KK51	KK51				
EE	source type	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI				
ES	id	2011	2012	2013		2015		2017	2018				
ES	source type	NFI	NFI	NFI		NFI							
FI	id	11	11	11	12	12	12	12	12	12/13	12/13	12/13	
FI	source type	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	
FR	id	2009-2015	2009-2016	2013-2017	2013-2017	2013-2017	2013-2017	2013-2017					
FR	source type	NFI	NFI	NFI	NFI	NFI	NFI	NFI					
GR	id					2015							
GR	source type					SoEF							
HR	id					2015					2020		
HR	source type					SoEF					SoEF		
HU	id	Cycle I	Cycle I	Cycle I	Cycle I	Cycle II	Cycle II	Cycle II	Cycle II	Cycle II			
HU	source type	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI			
IE	id	NFI2	NFI2			NFI3	NFI3	NFI3			NFI4	NFI4	NFI4
IE	source type	NFI	NFI			NFI	NFI	NFI			NFI	NFI	NFI
IT	id					2015							
IT	source type					NFI							
LT	id					2015	2016	2017					
LT	source type					census	census	census					
LU	id					2015					2020		
LU	source type					SoEF					SoEF		
LV	id	2011	2012	2013	2014	2015	2016						
LV	source type	NFI	NFI	NFI	NFI	NFI	NFI						
MD	id					2015					2020		
MD	source type					SoEF					SoEF		
ME	id					2015					2020		
ME	source type					SoEF					SoEF		
MK	id					2015					2020		
MK	source type					SoEF					SoEF		
MT	id					2015							
MT	source type					SoEF							
NL	id					2015					2020		
NL	source type					SoEF					SoEF		
NO	id					2015					2020		
NO	source type					SoEF					SoEF		
PL	id	II	II	II	II	III	III	III	III	III	WISL 2018 - 2022	WISL 2018 - 2022	WISL 2018 - 2022
PL	source type	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI
PT	id					2015							
PT	source type					SoEF							
RO	id	Cycle I	Cycle I	Cycle II	Cycle II	Cycle II	Cycle II	Cycle II	Cycle II				
RO	source type	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI				
RS	id					2015							
RS	source type					SoEF							
RU	id					2015							
RU	source type					SoEF							
SE	id	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020		
SE	source type	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI		
SI	id	2011	2012	2013	2014	2015	2016	2017					
SI	source type	NFI	NFI	NFI	NFI	NFI	NFI	NFI					
SK	id	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
SK	source type	census	census	census	census	census	census	census	census	census	census	census	census
TR	id					2015					2020		
TR	source type					SoEF					SoEF		
GB	id					2015					2020		
GB	source type					SoEF					SoEF		
UK	id					2015					2020		
UK	source type					SoEF					SoEF		

Table 10: Overview of data entries and sources for forest increment, 2000-2010.

cntry_ID		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2002	2003	2004	2005	2006	2007	2008	2009	2010
AL	id																				
AL	source type																				
AT	id	92/96	92/96	92/96	92/96	00/02	00/02	00/02	00/02	00/02	00/02	07/09	07/09	07/09	07/09	07/09	07/09	07/09	16/21	16/21	16/21
AT	source type	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI
BA	id																				
BA	source type																				
BE	id																				
BE	source type																				
BG	id	1990				1995					2000					2005					2010
BG	source type	census				census					census					census					census
BY	id	1990									2000					2005					2010
BY	source type	SoEF									SoEF					SoEF					SoEF
CH	id																				
CH	source type																				
CY	id																				
CY	source type																				
CZ	id	1990									2000					NFI I & NFI II	NFI I & NFI II	NFI I & NFI II	NFI I & NFI II	NFI I & NFI II	2010, NFI I & NFI II
CZ	source type	census									census					NFI	NFI	NFI	NFI	NFI	census, NFI
DE	id												3	3	3	3	3	3	3	3	3
DE	source type												NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI
DK	id	1990									2000					2005					2010
DK	source type	SoEF									SoEF					SoEF					SoEF
EE	id									KK51	KK51	KK51	KK51	KK51	KK51	KK51	KK51	KK51	KK51	KK51	KK51
EE	source type									NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI
ES	id																				
ES	source type																				
FI	id	9	9	9	9	9	9	9	9	10	10	10	10	10	10	10	10	10	10	11	11
FI	source type	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI
FR	id															2005-2009	2005-2009	2005-2009	2005-2009	2005-2009/2009-2013	2009-2014
FR	source type															NFI	NFI	NFI	NFI	NFI	NFI
GR	id																				
GR	source type																				
HR	id	1990									2000					2005					2010
HR	source type	SoEF									SoEF					SoEF					SoEF
HU	id																				
HU	source type																				
IE	id														NFI1	NFI1	NFI1			NFI2	NFI2
IE	source type														NFI	NFI	NFI			NFI	NFI
IT	id															2005					
IT	source type															NFI					
LT	id								NFI I	NFI I	NFI I	NFI I	NFI I	NFI II	NFI II	NFI II	NFI II	NFI II		2009	
LT	source type								NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI		census	
LU	id																				
LU	source type																				
LV	id																				
LV	source type																				
MD	id																				
MD	source type																				
ME	id																				
ME	source type																				
MK	id																				
MK	source type																				
MT	id																				
MT	source type																				
NL	id	1990									2000					2005					2010
NL	source type	SoEF									SoEF					SoEF					SoEF
NO	id	1990									2000					2005					2010
NO	source type	SoEF									SoEF					SoEF					SoEF
PL	id															II	II	II	II	II	III
PL	source type															NFI	NFI	NFI	NFI	NFI	NFI
PT	id																				
PT	source type																				
RO	id																				Cycle II
RO	source type																				NFI
RS	id																				
RS	source type																				
RU	id																				
RU	source type																				

SE	id	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
SE	source type	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI
SI	id					1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
SI	source type					census	census	census	census	census	census	census	census	census	census	NFI	NFI	NFI	NFI	NFI	NFI	census
SK	id																					
SK	source type																					
TR	id	1990										2000					2005					2010
TR	source type	SoEF										SoEF					SoEF					SoEF
GB	id	1990										2000					2005					2010
GB	source type	SoEF										SoEF					SoEF					SoEF
UK	id	1990										2000					2005					2010
UK	source type	SoEF										SoEF					SoEF					SoEF

Table 11: Overview of data entries and sources for forest increment, 2011-2020.

cntry_ID		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
AL	id												
AL	source type												
AT	id	16/21	16/21	16/21	16/21	16/21	16/21	16/21	16/21				
AT	source type	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI				
BA	id												
BA	source type												
BE	id												
BE	source type												
BG	id					2015							
BG	source type					census							
BY	id					2015							
BY	source type					SoEF							
CH	id												
CH	source type												
CY	id												
CY	source type												
CZ	id	NFI I & NFI II		2013	2014	2015	2016	2017					
CZ	source type	NFI		census	census	census	census	census					
DE	id	3	3	4	4	4	4	4	4	4	4	4	4
DE	source type	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI
DK	id					2015							
DK	source type					SoEF							
EE	id	KK51	KK51	KK51	KK51	KK51	KK51	KK51	KK51				
EE	source type	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI				
ES	id												
ES	source type												
FI	id	11	11	11	11	11	12	12					
FI	source type	NFI	NFI	NFI	NFI	NFI	NFI	NFI					
FR	id	2009-2015	2009-2016	2013-2017	2013-2017	2013-2017	2013-2017	2013-2017					
FR	source type	NFI	NFI	NFI	NFI	NFI	NFI	NFI					
GR	id												
GR	source type												
HR	id					2015							
HR	source type					SoEF							
HU	id												
HU	source type												
IE	id	NFI2	NFI2			NFI3	NFI3	NFI3			NFI4	NFI4	NFI4
IE	source type	NFI	NFI			NFI	NFI	NFI			NFI	NFI	NFI
IT	id					2015							
IT	source type					NFI							
LT	id					2015	2016	2017					
LT	source type					census	census	census					
LU	id												
LU	source type												
LV	id												
LV	source type												
MD	id												
MD	source type												
ME	id												
ME	source type												
MK	id												
MK	source type												
MT	id												
MT	source type												
NL	id					2015							
NL	source type					SoEF							
NO	id					2015							
NO	source type					SoEF							
PL	id	III	III	III	III	WISL 2018 - 2022	WISL 2018 - 2022	WISL 2018 - 2022	WISL 2018 - 2022	WISL 2018 - 2022			
PL	source type	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI			
PT	id												
PT	source type												
RO	id	Cycle II	Cycle II	Cycle II	Cycle II	Cycle II							
RO	source type	NFI	NFI	NFI	NFI	NFI							
RS	id												
RS	source type												
RU	id												
RU	source type												
SE	id	2011	2012	2013	2014	2015	2016						
SE	source type	NFI	NFI	NFI	NFI	NFI	NFI						
SI	id	2011	2012	2013	2014	2015	2016	2017					
SI	source type	NFI	NFI	NFI	NFI	NFI	NFI	NFI					
SK	id												
SK	source type												
TR	id					2015							
TR	source type					SoEF							
GB	id					2015							
GB	source type					SoEF							
UK	id					2015							
UK	source type					SoEF							

Table 12: Overview of data entries and sources for forest harvest, 2000-2010.

cntry_ID				2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
AL	id	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008		2009	2010	
AL	source type	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF		SoEF	
AT	id	92/96	92/96	92/96	92/96	00/02	00/02	00/02	00/02	00/02	00/02	00/02	07/09	07/09	07/09	07/09	07/09	07/09	07/09	16/21	16/21		16/21	
AT	source type	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI		NFI	
BA	id			1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008		2009	2010	
BA	source type			SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF		SoEF	
BE	id	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008		2009	2010	
BE	source type	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF		SoEF	
BG	id	1990					1995					2000					2005						2010	
BG	source type	census					census					census					census						census	
BY	id										1999	2000	2001	2002	2003	2004	2005	2006	2007	2008		2009	2010	
BY	source type										SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF		SoEF	
CH	id	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008		2009	2010	
CH	source type	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF		SoEF	
CY	id																							
CY	source type																							
CZ	id											2000	2001	2002	2003	2004	2005	2006	2007	2008		2009	2010	
CZ	source type											census	census	census	census	census	census	census	census	census	census		census	
DE	id														3	3	3	3	3	3	3	3	3	3
DE	source type													NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI		NFI	
DK	id	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008		2009	2010	
DK	source type	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF		SoEF	
EE	id										KK51	KK51	KK51	KK51	KK51	KK51	KK51	KK51	KK51	KK51	KK51		KK51	
EE	source type										NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI		NFI	
ES	id																2005	2006	2007	2008		2009	2010	
ES	source type																census	census	census	census	census		census	
FI	id							1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008		2009	2010	
FI	source type							census	census	census	census	census	census	census	census	census	census	census	census	census	census		census	
FR	id																2005-2009	2005-2009	2005-2009	2005-2009	2005-2009/2009-2013		2009-2014	
FR	source type																NFI	NFI	NFI	NFI	NFI		NFI	
GR	id	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008		2009	2010	
GR	source type	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF		SoEF	
HR	id																						2010	
HR	source type																						SoEF	
HU	id																						Cycle I	
HU	source type																						NFI	
IE	id															NFI1	NFI1	NFI1			NFI2		NFI2	
IE	source type															NFI	NFI	NFI			NFI		NFI	
IT	id																2005							
IT	source type																NFI							
LT	id		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008		2009	2010	
LT	source type		census	census	census	census	census	census	census	census	census	census	census	census	census	census	census	census	census	census	census		census	
LU	id										1999	2000	2001	2002	2003	2004	2005	2006	2007	2008		2009	2010	
LU	source type										SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF		SoEF	
LV	id																							
LV	source type																							
MD	id						1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008		2009	2010	
MD	source type						SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF		SoEF	
ME	id															2004	2005	2006	2007	2008		2009	2010	
ME	source type															SoEF	SoEF	SoEF	SoEF	SoEF	SoEF		SoEF	
MK	id				1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008		2009	2010	
MK	source type				SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF		SoEF	
MT	id																							
MT	source type																							
NL	id	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008		2009	2010	
NL	source type	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF		SoEF	
NO	id	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008		2009	2010	
NO	source type	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF		SoEF	
PL	id																II	II	II	II	II		III	
PL	source type																NFI	NFI	NFI	NFI	NFI		NFI	
PT	id	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008		2009	2010	
PT	source type	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF		SoEF	
RO	id	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008		2009	2010	
RO	source type	census	census	census	census	census	census	census	census	census	census	census	census	census	census	census	census	census	census	census	census		census	
RS	id																	2006	2007	2008		2009	2010	
RS	source type																	SoEF	SoEF	SoEF	SoEF		SoEF	
RU	id			1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008		2009	2010	
RU	source type			SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF		SoEF	
SE	id	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008		2009	2010	
SE	source type	census	census	census	census	census	census	census	census	census	census	census	census	census	census	census	census	census	census	census	census		census	
SI	id					1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009		2010	
SI	source type					census	census	census	census	census	census	census	census	census	census	NFI	NFI	NFI	NFI	NFI	NFI		census	
SK	id																							
SK	source type																							
TR	id	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008		2009	2010	
TR	source type	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF		SoEF	
GB	id	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008		2009	2010	
GB	source type	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF		SoEF	
UK	id						1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008		2009	2010	
UK	source type						SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF		SoEF	

Table 13: Overview of data entries and sources for forest harvest, 2011-2022.

cntry_ID		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
AL	id	2011	2012	2013	2014	2015	2016	2017					
AL	source type	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF					
AT	id	16/21	16/21	16/21	16/21	16/21	16/21	16/21	16/21				
AT	source type	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI				
BA	id	2011	2012	2013	2014	2015	2016	2017					
BA	source type	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF					
BE	id	2011	2012			2015							
BE	source type	SoEF	SoEF			SoEF							
BG	id					2015							
BG	source type					census							
BY	id	2011	2012	2013	2014	2015	2016	2017					
BY	source type	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF					
CH	id	2011	2012	2013	2014	2015	2016	2017					
CH	source type	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF					
CY	id			2013	2014	2015	2016						
CY	source type			SoEF	SoEF	SoEF	SoEF						
CZ	id	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020		
CZ	source type	census	census	census	census	census	census	census	census	census	census		
DE	id	3	3	4	4	4	4	4	4	4	4	4	4
DE	source type	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI
DK	id	2011	2012	2013	2014	2015	2016	2017					
DK	source type	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF					
EE	id	KK51	KK51	KK51	KK51	KK51	KK51	KK51	KK51				
EE	source type	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI				
ES	id	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020		
ES	source type	census	census	census	census	census	census	census	census	census	census		
FI	id	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
FI	source type	census	census	census	census	census	census	census	census	census	census	census	census
FR	id	2009-2015	2009-2016	2013-2017	2013-2017	2013-2017	2013-2017	2013-2017					
FR	source type	NFI	NFI	NFI	NFI	NFI	NFI	NFI					
GR	id	2011	2012	2013	2014	2015	2016						
GR	source type	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF						
HR	id	2011	2012	2013	2014	2015	2016	2017					
HR	source type	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF					
HU	id	Cycle I	Cycle I	Cycle I	Cycle I	Cycle II	Cycle II	Cycle II	Cycle II	Cycle II			
HU	source type	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI			
IE	id	NFI2	NFI2			NFI3	NFI3	NFI3			NFI4	NFI4	NFI4
IE	source type	NFI	NFI			NFI	NFI	NFI			NFI	NFI	NFI
IT	id					2015							
IT	source type					NFI							
LT	id	2011	2012	2013	2014	2015							
LT	source type	census	census	census	census	census							
LU	id	2011	2012	2013	2014	2015	2016						
LU	source type	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF						
LV	id	2011	2012	2013	2014	2015	2016						
LV	source type	NFI	NFI	NFI	NFI	NFI	NFI						
MD	id	2011		2013	2014	2015	2016						
MD	source type	SoEF		SoEF	SoEF	SoEF	SoEF						
ME	id	2011	2012	2013	2014	2015	2016	2017					
ME	source type	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF					
MK	id	2011		2013	2014	2015	2016						
MK	source type	SoEF		SoEF	SoEF	SoEF	SoEF						
MT	id												
MT	source type												
NL	id	2011	2012	2013	2014	2015	2016	2017					
NL	source type	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF					
NO	id	2011	2012	2013	2014	2015	2016	2017					
NO	source type	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF					
PL	id	III	III	III	III	WISL 2018 - 2022	WISL 2018 - 2022	WISL 2018 - 2022	WISL 2018 - 2022	WISL 2018 - 2022			
PL	source type	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI	NFI			
PT	id	2011	2012	2013	2014	2015	2016	2017					
PT	source type	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF					
RO	id	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
RO	source type	census	census	census	census	census	census	census	census	census	census	census	census
RS	id	2011		2013	2014	2015	2016						
RS	source type	SoEF		SoEF	SoEF	SoEF	SoEF						
RU	id	2011	2012	2013	2014	2015	2016						
RU	source type	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF						
SE	id	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
SE	source type	census	census	census	census	census	census	census	census	census	census	census	census
SI	id	2011	2012	2013	2014	2015	2016	2017					
SI	source type	NFI	NFI	NFI	NFI	NFI	NFI	NFI					
SK	id		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
SK	source type		census	census	census	census	census	census	census	census	census	census	census
TR	id	2011	2012	2013	2014	2015	2016	2017					
TR	source type	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF					
GB	id	2011	2012	2013	2014	2015	2016	2017					
GB	source type	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF					
UK	id	2011	2012	2013	2014	2015	2016	2017					
UK	source type	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF	SoEF					

5.2. NUTS+ region classification

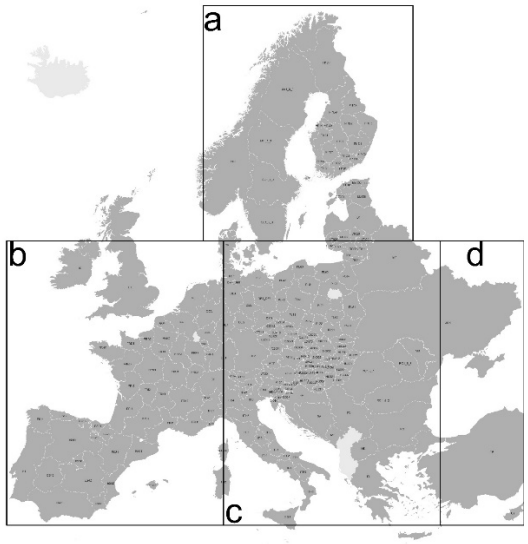

Figure 18: EUFo region classification from NUTS+ showing cutouts.

Figure 19: EUFo region classification from NUTS+, cutout a.

Figure 20: EUFo region classification from NUTS+, cutout b.

Figure 21: EUFo region classification from NUTS+, cutout c.

5.3. Country-level forest biomass stocks