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1 Introduction and project achievements

This methodological report documents the development work carried out under the Eurostat grant aimed at establishing a robust framework for compiling European Forest Accounts (EFA) in Estonia. The overarching objective was to develop the methodology, produce revised and new data for 2022 and 2023, and lay the foundation for the production of regular official statistics starting in 2026. Project Context and Objectives

WP1 has five tasks:

T1.1 Developing of the methods and data for the forest area (EFA A1a tables)

T1.2 Developing of the methods and compilation of the data for the timber stock (EFA A2a tables, physical accounts)

T1.3 Developing of the methods and compilation of the data for the timber stock (EFA A2b tables, monetary accounts)

T1.4 Developing of the methods and compilation of the data for forest activity accounts (EFA B tables) tables

T1.5 Developing of the data management processes and meta info for the forest accounts.

Fulfilling of the project tasks and meeting objectives required a coordinated approach involving statisticians, forestry scientists, economists, and stakeholders. A project team was formed, bringing together experts from Statistics Estonia, the Estonian Environment Agency, the Estonian University of Life Sciences, and representatives from the Ministry of Environment.

Methods and workflows were complied in line with the principles of official statistics, including transparency, reproducibility.

Two major methodological seminars were pivotal in shaping the project's direction and evaluating the results. These sessions provided clarity on the interconnections between different EFA tables and helped identify which variables could be compiled within the grant period and which required longer-term development. Insights from other countries on the expert seminars and discussions Swiss Statistics—with their extensive experience in forest accounting—and contributions from Lithuanian Statistics experts enriched Estonia's approach, offering both methodological depth and regional relevance.

Stakeholder engagement was structured in two phases:

An expert kick-off meeting to analyse previous work and define technical priorities. Annex 3

Two methodological seminars to validate approaches and align expectations. Annex 4 and Annex 5

This sequencing ensured that decisions were evidence-based, and that stakeholder input was integrated at the right stage.

During the grant, Estonia consolidated its methodological framework for EFA A-tables (A1a and A2a), ensuring continuity with the earlier efforts while introducing the enhancements for future stability and reproducibility of forest account compilation. The efforts taken in Statistics Estonia for independent compilation of EFA physical tables position Estonia for routine, auditable production of forest accounts starting in 2026, aligned with official statistics standards: for A1a and A2a improvements focused on workflow reproducibility in statistics Estonia and further discussions of definitional issues (deadwood, non-stemwood). Both tables underwent revisions for 2022 and updates for 2023, reflecting improved source data and error corrections.

For the building up the knowledge base and future workflows in Statistics Estonia, collaboration with the Estonian Environment Agency as the main knowledge holder and compiler of NFI was crucial.

The 2025 compilation of monetary timber balance (Table A2b) brought improvements in timber valuation. Comparative analyses highlighted sensitivities to discount rates, species aggregation, and cost assumptions, informing Estonia's preferred approach. Estonia moved from an earlier simple stumpage price approach to a species- and assortment-based model, adopting the National Accounts compliant method (Method 2) for reporting. This ensures greater accuracy and alignment with international standards. For timber stock valuation, the Net Present Value (NPV) method was applied using NFI age-class data and a five-year average discount rate. Revised 2022 tables and new 2023 tables were compiled. For the timber valuation methods development, collaboration with experts from the University of Life Sciences was essential as well as the consultations with Eurostat and experts from other organizations were indispensable. Estonia presented analytical work at the UN London Group

and contributed to the SEEA CF Technical Committee, to the global guidance on timber asset and flow accounts focusing on aspects like stumpage prices, age structure, and discount rates. These contributions reinforced Estonia's role as a proactive participant in international methodological development.

In 2025, the compilation of B tables was improved to ensure stronger links between physical and monetary data and better alignment with National Accounts. Output of forest trees and intermediate consumption of trees were recalculated using stumpage price-based values from A2b, creating consistency across tables. EKOMAR business statistics were integrated with adjustments for shadow economy and own-account production, improving coverage. Technical descriptions and metadata were updated to support reproducibility, and 2022 data were revised alongside the 2023 compilation using the enhanced workflow. The discussion of intermediate results at the UN London Group meeting, validation of the transmitted data accompanied by specification of methodologies, positioned Estonia for routine production of B tables from 2026, aligned with EFA standards.

Algorithms and calculation logic for A-tables (A1a and A2a) were created and tested in Statistics Estonia against EFA guidelines. Scripts were developed for A1a and calculations were done for A2a tables, ready to be integrated into Statistics Estonia's databases in near future.

A formal data-sharing agreement is in progress to secure annual delivery of both raw NFI data and aggregated totals from the Environment Agency. This dual approach ensures:

Internal reproducibility and methodological transparency.

Integration of expert-derived variables (e.g., removals, irretrievable losses) that cannot be fully automated.

Agreements for expert-derived variables were standardized to reduce dependency risks. Agreements for the data capture, and documentation ensure that even externally sourced inputs are transparent and auditable.

EFA tables and metadata were published in Statistics Estonia's web database, accompanied by an explanatory article to make the results accessible to the general public.

The project achieved its objectives under WP1 and positioned Estonia in long-term for sustainable production of forest accounts. By embedding reproducible workflows, securing data capture, and aligning methods with international standards, Estonia meets the transparency and quality criteria of official statistics

Several enhancements are also designed in order to further consolidate Estonia's capacity for routine forest account production. The next steps include for example strengthening calculations for increment; completing SIMS-based metadata integration. Also formalizing workflows for harmonization with National Accounts, particularly for the output of forest trees, intermediate consumption of trees, and work-in-progress valuations is an issue of longer term coordination. Updating harvesting cost models, assortment structures, and exploring integration with ecosystem accounts will further future-proof the statistical system in the area of forest accounts. These actions will ensure Estonia's readiness for routine, auditable forest accounts production aligned with the requirements of the regulation 691/2011.

2 Activities carried out as regards methodologies and data for the area of wooded land EFA table A1a

Current chapter provides an overview on activities carried out as regards methodologies and data for the area of wooded land (EFA A1a tables) accounts in 2025. During the reporting period, several key developments were made. The data management processes and metadata related to forest accounts were enhanced to improve data quality and usability. Datasets for forest area statistics (EFA A1a tables) were compiled for the reporting year 2023 with the revisions made to 2022 data. Calculations were tested in Statistics Estonia for the production of wooded land accounts components based on administrative basic data. Refining the methodologies and data for the forest area (EFA A1a tables) was carried out.

2.1 Methods and data for the forest area (EFA A1a tables) and compilation of data for the reporting years 2023 and revising 2022

The revision of the basic approach and basic methodology was not necessary. Methodology remained unchanged compared to the "Description of the methodology and methodological issues for forestry account, 2024 [1] ("EFA2024report"). The revision of already submitted data for 2022 is outlined in detail.

Major emphasis of work carried out in 2025 was on the description of calculation rules and validation of NFI estimates. Estonian Environment Agency (EstEA) provided basic data of NFI, description of NFI calculation methods, technical description for NFI based estimate generation, calculation scripts (R-code) and consultation. Statistics Estonia carried out validation of EFA table A1a estimates which are based on NFI.

2.1.1 Overview of the compilation of the Area of Wooded Land (Table A1a) for the current reporting period

The compilation of the area of wooded land for the current reporting period follows the methodological framework established based on the approaches developed in the "Description of the methodology and methodological issues for forestry account, 2024" and described in detail in Chapter 2 of this report. The indicated 2024 methodological report forms the primary reference for all national definitions, data sources, processing steps, and harmonisation principles that underpin the present compilation. Data for years 2022 and 2023 are provided according to the developed and described methodology.

EstEA provided basic data of NFI, description of NFI calculation methods, technical description for NFI based estimate generation and consultations. Statistics Estonia carried out validation of EFA table A1a estimates which are based on NFI. It included the generation of estimates from NFI basic data according to the provided technical descriptions.

As outlined in the EFA2024 report in Chapter 2, the National Forest Inventory (NFI) remains the core data source for estimating the opening and closing area of forest land and other wooded land. The Estonian NFI operates on a continuous five-year rolling cycle, providing harmonised, nationally representative area estimates based on measurements and assessments of systematically distributed field plots. This approach ensures that the wooded land area used for EFA reporting corresponds to direct observations collected under a consistent, long-term sampling design. The use of FAO FRA definitions for forest land and other wooded land—integrated into the NFI more than a decade ago—guarantees international comparability and is fully consistent with both the 2024 methodology and the requirements set out in the European Forest Accounts (EFA) Manual.

In line with the procedures described in the EFA2024 report, NFI plot information was combined with the protection regime data from the Estonian Nature Information System (EELIS) to classify wooded land into available for wood supply (AWS) and not available for wood supply (NAWS) subcategories. The comparison of NFI sample locations with GIS-based protection layers—using the strictest applicable protection regime and the protection hierarchy agreed with the Ministry of Environment—has been retained without modification. This ensures full methodological continuity and is consistent with the classification principles recommended in the EFA Manual. It must be noted that in course of time the list of protection regimes considered as reason for strict protection (classification into FNAWS category) may change as new protection reasons may be defined or management possibilities for protection categories may be re-defined.

The flow variables—afforestation and other increase and deforestation and other decrease—were compiled using GHG LULUCF land-use change data (CRT tables). Estonia does not have direct measurement-based estimates of

[1] https://stat.ee/sites/default/files/2024-12/D1.1.Description%20of%20the%20methodology%20and%20methodological%20issues%20for%20forestry%20account.pdf

annual forest area gain or loss; therefore, land-use transitions detected on NFI sample plots remain the only nationally consistent and internationally accepted source of change information. Following the approach applied in 2024, the flow variables represent combined transitions between land-use categories rather than isolated measurements of forest increase or decrease. Where flow information for subcategories is unavailable, the proportional allocation method used in 2024 has been applied again, in line with the flexibility allowed by the EFA Manual. The implementation of the results was carried out in 2025. IPFP (Iterative Proportional Fitting Procedure) method was used to fit the land-use change matrixes to the estimates of opening and closing areas of LULUCF land-use categories. New approach will avoid the underestimation of land-use changes which distort the historical forest land area estimates and provides the possibility to abolish the backward calculation of forest land area estimates (valid scheme at present). New methodology has been tested and is waiting for the approval to be used in GHG reporting for LULUCF sector. Once approved, the results will be reflected in A1a table from GHG LULUCF CRT tables. New methodology uses the average land-use estimates from last 10 years to avoid too high fluctuation of estimates (present methodology uses 5-year average). The use of estimates according to the new methodology have to be carefully discussed as there is discrepancy between yearly reporting and long period to obtain average estimate. If new methodology will be used then balancing item will have “0” value in A1a table.

Consistent with both the 2024 methodology and the guidance in the EFA Manual (Section 3.2.1), discrepancies between opening stocks, documented flows, and closing stocks were assigned to the balancing item. As the NFI produces independent estimates for opening and closing years, perfect reconciliation is neither expected nor required. The proportional distribution of the balancing item across forest subcategories—first applied in the 2024 report—was retained to ensure internal coherence and comparability of time series.

The treatment of Other Wooded Land (OWL) remains unchanged from the conclusions drawn in the 2024 report. OWL constitutes a relatively small area in Estonia and is subject to high sampling variability due to the low number of NFI plots falling into this category. For this reason, the 2024 methodology recommended that flow variables for OWL should not be reported, as doing so would generate fluctuations driven by sampling error rather than actual land-use change. This approach is consistent with the EFA Manual’s allowance to omit categories with insufficient statistical robustness

The category “Other land with tree cover available for wood supply” remains unreported for the current period for the same reasons identified in the 2024 report. The land-use types included in this EFA category—agro-forestry, short-rotation forestry, and short-rotation coppice—are almost non-existent in Estonia. While tree-covered areas exist outside forest land (e.g., ditch banks, powerline corridors, bushlands), these do not meet the definitional criteria established by the EFA Manual. This conceptual mismatch between the EFA category and Estonia’s land-use structure was explicitly acknowledged in the EFA2024 report and remains unchanged.

In conclusion, the compilation of EFA Table A1a for the current reporting period follows the methodological principles and national procedures detailed in the “Description of the methodology and methodological issues for forestry account, 2024”. The approach is aligned with the requirements of the European Forest Accounts Manual, transparent in its data processing steps, and consistent with Estonia’s established wooded land reporting practices. Through this alignment, the present compilation ensures a coherent continuation of the methodological foundations set in 2024 while maintaining international comparability and acknowledging the national data limitations identified previously.

2.1.2 Revisions of the Area of Wooded Land (Table A1a) for 2022 data

Environmental Agency has made revisions in basic input data and calculations. The following revisions were made in A1a table for year 2022 compared to data reported in 2024:

- Estimates for afforestation and other increase and deforestation and other decrease were updated on the basis of the GHG reporting CRT tables according to 20252 submission (former reported figures were derived from the 20243 submission). Present calculation methodology of forest land area change items includes the update of the estimates for previous years.
- Estimates for afforestation and other increase and deforestation and other decrease for forest land subcategories were re-calculated based on updated of total change estimates for forest land.
- As a result of previous update the balancing item estimates for total forest land and sub-categories were recalculated.

[2] Estonia. 2025 Common Reporting Table (CRT); https://unfccc.int/documents/646498
[3] Estonia. 2024 Common Reporting Table (CRT); https://unfccc.int/documents/645198

Methodologies and data for the timber accounts (EFA A2a tables)

Current chapter provides an overview on activities carried out as regards methodologies and data for the timber (EFA A2a tables) accounts in 2025. During the reporting period, several key developments were made. The data management processes related to forest accounts were enhanced to improve data quality. Datasets for timber statistics (EFA A2a tables) were compiled: for the reporting year 2023 and the revisions were made to 2022 data.

2.2 Methods and data for the timber stock (EFA A2a tables, physical accounts)

In the area of timber stock accounts (table A2a) more robust and transparent management of timber-related information was desired.

The revision of the methodology was not necessary. Methodology remained unchanged compared to the "Description of the methodology and methodological issues for forestry account, 2024 ("EFA2024report"). The revision of already submitted data for 2022 is outlined in detail in a chapter 3.1.2 below.

Major emphasis was on the description of calculation rules and validation of NFI estimates. Estonian Environment Agency (EstEA) provided basic data of NFI, description of NFI calculation methods, technical description for NFI based estimate generation, calculation scripts (R-code) and consultations. Statistics Estonia carried out validation of EFA table A2a estimates which are based on NFI.

As methodology was developed enough, the system for integration of relevant data was initiated within Statistics Estonia to facilitate more coherent and efficient data flows.

2.2.1 Methodology for the data for the timber stock (EFA A2a tables, physical accounts).

The compilation of the timber on wooded land follows the methodological framework established based on the approaches developed in the "Description of the methodology and methodological issues for forestry account, 2024" (EFA2024 report) and described in detail in Chapter 3 of this report. The indicated 2024 methodological report forms the primary reference for all national definitions, data sources, processing steps, and harmonisation principles that underpin the present compilation. Data for years 2022 and 2023 were compiled according to the described methodology. EstEA provided basic data of NFI, description of NFI calculation methods, technical description for NFI based estimate generation, calculation scripts (R-code) and consultation. Statistics Estonia carried out validation of EFA table A2a estimates which are based on NFI. It included the generation of estimates from NFI basic data according to the provided technical descriptions.

As outlined in the EFA2024 report, NFI remains the core data source for estimating:

- volume of timber on different categories of wooded land;
- increment of growing stock on forest land;
- felling volumes as a basis for removals' estimates.

Data for timber stocks' subcategories of forest land and other wooded land according to the availability for wood supply are based on NFI plot data. Locations of the sample plots are compared to the nature protection GIS layers from the Estonian Nature Information System EELIS.

Estimate of removals is combined expert estimate based on felling volume statistics from NFI, expert estimate about the removals from outside the forest land and expert estimate about the removals of non-stemwood from forest land (based on removals of felling residues reported on felling sample plots of NFI). Estimation is based on the approach used in "Wood balance of Estonia"[4]. The expert estimate from Wood Balance is basis for the data reporting on removals in Joint Forest Sector Questionnaire (JFSQ).

The use of FAO FRA definitions—systematically integrated into the NFI — guarantees international comparability and is consistent with both the 2024 methodology and the requirements set out in the European Forest Accounts (EFA) Manual. Estonia has highlighted repeatedly the inconsistencies in approach to include different fractions of timber (notably deadwood and non-stemwood) for different reporting items (described in detail in EFA2024 report). Those inconsistencies remain and may need update of reporting framework and EFA manual in future.

NFI provides annual estimates for opening and closing stock for timber on forest land and other wooded land. Tree and stump measurements are converted into volume estimates according to the volume calculation models for each sample plot. Growing stock and deadwood volume estimates are calculated separately. Deadwood volume

[4] https://keskkonnaportaal.ee/sites/default/files/Teemad/Mets/Puidubilanss%202023.pdf

estimates are calculated separately for standing and lying deadwood. Timber stock estimate is the sum of growing stock and standing and lying deadwood. Forest accounts' approach excludes deadwood which has lost the quality for timber or fuelwood (decayed/rotten snags and notches). Data of sample plots are generalised to the whole territory of Estonia. Timber estimates for opening and closing stock of subcategories of forest land and other wooded land according to the availability for wood supply are based on NFI plot data.

Trees are measured also on the other Estonian land categories on NFI sample plots. This forms the basis for calculation of the volume on OWL (only on the national land-use categories: swamps/boglands, natural grasslands and areas covered with bushes). Estimates of OWL have high relative error. EstEA suggests not to report the OWL yearly estimates and time-series to avoid unreasonable changes caused by the high variability. The total volume of timber on OWL is quite small, and removals' estimate covers all timber from forest and non-forestland.

In 2024 for the first time the annual estimates were produced based on measured increment on permanent volume sample plots of NFI (see chapter 3.4 of EFA2024 report). The single year estimate is based on 5-year average gross annual increment (GAI) and mortality on re-measured sample plots. Relevant net annual increment (NAI) estimate represents average annual volume growth in 5 years. To avoid high fluctuation of estimates caused by variation the 5 most recent re-measurements are included in final estimate. Net annual increment reflects the increase of volume of stemwood of living trees. This is not comparable to opening/closing stock and removals' estimates which include deadwood. Further work must be done to clarify deadwood inclusion in reporting and in revising the EFA handbook.

Removals' estimates were taken from JFSQ reports. JFSQ report is compiled annually by Estonian Environment Agency. Estonian Wood Balance estimation approach is the basis for removals' estimates. Removals' estimate is expert estimates based on data of felling volumes (stemwood volume of felled trees), estimates of amounts of harvested non-stemwood from forest land and estimates of harvested timber from outside the forest land. Total removals volume was distributed to forest land available for wood supply and other land with tree cover available for wood supply. Removals from FNAWS are considered zero. Removals from other wooded land are a part of the removals estimate for other land with tree cover available for wood supply.

According to the definition Irretrievable losses include felling residues, all fellings from windthrow that cannot be removed from the forest, as well as timber lost through forest fires. There is no national definition/data for irretrievable losses comparable to EFA's (see chapter 3.4 of EFA2024 report). The general approach of felling residues must be in line with definition of removals: if removals include the harvest of non-stem-wood, then felling residues should account the non-stemwood (mostly branches) left in the forest during the harvest. Irretrievable losses' estimate in table A2a is an expert estimate based on estimates of total removed timber, total felled stemwood and felling residues. The removal of felling residues (not the amount) is registered on the NFI felling plots. It is possible only indirectly to estimate the non-stemwood of felled trees (coefficient 16% of stemwood volume was used). Irretrievable losses were calculated adding non-forestland removals' volume and total volume of felled trees on forest land (including non-stemwood), then subtracting total removals' volume. It is assumed that non-forestland removals' expert estimate includes non-stemwood.

Balancing item Opening and closing stock of timber are based on area estimates in table A1a. Discrepancy is partly caused by the different approach to volume estimates (inclusion of non-stemwood in case of removals and irretrievable loss) and accounting of deadwood. This causes the situation where closing stock will not sum up from the opening stock plus net annual increment minus removals and irretrievable losses. The difference is attributed to the "Balancing item" category in table A2a. The balancing item of timber on forest land was distributed into subcategories of forest land proportionally to the share of subcategory from the total opening stock.

Statistical re-classification (+/-) As stated in EFA2024 report, in case of the timber on sub-categories of forest land area the re-classification is possible as there exist the opening and closing timber stocks for FAWS and FNAWS. The reclassification is justified due to the on-going process of creation of new and re-valuation of existing protection regimes (change in management/protection status). The area and thereby the timber volume of unmanaged/strictly protected forest land has steadily increased i.e., the areas which formerly belonged to the FAWS category were moved to FNAWS category because of legal process. The re-classification was calculated as a last step after the opening/closing stock, flow items and balancing item were filled in the table.

2.2.2 Revision of data

The following revisions were made in A2a table for year 2022:

- Opening and closing stock of forest land and forest land available for wood supply were updated (increase in the magnitude of 7000 m3). An error was found in the fieldwork data. Estimates for the balancing item remained unchanged.

- Estimates of net increment for FAWS and FNAWS were corrected in the magnitude of 0.1 million m3, the total net increment remained unchanged. The reason for change was input mistake in 2024.
- As a result of previous update, the estimates for statistical re-classification figures for FNAWS and FAWS were recalculated in the same magnitude (0.1 million m3).

The following revisions were made in A2a table for year 2023:

- Removals figure was updated during the project period from 10.7 to 12.3 million m3. Initial removals figure based on JFSQ2025 June submission to Eurostat, estimate was calculated from the expert estimate by EstEA (comparison of cleared forest areas from remote sensing and felling notifications). NFI total felling estimate became available later in year and relevant corrections were made to removals' estimates. Corrected removals' figure was reported to Eurostat also as JFSQ update.
- As a result of previous update, the estimates for irretrievable losses were re-calculated. The estimate of irretrievable losses is based on the removals' figure i.e. the change in estimate of removals necessitates change in irretrievable losses.

3 Reproducing Forest Accounts A-Tables: concepts, methods, and routine production in Statistics Estonia

3.1 Introduction

The accurate and repeatable compilation of forest accounts is foundational to the statistical architecture that links environmental stocks and flows to the economy. Within the European Forest Accounts (EFA) module, the A-tables—specifically A1a (Area of wooded land) and A2a (Timber on wooded land, physical)—provide the physical metrics upon which monetary valuation (A2b) and activity accounts (B-tables) are dependent. For Estonia, the ambition to reproduce/verify the A-tables for time period of 2021–2022 (as opening and closing areas respectively) using National Forest Inventory (NFI) and other administrative data sources responds to the need to establish routine methodological production pathways consistent with EFA guidance and standards of official statistics while remaining faithful to national data realities and expert practices (e.g., NFI and wood balance) .

The present chapter offers an overview of this reproducing effort. It details the conceptual framework, data sources, and analytical procedures employed; reflects on assumptions, uncertainties, and reproducibility; and clarifies how the resulting procedures support routine production and quality assurance. By foregrounding transparency ("no black boxes"), the chapter emphasizes the separation between calculated variables from NFI and expert-dependent components (as input for removals and irretrievable losses), thus contributing to the compilation and validation in future.

3.2 Conceptual and methodological framework

3.2.1 The role of EFA A-tables in environmental-economic accounting

The EFA A-tables fulfil a dual role: they quantify (a) the extent of wooded land (A1a) and (b) the stock and flows of timber on wooded land in physical units (A2a). Together, they render measurable supply-side of forest assets, allowing monetary valuation (A2b) and downstream economic aggregates (B-tables) to be computed on sound and observable bases. In the System of Environmental-Economic Accounting (SEEA) Central Framework, physical asset accounts must conform to stock–flow identities, with opening stock + additions − reductions ± reclassifications ± balancing item = closing stock. The A-tables implement these identities explicitly and provide the platform to link to national accounts (SNA) concepts, including work-in-progress on cultivated biological assets when combined with flow valuation.

3.2.2 National embedding and international alignment

The Estonian implementation builds upon a national data backbone (NFI) and a shared conceptual vocabulary with EFA reporting logic (split of forest available/not available for wood supply; optional treatment of other wooded land), while exposing intersections and distinctions relative to other frameworks (e.g., FRA definitions of growing stock versus EFA's inclusion of large branches and certain deadwood categories).

Principles guiding reconstruction

Two guiding principles guided the reconstruction:

1. Reproducibility: All calculations needed for A1a and A2a tables that can be derived from NFI should in principle be reproducible, within Statistics Estonia.
2. Transparency: Where expert opinion is required (e.g., for removals and irretrievable losses), the method itself must be profoundly described and documented

3.2.3 National Forest Inventory (NFI) and spatial overlays

The National Forest Inventory (NFI) is the primary data source for estimating the opening and closing areas of forest land and other wooded land. In Estonia, the NFI is implemented as a continuous five-year rolling program that delivers harmonized, nationally representative area estimates based on measurements and assessments from systematically distributed field plots. This design ensures that the wooded land area used for EFA reporting is grounded in direct observations collected through a consistent, long-term sampling framework. NFI plot information is linked with protection regime data from the Estonian Nature Information System (EELIS) to assign wooded land to the available for wood supply (AWS) and not available for wood supply (NAWS) categories. Wooded land is classified according to the EFA taxonomy. In Estonia, the list of restriction layers (protection regime data) used for this classification is coordinated annually by EstEA, the Ministry of Climate, and RMK to

ensure that NFI plots are coded consistently as either “available” or “not available” for wood supply. Role of EstEA’s technical guide and expert tutoring in methodological consolidation

The underlying principles for this reproduction was established through the first comprehensive technical guide (“Tehniline kirjeldus metsa arvepidamine metsavarude andmetabelite A1a (puittaimestikuga maa) ja A2a (puit) koostamiseks statistilise metsainventeerimise andmete põhjal”), prepared by the Estonian Environment Agency (EstEA) under a dedicated subcontract. This guide provides detailed instructions for compiling the A1a and A2a tables (covering wooded land and timber stock). An overview of the relevant technical guidance documents is presented in Annex 6.

EstEA provided basic data of NFI, description of NFI calculation methods, calculation scripts. In addition to producing, EstEA delivered targeted training sessions for Statistics Estonia. These sessions supported the transfer of domain expertise and helped integrate the methods into a reproducible operational workflow. The subcontract therefore served two purposes: it supplied the technical specifications needed to comply with Eurostat’s methodological standards and strengthened internal capacity for routine production, reducing reliance on ad hoc expert support.

EstEA contribution was essential and served as the primary basis rather than auxiliary, enabling Estonia to align its forest accounts with SEEA/EFA principles while meeting the transparency and quality requirements of the grant agreement.

3.3 Analytical procedures for routine production and metadata

3.3.1 Estimating areas in A1a

Statistics Estonia carried out validation of EFA table A1a estimates which are based on NFI. It included the generation of estimates from NFI basic data according to the provided technical descriptions. The compilation of the area of wooded land for 2021-2022 (opening and closing area respectively) reporting period follows the methodological framework established based on the approaches developed in the “Description of the methodology and methodological issues for forestry account, 2024 and described in detail in Chapter 2 of this report. The indicated 2024 methodological report forms the primary reference for all national definitions, data sources, processing steps, and harmonisation principles that underpin the present compilation.

Different area estimation categories are carried out at the plot level, accounting the proportion of each sub-plot that lies on terrestrial land. The resulting shares for each category (for example, forest available for wood supply) are then expanded to the national terrestrial area for the reference year. Importantly, flow variables—such as afforestation, deforestation, and other increases or decreases are calculated from land-use change matrices based on transitions observed in the NFI.

As a result of provided basic data of NFI, description of NFI calculation methods, technical description for NFI based estimate generation, calculation scripts and consultations by EstEA, it was possible to fully reproduce EFA table A1a (Table 1) by Statistics Estonia.

Table 1. Reproduced area of wooded land in 1000 ha for 2022 (reference year). Colours denote green: fully reproducible from NFI, yellow: in works, still achievable, and orange: not fully achievable

Done/achiveable
In works
In works/not fully achiveable

Area of wooded land, in 1000 ha, Reference year = 2022

Code	Description	Opening area (December 2021)	Afforestation and other increase	Deforestation and other decrease	Statistical re-classification (+/-)	Balancing item (+/-)	Closing area (December 2022)
1	Forest	2447.41	1.35	0.69	0	-1.32	2446.75
1.1	Forest available for wood supply	1988.9	1.1	0.56	-15.68	-1.07	1972.68
1.2	Forest not available for wood supply	458.51	0.25	0.13	15.68	-0.25	474.07
2	Other wooded land	101.27				1.58	102.84
2.1	Of which available for wood supply	75.5				0.95	76.45
3	Other land with tree cover available for wood supply						

Estimating timber stocks in A2a

Statistics Estonia also carried out validation of EFA table A2a estimates which are largely based on NFI. It included the generation of estimates from NFI basic data according to the provided technical descriptions. In case of A2a, NFI remains the primary data source for estimating volume of timber on different categories of wooded land, increment of growing stock on forest land and for felling volumes as a basis for removals' estimates. The compilation of the timber on wooded land for 2021-2022 reporting period follows also the methodological framework established based on the approaches developed in the "Description of the methodology and methodological issues for forestry account, 2024" (EFA2024 report) and described in detail in Chapter 3 of this report. The indicated 2024 methodological report and provided technical guidance notes form the primary reference for all national definitions, data sources, processing steps, and harmonisation principles that underpin the present compilation.

The NFI provides annual national estimates of opening and closing timber stocks based on plot-level measurements converted to volume, with timber defined as growing stock plus usable deadwood and reported by land category and availability for wood supply.

Net annual increment reflects the increase in stem wood volume of living trees only and is therefore not directly comparable with opening and closing stock or removals estimates, which also include deadwood. Net increment is defined as tree growth minus mortality. In Estonia, both components are estimated from repeated measurements on permanent NFI plots. Five overlapping five-year periods are constructed within rolling decades to calculate annual growth and mortality rates, which are then averaged to produce the final period estimate.

Two flow items—removals and irretrievable losses—cannot be fully estimated from NFI data alone in Estonia. Wood-balance approach is therefore used, that integrates NFI information (such as recorded fellings and residue removal on felling plots), roadside volume data from RMK, and estimates of non-forest energy wood. These sources are combined to produce expert estimates.

Irretrievable losses represent residual biomass left in forests, such as uncollected branches and tops or biomass. These losses are estimated using shares that are consistent with observed residue removal rates. It is foreseen that the resulting expert estimates will be transferred annually to Statistics Estonia, allowing routine integration while maintaining transparency of the methods used.

As a result of provided basic data of NFI, description of NFI calculation methods, technical description for NFI based estimate generation, calculation scripts and consultations by EstEA, it was possible in principle almost entirely reproduce EFA table A2a (Table 2) by Statistics Estonia. Due to time constraints only net increment was not fully calculated, although EstEA has provided both technical description and calculation scripts, therefore this calculation should be achievable in coming months also in Statistics Estonia. As scripts for calculation and technical description are now available, the future reproduction is now feasible.

As stated before, both removals and irretrievable losses can't be directly calculated from NFI and needs expert estimates on several inputs, these variables can't be reproduced solely by Statistics Estonia. Therefore currently statistical re-classification and calculation of balancing item can't be directly calculated as these are dependent on aforementioned variables values.

Table 2. Reproduced timber on wooded land in 1000 m3 over bark for 2022 (reference year). Colours denote green: fully reproducible from NFI, yellow: in works, still achievable, and orange: not fully achievable

Done/achiveable
In works
In works/not fully achiveable

Timber on wooded land, in 1000 m3 over bark, reference year = 2022

Code	Description	Opening area (December 2021)	Net increment	Removals	Irretrievable losses	Statistical re-classification (+/-)	Balancing item (+/-)	Closing area (December 2022)
1	Forest	511109.35						504134.25
1.1	Forest available for wood supply	399445.17						387118.62
1.2	Forest not available for wood supply	111664.18						117015.63
2	Other wooded land	2434.97						2482.35
2.1	Of which available for wood supply	2302.92						2333.63
3	Other land with tree cover available for wood supply							

3.4 Conclusion

This reconstruction exercise demonstrates that Statistics Estonia can largely reproduce the core European Forest Accounts (EFA) A-tables (A1a and A2a) for the 2021–2022 period using National Forest Inventory (NFI) data as the primary source. The work confirms that NFI-based estimators, when combined with clearly documented methodologies and quality controls, provide transparent, and internationally aligned foundation for physical forest accounting under the SEEA and EFA frameworks

The reproduction of A1a (area of wooded land) was fully achieved by Statistics Estonia, validating both the methodological framework and the operational feasibility of routine production based on NFI inputs. For A2a (timber on wooded land), opening and closing stocks and most flow components were reproduced in principle, with remaining gaps linked mainly to time constraints and the intrinsic need for expert inputs. In particular, removals and irretrievable losses cannot be derived from NFI alone and continue to rely on a documented wood-balance approach integrating multiple data sources and expert judgements. The process highlights the critical role of EstEA technical guidance and tutoring in consolidating methods, transferring domain knowledge, and embedding calculations into reproducible workflows within Statistics Estonia also in future. This dual focus on documentation and capacity building reduces dependence on ad hoc expertise and strengthens institutional ownership of forest account compilation.

Overall, the reconstruction confirms that forest account is largely reproducible, and compliant with Eurostat and SEEA requirements. Remaining challenges—most notably the full operationalization of net increment calculations and the systematic integration of expert-based flow components—are clearly identified and technically resolvable. Addressing these in future will further enhance transparency, and long-term sustainability of EFA production in Estonia.

The reconstruction of the EFA A-tables (2021–2022) from NFI demonstrates the feasibility of a transparent, reproducible production process that balances statistical rigor with national practice (wood-balance for removals/losses) and international comparability (SEEA/EFA). The approach exemplifies the “no black boxes” principle and offers a replicable template for subsequent reference years.

WP1 tasks (A1a/A2a methods and data, metadata and routine processes) are directly supported by the procedures described here. Risk management (staff availability, expert dependency, input instability) is addressed through scripting and method application.

4 Data capture and establishment of routine procedures

4.1 Introduction

One of the objectives under the Eurostat grant is to ensure that Estonia can produce European Forest Accounts (EFA) tables on a regular, reproducible basis starting in 2026.

This requires securing reliable annual data capture, defining exchange protocols, and embedding automated workflows for processing and validation. The grant emphasizes transparency, reproducibility, and compliance with official statistics principles. This chapter explains what has been done and is planned to be done to guarantee data availability, processing capability, and version control, and clarifies why these efforts are essential—not duplication, but compliance with transparency and quality standards. Preparatory work has been done for smooth data flows for 2026 and onwards. Risk mitigation measures include scripting for reproducibility, formalizing expert input delivery, and establishing version-controlled metadata. These steps ensure sustainability of annual production starting in 2026

4.2 Securing data capture for the next period

From 2026 onwards, the arrangement was agreed and is in the form of implementation that Statistics Estonia will receive both raw NFI data and aggregated totals from the Environment Agency under a formal data-sharing agreement. This dual approach ensures:

1. Raw NFI datasets for internal reproducibility and methodological transparency.
2. Aggregated expert-derived variables and pre-compiled A1a and A2a tables for reference and validation.
3. Special components that need to be added (e.g., removals and irretrievable losses).

This arrangement was designed to meet official statistics criteria:

Traceability: Every published figure can be linked to its source and applied formula.

Auditability: Internal workflows allow Statistics Estonia to reproduce results independently.

Compliance: Meeting Eurostat's requirements for metadata, version control, and retention.

Concerns were raised among the administrative data holders about the duplication of efforts. It is important to clarify that the reproducing and basic data capture for A tables is not duplication, but a necessary safeguard to ensure that official statistics are compiled under a transparent, documented, and reproducible system. External expert input remains essential for certain variables, but Statistics Estonia has to integrate the inputs into a controlled workflow that meets international standards.

To ensure transparency and traceability of expert-derived variables such as removals and irretrievable losses, a data exchange framework will be implemented as well. The detailed file delivery arrangements are still under discussion with the Environment Agency; however, a basic agreement on principles has already been reached, and the formal specification will be finalized in the coming months. The agreed framework will include standardized data fields, version control, and delivery deadlines, while allowing flexibility in file formats depending on technical feasibility and mutual agreement.

4.3 Workflow for routine production

The agreed objective is to establish a regular, automated process for providing the feasibility for validating EFA tables starting in 2026. The workflow is planned to be implemented in Statistics Estonia's Oracle-based systems and will follow these steps:

Import raw NFI data into Statistics Estonia's secure environment.

Store data in the database with standardized structures and classifiers.

If relevant:

apply agreed formulas and scripts for area estimation and timber stock calculation.

integrate expert-provided aggregates for removals and irretrievable losses and reproduce calculate EFA tables (A1a and A2a)

integrated metadata.

Validate outputs against reference checks and quality indicators.

Scripts developed during the project already allow internal calculation of most variables, ensuring transparency and reproducibility. Exceptions remain for removals and irretrievable losses, which require expert judgment; these will be integrated with documented assumptions.

5 Improving the methodologies and compiling the data for the timber stock (EFA A2b tables, monetary accounts)

5.1 Introduction summary – A2b Monetary timber accounts

The 2025 reporting cycle marked a major advancement in Estonia's approach to valuing timber resources under the European Forest Accounts framework. Building on the physical data from A2a, the project introduced a more sophisticated methodology for stumpage price estimation and timber asset valuation. Three alternative stumpage price models were tested, ranging from simple averages to species- and assortment-specific calculations. After thorough evaluation, the National Accounts-based method (Method 2) was adopted for reporting, ensuring conceptual robustness and alignment with international standards.

For timber stock valuation, Estonia applied the Net Present Value (NPV) method, using species-specific age-class data from the National Forest Inventory and discounting future income streams at a five-year average discount rate (2.58%). This approach balances stability with comparability and was complemented by sensitivity analysis using OECD's recommended 2% rate. The workflow for monetary valuation was embedded in Statistics Estonia's automated system, supported by detailed technical descriptions and SIMS-compliant metadata, ensuring transparency and reproducibility.

These methodological improvements—combined with updated harvesting cost models, refined assortment allocation, and enhanced metadata—position Estonia for routine, auditable production of monetary forest accounts starting in 2026. The result is a coherent, internationally aligned framework that strengthens the policy relevance and analytical value of forestry statistics.

5.1.1 Compilation of data for the reporting years 2023 and revising 2022 if relevant, overview

The monetary valuation of net increment, removals, and irretrievable losses is based on physical data provided by the Environment Agency (Table A2a). The key parameter determining the monetary value of timber stocks and flows is the stumpage price per cubic metre of roundwood. The primary source for estimating stumpage prices is the annual average roadside prices of timber assortments sold by the State Forest Management Centre (RMK), supplemented by the price of logging residues, i.e. material that does not qualify as roundwood but influences the aggregated stumpage price. Total removals by tree species were divided into assortments using the proportional shares.

In 2022, stumpage prices were calculated separately for timber originating from state and private forests. For the reference year 2023, however, a unified dataset was applied. The modelled average wood procurement cost was deducted from the average roadside price to derive the average stumpage price per cubic metre of timber.

As from 2024, the National Forest Inventory (NFI) revised the reporting methodology for increment and now presents only a single aggregate figure for the whole of Estonia. In the national accounts model, however, increment is continuously allocated across timber assortments based on the proportional distribution of removals. Under this approach, tree species are grouped into seven categories and assortments into five categories, based on removals data. For the current compilation cycle, the public and private ownership categories were merged. The distribution of harvest among assortments was derived using proportional shares from the 2014 calibration(last available), while ensuring that the total harvest volume remained consistent with the 2023 data.

To assess the monetary value of timber stock using the net present value (NPV) method, data on timber stock in physical units by tree species and age class were obtained from the Environment Agency. The assessment relies on NFI data on the distribution of managed stands across age classes, according to dominant species, in 10-year intervals. This represents a slightly different approach from 2022, when managed stands were allocated to 20-year age classes.

When estimating the NPV of future cash flows, a five-year average discount rate applicable to the state forest organisation was used, adjusted by deducting the sector-specific inflation rate. For 2023, the five-year average rate is 2.58%.

5.2 Developing of the methods and compiling the data for the timber flows (EFA A2b tables, monetary accounts)

The monetary valuation of net increment, removals and irretrievable losses is based on the physical data provided by the Environment Agency (Table A2a). The key parameter determining the monetary value is the stumpage price per cubic meter of roundwood. For valuation purposes, either the aggregated average stumpage price or the stumpage price of fuelwood as a specific assortment is applied. The aggregated average stumpage price is

applied for timber flows in forest available for wood supply. The latter is used for timber located on other wooded land as well as on other land with tree cover that is available for wood supply.

Stumpage price data for different tree species and assortments are used to calculate a weighted stumpage price per cubic meter of removed timber. In general, two principal methods have been tested in Statistics Estonia for stumpage price estimation, while a third represents a modification of the second method. These methodological versions differ in their level of detail, and the data sources utilized. For the compilation of the A2b table earlier the Stumpage Price Method Version 1 was applied. However, this year after analyses the modification of the second method was chosen.

Because Estonia lacks publicly available data on stumpage price by timber assortment, stumpage prices must be estimated using various underlying datasets. The primary source for estimating stumpage prices is the set of annual average roadside prices of timber assortments sold by the State Forest Management Centre (RMK). In addition to availability on RMKs webpage comparable information on roadside prices is also provided by RMK to Statistics Estonia. RMK additionally reports prices for logging residues, i.e. material that does not qualify as roundwood. If the price of a particular assortment is absent, it indicates that the respective assortment was not marketed during the reference year. To obtain stumpage prices for state forests, average logging costs are deducted from the roadside prices; these stumpage prices are subsequently applied to national-level timber flow accounts.

5.2.1 Stumpage Price Method Version 1

This method was tested in the previous grant project as a first attempt to compile EFA table A2b and is also used for comparison with other stumpage price method. All necessary data for this method are available on RMK website and does not need further calculations, therefor it can be considered as simple and straightforward method to estimate stumpage price. Both weighted average roadside price and average procurement cost as a single value are calculated by RMK and are available on their web site on annual basis. The monetary valuation of net increment is obtained as follows:

Net increment (million euros) = (Gross increment – Deadwood) × Weighted average stumpage price

Weighted average stumpage price = weighted average roadside price – average timber procurement cost

For estimating weighted average roadside price average roadside prices are weighted by assortment according to their respective shares in total removals. Weighting is done by RMK.

Although all data was readily available and easy to use it gave different results than are used in National Accounts who estimate stumpage value using more detailed data, therefor this method was not chosen for reporting to ensure compliance with NA.

5.2.2 Stumpage Price Method Version 2

The Stumpage price method version 2 which has been designed in NA to estimate net increment value was tested in addition to method 1. This method uses roadside prices provided by RMK, differentiated by tree species and assortments. Harvesting costs are modelled and estimated separately by tree species, assortment, and ownership category (RMK and other forest owners). Based on roadside prices and the corresponding harvesting costs, average stumpage prices are then calculated for each tree species by subtracting harvesting cost from roadside price.

Stumpage value method version 2 had two alternative calculation options depending on assortments inclusion.

<u>First option</u>

Using more detailed information and division into assortment, Method 2 gives lower values than Method 1 and difference are caused by coverage of assortments and different prices. For example, the first method considers the high value of veneer-logs, while the second does not. In the first method, firewood is accounted for using the average value, while in the second, it is considered using a lower firewood value that is due to differentiating between coniferous and broadleaf trees. If there is a larger annual difference in the firewood value, the difference will also be greater.

The public data that RMK publishes on their website about roadside prices were rather concise until 2022 when RMK started to show more detailed list of assortments with its prices. While before 2022 based on special agreement between RMK and Statistics Estonia got more detailed insights compared with publicly available information on roadside prices. As there are no good data source then RMK prices are used also for private forest owners.

Second option:

When comparing the results of different models used to allocate harvested volume into assortments, the 2014 model produced results that were more consistent with RMK data than the most recent model provided by the Environment Agency. The latest model had more limited coverage, and some assortments were assigned zero values despite the availability of corresponding roadside prices. Consequently, the assortment structure from the 2014 model was used in the calculations, even though it does not distinguish between RMK and other forest owners. This distribution is also more closely aligned with RMK assortment data, although the coverage is not identical. It was assumed that the overall forest structure has not changed substantially since that time. One reason for the discrepancy between RMK-reported quantities and the national forest inventory is that RMK reports sales volumes excluding treetops and branches (felling residues), which results in smaller total volumes. This difference is also evident when comparing quantities across individual assortment groups.

There is room for better calibration and reporting if those two datasets are to be aligned, but obvious differences remain, nevertheless. For Statistics Estonia it is important to decide whether monetary value that is based on the quantities that describe more total removals (bigger quantity but more waste and lower average price) or the potential sales (lower quantity but higher average prices) is used.

It is recommended to use data from the National Forest Inventory (NFI) rather than relying solely on RMK data, which may appear more accurate but can provide a biased perspective, as approximately half of Estonia's forests are managed by private owners.

5.2.3 Harvesting cost

Also, discussions about harvesting costs that are estimated using NA model (used in Stumpage price version 2) were held during the project.

The harvesting cost for forest cuttings that yield merchantable timber has been calculated in accordance with Annex 6 (Calculation of the Costs of Harvesting Merchantable Timber) of Government Regulation No. 242 (RT I, 03.09.2013, 2; https://www.riigiteataja.ee/akt/103092013002). In the formula, data from the Environmental Agency (stand height and breast-height diameter by age class and tree species) were used to determine the average volume of harvested stems, and GIS queries were used to determine the average extraction distance (relevant ETAK map layers, the distance from the centroid of the cadastral unit to the nearest road, i.e., a potential landing site). The result is the harvesting cost, i.e., the service price (felling + extraction), broken down by timber assortments and tree species, separately for RMK and other landowners.

Harvest cost model was last been updated in 2017 and although model is using solid theoretical and legally approved methods (uses methods that Estonia uses for obtaining forest real estate from private owners for conservation purposes), there might be room for prices update. Presumably this harvesting cost model does not have major impact to final result of net increment calculations. Currently the formula is under review and there is consideration using price index.

The net increment is multiplied by the stumpage price corresponding to the tree species and assortment. This yields the monetary value of the net increment for each tree species. By summing the values of all tree species, the total monetary value of the net increment is obtained.

5.2.4 Calculating stumpage price for 2023

From earlier work, three methodological alternatives for calculating stumpage prices were identified.

The first alternative uses RMK's weighted average prices (see Section 5.2.1). This method does not require detailed harvest quantities (m^3) for each tree species group and assortment, simplifying data needs.

The second alternative applies the model previously used by NA (see Section 5.2.2), updated using new data provided by both NA and the Environment Agency. NA delivers harvesting cost estimates for both state-owned and private forests, along with stumpage prices for different assortments. The assortment list and roadside prices supplied to Statistics Estonia differ slightly from publicly available data used in Method 1. The physical quantity of gross increment, deadwood, and harvest data originate from the Environment Agency. This method is only marginally more complex than Method 1 and provides more precise results when information at the tree-species or assortment level is required. As previously noted, this approach typically yields lower stumpage price estimates because the Environment Agency's dataset includes higher volumes of fuelwood and waste, which correspond to lower stumpage values. However, it requires more detailed external data from Statistics Estonia. When the quality of these data is inconsistent, disaggregating aggregated quantities into assortments may not improve accuracy. Overall, despite the dependence on detailed inputs, the model is conceptually sound and intuitive to apply.

The third alternative, tested in 2023, represents a modified version of Method 2. While calculating the net increment for 2023, several adjustments were introduced. A comparison between RMK sales quantities and the

National Forest Inventory's (NFI) modelled assortment distribution revealed notable discrepancies. RMK-reported sales quantities for 2023 were 21% lower than the harvest volumes produced by the calibrated NFI statistical model for RMK. As these harvest volumes were uncertain—likely due to calibration issues in the Environment Agency's model— 2014 assortment proportions were used, which were the last reliably calibrated set. Ownership categories were not distinguished. The future application of this approach remains under discussion and may change depending on decisions reached with the Environment Agency, which is responsible for calibration.

As previously noted, the harvesting cost model should be updated with the most recent price information. It was monitored whether removals volumes are estimates and whether their allocation across tree species groups and assortments reflects actual conditions.

Since Statistics Estonia cannot independently determine whether physical forestry figures are final, it would be advisable to establish a clear workflow to ensure compliance with publication and reporting schedules.

Statistics Estonia maintains an agreement with RMK for the exchange of price data. This year, a special request was submitted to obtain also the underlying quantities for RMK's assortment list. This practice could continue in future years to support approximate comparisons between removals and harvest, recognizing that RMK records sales quantities rather than removals. The assortment list additionally helps identify which assortment types may be missing from NFI data. When comparing quantities from different sources, it must be acknowledged that datasets are produced for internal operational purposes rather than forest accounting and are therefore based on different methodologies.

In the longer term, additional data sources from the forestry and logging sector may be considered for use in stumpage price calculations. For example, taxable transaction data from the Tax and Customs Board could offer another complementary source.

In conclusion, the choice of stumpage price calculation method depends on the quality and granularity of source data as well as the methodological requirements set by the European Forest Accounts (EFA). The EFA Handbook provides a range of methodological options, enabling countries to select approaches consistent with their data availability and statistical traditions. It is important to note that stumpage price represents a monetary valuation approach applicable to timber flows (harvest, increment, deadwood, etc.), wood in the rough, and standing timber assets.

For the 2023 reference year, the general approach applied in the National Accounts (NA) model for arranging net increment was confirmed for continued use. Under this approach, tree species are grouped into seven categories and assortments into five categories, based on removals data. In this cycle, former public and private ownership categories were merged. The distribution of harvest into assortments was derived using proportional shares from the 2014 calibration, while maintaining the total harvest volume consistent with the 2023 data.

5.2.5 Way forward regarding stumpage price calculation

From tested approaches stumpage price method 2 (option 2) was chosen to be used for the reporting in coming years. Still, it is planned to update the harvesting cost model with updated prices. Secondly, it has to be monitored if the removals division into tree species and assortment reflects true situation. This year Environment Agency updated physical data in August and therefor estimated quantities of 2023 were used before the final calculations of EFA. As Statistics Estonia itself cannot evaluate whether the quantities are final or not, then a clear workflow is in a process of agreement to respect delivery and publishing deadlines.

Statistics Estonia uses RMK price data. This year additional special query was sent to present quantities behind assortments list. This practice can be used in following years too to double check the coverage of harvest into assortments. RMK is showing quantities of their sales and not the quantities of removals. This list is also indicating what assortments can be missing in National Forest Inventory data. Those quantities are obtained from different sources and if comparing them, it has to be kept in mind that these are not recorded for the use in forest accounts but for the organization's inner purposes (these are also using different methods to record data).

In a longer run it can be considered using additional data from forest and logging sector to calculate stumpage price, for example using Tax and Customs Board data about taxable transactions.

5.2.6 Results for the A2b table flow items 2023 data and 2022 revision

The monetary value of net increment is calculated as the product of the physical value (m^3) presented in EFA Table 2a and the average stumpage price of timber (€/m^3) for the accounting year.

The monetary value of timber removals is calculated as the product of the physical value (m^3) presented in EFA Table 2a and the average stumpage price of timber (€/m^3) for the accounting year. The monetary valuation of irretrievable losses, revaluation, statistical reclassification, and the balancing item was calculated using the same

principles as those applied to net increment and removals. The physical values presented in Table A2a were multiplied by the aggregated average stumpage price.

For the valuation of wood resources and flows on other forest land and non-forest land, the stumpage price of fuelwood is used. The physical units in EFA Table 2a are multiplied by the average stumpage price of fuelwood for the year under review.

The results for the A2b table flow items for 2023 are presented in Annex 2.

The two main reasons for the changes in 2022 were corrections to the volumes of physical flows and a revised methodology for calculating stumpage prices compared to the previous approach (see 6.2.4 Calculating stumpage price for 2023).

Estimates of net increment for FAWS and FNAWS were corrected in the magnitude of 0.1 million m3, the total net increment remained unchanged. Removals´ figure was updated during the project period from 10.7 to 12.3 million m3. As a result of previous update, the estimates for irretrievable losses were re-calculated. The estimate of irretrievable losses is based on the removals' figure i.e. the change in estimate of removals necessitates change in irretrievable losses.

In earlier report for 2024, timber flow calculations for reference year 2022 used an average stumpage price of €63.67 per m³, calculated on the basis of RMK's aggregated indicators. In 2025, a methodology was adopted that applies the assortment structure obtained using the assortment model employed in National Accounts and the timber harvesting model updated in 2017. The aggregated average stumpage price for 2022 using this methodology is €46.68 per m³. Using the resulting stumpage price, the 2022 timber flows for FAWS—Net Increment, Removals, and Irretrievable Losses—were recalculated. The same stumpage price was also used to calculate the values of Revaluation, the Balancing Item, and Statistical Re-classification.

For the valuation of timber stocks and flows on other wooded and for other land with tree cover, the 2022 fuelwood stumpage price of €27.37 per m³ is applied.

The results of the revised calculations for 2022 are presented in Annex 1.

5.2.7 Developing of the methods for the calculation of the stocks

5.2.7.1 The Net Income Method (Net Present Value of Expected Resource Rent)

Following the monetary valuation of timber resources for the 2022 reference year, the Net Income Method was identified as the most appropriate approach for valuing timber assets, in line with the SEEA Central Framework and the European Forest Accounts (EFA). The timber asset under consideration comprises forest stands across a range of age classes. By discounting the future income expected from stands that have not yet reached maturity, the method assigns a monetary value that is consistent and comparable across all age classes.

The Net Income Method—also referred to as the Resource Rent Method—calculates the net present value (NPV) of potential future income generated by the existing timber stock (European Forest Accounts Handbook, 2024 edition). The method estimates the present value of expected net revenues from timber flows over a defined planning horizon, discounting future cash flows at a specified interest rate. The general NPV formula follows the SEEA Central Framework (2012), Chapter 5.

Resource rent was estimated using the appropriation method (EFA Handbook, Section 5.4.5) based on stumpage prices. In Estonia, future income was calculated by multiplying the growing stock of each age class by the average stumpage price of the corresponding tree species. Stumpage prices were determined by distributing the growing stock of mature stands into assortments using a specialized assortment program. For monetary valuation, the stumpage price of December 2021 was applied to opening stock, while the average stumpage price of 2022 was applied to closing stock.

Stages of Monetary Valuation Using the Net Income Method

A. Determining the Timber Asset (Growing Stock Volume)

The size of the timber asset is derived from National Forest Inventory (NFI) data produced by the Environmental Agency. The NFI provides the distribution of managed forest stands by dominant tree species and by 10-year age classes. The Environmental Agency reports the area (in 1,000 ha) of stands by species and age class.

B. Determining the Potential Future Harvest Volume

The average standing volume per hectare of mature stands (those that have reached the final felling age) for each dominant species is obtained from NFI data. These values are published annually in Forest in Estonia in the table

“”Average standing volume of managed stands by dominant species and age class”. Environmental Agency NFI data are used for this purpose.

C. Calculating the Potential Future Harvest Volume (m^3)

The area of stands that have reached the felling age for each dominant species is multiplied by the average standing volume per hectare of those stands.

The following felling ages (table 3) are applied in this methodology:

Table 3. Felling ages of the tree species

Tree species	Felling age (years)
Scots pine	90
Norway spruce	70
Birch	60
Aspen	40
Black alder	50
Grey alder	30
Other species	80

The standing volume per hectare is taken from the age class following immediately the one in which the felling age occurs (e.g. for aspen, age class 41–50 years).

D. Calculating the Cash Flow

The potential harvest volume is multiplied by the average stumpage price of the dominant species.

Stumpage prices are based on the average roadside assortment prices reported by the State Forest Management Centre (RMK) to Statistics Estonia, from which the corresponding felling and forwarding costs are deducted. These costs are estimated by Statistics Estonia using established NA models (stumpage price Method 2).

Weighted average stumpage prices by species are then calculated based on assortment-level prices and their shares in the total felling volume.

E. Calculating Expected Future Income

The potential harvest volume for each species is multiplied by the species-specific average stumpage price to derive the income expected after n years.

The period n is calculated as:

n = felling age − average age of the stand age class

For example:

• 11–20 years → n = felling age − 15

• 41–50 years → n = felling age − 45

This period n determines the exponent used in the discount factor for calculating present value.

F. Discounting Future Income

Future income is discounted to present value using the discount rate applied by RMK in valuing its biological assets, as reported in its annual financial statements.

The interest rate is defined as:

interest rate = discount rate − inflation rate

- The discount rate (return on equity) is calculated for RMK by the State Assets Department of the Ministry of Finance.

- The inflation rate is the forestry sector inflation forecast provided by the Macroeconomic Policy Department of the Ministry of Finance.

G. Calculating NPV by Tree Species

For each species, the present values of expected future income across all age classes are summed to obtain the total NPV of that species.

H. Calculating the Total Timber Asset Value (Timber Stock NPV)

The final step is to sum the net present values of all tree species to obtain the total net present value of future timber flows, representing the monetary value of the timber asset in the EFA balance sheet.

The results of the described monetary valuation of timber for the year 2023 are presented in the Annexes 2 according to the EFA balance sheet format. Data for the year 2022 are presented in Annex 1.

5.2.7.2 Considerations in selecting the discount rate

In general, a distinction is made between private discount rates and social discount rates. Under the SEEA framework, countries may select discount rates in accordance with national circumstances and valuation objectives. Private discount rates are typically used by firms to estimate the cost of capital and evaluate investment returns.

Social discount rates are applied in public policy and environmental valuation to reflect society's intertemporal preferences regarding benefits and costs occurring at different points in time.

To improve cross-country comparability, scenario-based discount rates are recommended—most notably the 2% rate suggested by the OECD—while still allowing countries the flexibility to apply rates that align with their institutional setting and policy context.

The SEEA Ecosystem Accounting (SEEA EA) framework emphasizes flexibility, transparency, and internal consistency. It encourages the use of scenario-based assessments, accompanied by clear documentation of assumptions. The OECD guidelines similarly note that discount rates have a substantial impact on the present value of environmental assets and depletion estimates. The choice of rate therefore depends on analytical purposes, with a general recommendation that discount rates be consistent with the institutional and policy context in which the valuation is undertaken.

Eurostat has suggested in bilateral communication to use five-year average with the aim to ensure that valuation practices reflect prevailing economic conditions while avoiding excessive volatility caused by short-term market fluctuations.

5.2.7.3 Application in Estonia

5.2.7.3.1 Current situation

The SEEA Central Framework (2012) recommends valuing natural resources using the Net Present Value (NPV) method, which discounts expected future resource rents to estimate asset values. However, the framework does not prescribe a specific discount rate, leaving countries to select their own approach. This flexibility has resulted in significant variability in practice, with some countries using market-based rates, others applying social discount rates, and some relying on government-prescribed rates.

5.2.7.3.2 Identified Problem and solution

The absence of harmonized guidance on discount rates has created several challenges:

1. Inconsistency in valuation results: Different discount rates can lead to large differences in asset values, undermining international comparability.
2. Uncertainty for compilers as statistical offices lack clear criteria for choosing between market rates, social rates, or policy-driven rates.
3. Risk treatment ambiguity as there is confusion about whether market-related risk should be reflected in the discount rate or in the calculation of resource rent.

Eurostat recommended the use of a five-year average forest sector discount rate for valuing forest-related assets and calculating depletion. This recommendation is intended to provide a practical and consistent approach for countries compiling forest accounts, particularly in the context of applying the Net Present Value (NPV) method. By focusing on a sector-specific rate averaged over a recent period, Eurostat aims to ensure that valuations reflect prevailing economic conditions while avoiding excessive volatility caused by short-term market fluctuations. This approach was adopted.

The practicality of this recommendation lies in its reliance on readily available data and its ability to smooth out temporary fluctuations in interest rates. Sector-specific rates (government bond yields) are generally published and accessible, making the calculation of a five-year average straightforward for Statistics Estonia. This approach also aligns with the principle of using observable market-based indicators, which enhances transparency and credibility. By focusing on the forest sector, the recommendation acknowledges the unique characteristics of forestry investments, such as long rotation periods and relatively stable returns, which differ from other sectors of the economy.

Testing:

In the 2025 compilation, three discount-rate scenarios were applied to assess the sensitivity of timber asset values to the choice of discount rate:

1. A 2% discount rate, as recommended by the OECD for the valuation of natural resources and for sensitivity analysis, which is expected to become a standard element of reporting in future cycles.

2.The discount rate applied to the state forest organization, adjusted by deducting the sector-specific inflation rate. This reflects the institutional practice used in the valuation of biological assets. The discount rate used for state forest organization biological assets reflects the expected return the state could earn on its capital elsewhere (opportunity cost of public funds). It's level depends on broader macroeconomic and financial conditions, including long-term interest rates, inflation expectations, and the overall monetary environment. It is also influenced by sector-specific and systemic risks. Those risks consider fluctuations in timber markets, economic uncertainty, regulatory changes, and environmental risks. Because the forest is state-owned, the rate is determined within the framework of national financial policy and guidelines for managing public assets, ensuring consistency with the state's long-term investment horizon. Inflation rate that is used to adjust the discount rate is the next 10-year expected inflation rate to the forestry sector. The discount rate must exceed the inflation rate so that the discounted net income from forestry operations yields a meaningful present value.

3. A discount rate based on the same state forest organization rate but calculated as a **five-year average** rather than a single-year figure, thereby reducing annual volatility and improving temporal stability. An example of the basis for discount rate for 2023 data can be seen in table 4.

Table 4. 5-year average discount rate used for 2023 data

Year	Discount rate
2019	2,32 %
2020	2,77 %
2021	3,21 %
2022	2,3 %
2023	**2,31 %**
5-year average	***2,58 %***

Following table displays the Estonian timber stock using different discount rates

Table 5. NPV value (million euros) of Estonian timber stock values according to the different discount rates

Period	NPV at 2% discount rate, recommended by OECD	NPV at 2.30 %(2022) 2.31% (2023) discount rate, national regulation based	NPV at 5-year average, 2.85% (2022) 2.58% (2023), discount rate
2022 opening	17 210,21	16 534,10	15 837,15
2022 closing	17 029,18	16 270,83	15 141,65
2023 opening	17 029,18	16 270,83	15 141,65
2023 closing	16 490,88	15 746,96	15 159,55

The net present value of timber assets (shown in table 5) varies by approximately 8% depending on the discount rate applied. For the final valuation, the **five-year average discount rate for the forest sector was used**. This choice reflects a balance between two generally recommended approaches:

(1) applying a **market-based rate**, which captures changes in economic conditions, and
(2) smoothing annual volatility by using a **multi-year average**.

The five-year average therefore provides a rate that remains grounded in current market conditions while ensuring greater stability and consistency across reporting years.

5.2.7.3.3 Further possible improvements

Despite its advantages, the five-year average approach has certain limitations. One concern is that it may still reflect cyclical economic conditions, particularly if the selected period includes years of unusually low or high interest rates due to monetary policy interventions or economic crises. This could lead to valuations that are not fully representative of long-term sustainability considerations. Furthermore, reliance on sector-specific rates may introduce complexity in cases where such rates are not clearly defined or consistently reported across countries. The approach also does not explicitly incorporate social or environmental preferences, which are increasingly relevant in the context of sustainable resource management.

When compared to OECD and SNA guidance, Eurostat's recommendation represents a middle ground between strict harmonization and national flexibility. The OECD Guide and the 2025 SNA propose a common baseline discount rate of two percent for international comparability, while allowing countries to use government-prescribed rates or long-term averages of government bond yields. Eurostat's approach is more tailored, emphasizing sector-specific considerations and a relatively short average period. While this enhances relevance for forestry, it may reduce comparability across countries and sectors, which is a key objective of global statistical standards.

To strengthen the recommendation, several improvements could be considered. First, combining the five-year average with an international baseline, such as the two percent rate suggested by the OECD, would allow for both national relevance and global comparability. Second, introducing a cap and floor for discount rates could prevent extreme valuations during periods of economic volatility. Third, requiring sensitivity analysis using alternative rates would provide policymakers with a clearer understanding of valuation uncertainty. Finally, integrating considerations of climate risk and sustainability into discount rate selection would ensure that valuations reflect not only market conditions but also long-term environmental objectives.

5.2.8 Comparison of A2b flow items with B tables and coherence with national accounts

Timber flows in the System of National Accounts (SNA) are reflected through various transactions. SNA in principle includes all activities that have been carried out in the economy, the most obvious flow that can be detected is the market of harvested timber. The EFA guidelines recommend calculating the value of wood in the rough based on physical quantities and roadside prices (i.e., the basic price of harvested timber), this approach was followed to compile EFA figures. Currently the value of **wood in the rough** as a separate good is not distinguished within the forestry activity output in the Estonian national accounts. In the Estonian national accounts, economic data from forestry enterprises are considered, but the linkage with physical quantities remains weak. Future integration workflows between the EFA and SNA are under development.

A similar situation applies to the **output of forest trees**. Although national accounts include this in the total forestry output, it is not distinguished as a separate product. Moreover, the methodology for calculating this item in SNA requires further development (update of mortality and increment physical values). We see that the EFA could serve as an important data source for this purpose in the future. For EFA compilation instructions described in the EFA manual were followed and physical amount of net increment was multiplied with stumpage price. Estonian Environment Agency changed since 2024 their reporting on increment (National Forest Inventory), now only presenting one figure that applies to whole Estonia via several years. NA is still using older version of increment calculation that was based on another model and distinguished by tree species and owners. In NA calculations the increment is continuously split by the selection of not complete timber assortments. Split is based on removals proportions. Still the estimations of increment in the Environment Agency are under development and might be updated in coming year.

Work in progress is regularly calculated by the SNA team, using physical volumes of increment and harvest broken down by wood species and harvest assortments. Mortality data is also incorporated to calculate the net increment value. All physical data are provided by the Environment Agency, while prices are sourced from RMK. Since the value of work in progress is calculated by subtracting harvest from net increment, EFA monetary timber asset table can also be used as the basis for these calculations. Analyze of the differences between NA and EFA revealed that mortality value has not been updated in NA calculations resulting also in different value of work in progress as mortality is important part of net increment value.

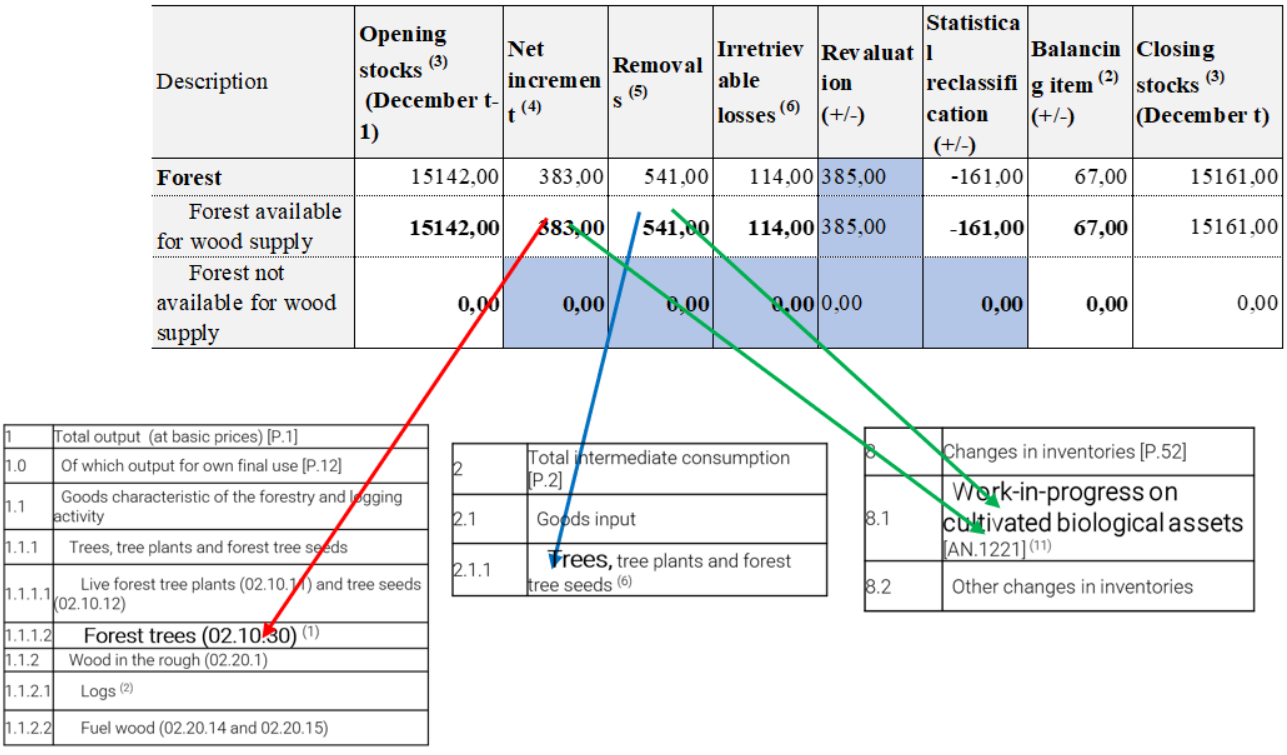
Results for various timber-related values can be found in Table 6. The values that are not visible in SNA were calculated based on the EFA guidelines. These values also depend on the calculation methodology of the stumpage price. The table presents separate values, as two different stumpage price calculation methods were tested in the project.

Table 6. Transactions with timber in SNA, million euro

Transaction	Calculation formula	Value 2023 stumpage price I	Value 2023 stumpage price II	SNA
Output of wood in the rough	Harvested timber * roadside price	934	690	Included in P.1 (output) of forestry (NACE A.02)
Output of forest trees	Standing timber * stumpage price	514	383	Included in P.1 (output) of forestry (NACE A.02)
Work in progress	Net increment – harvest (calculated with stumpage price)	-248	-157	SNA 2008 – under inventories (AN1221) SNA 2025 – under biological resources (AN33)

As EFA aims to provide connected information of timber and forestry related physical and monetary data, it is important to ensure comparable bases to compile different EFA tables. Figure 1 shows connections between table A2b and B1, it is seen that it's crucial to make discussed decision on which method, assumptions and bases should be used to calculate stumpage price. Value of net increment in Table A2b is used as input for output of product "Forest trees" in Table B1. Value of removals in Table A2b is input for values of intermediate consumption of "Trees" and work-in-progress on cultivated biological assets (that is calculated as net increment – removals).

Figure 1. Links between Tables A2b and B1



As work in progress value is included in NA and EFA, it was possible to compare the results. Comparison revealed that work- in-progress values differ due to the differences in physical input data. These underlying differences are that are described in more detail in Chapter 6.1.1 But as the methodologies and formulas should be the same, then in the future if all input data are coherent, EFA could be used as a data source for NA. Also, net increment and removals are included to NA production accounts but as NA is not as detailed, then these items are not distinguished separately but can be analyzed during the compilation of output and intermediate consumption. Possible workflow between EFA and NA compilers can be agreed in the future when EFA results are validated by NA team. NA still has to make calculations for the whole timeseries that cover more years than EFA does.

5.2.9 Analyses of the timber flows and stocks, contribution to the 31th UN London Group

Present chapter gives an analytical overview and summary of Estonia's contribution to the UN London Group on Environmental Accounting. Statistics Estonia, in cooperation with the Estonian University of Life Sciences, prepared a methodological article "Timber flows and stocks, comparison of the monetary valuation methods" for the 31st Meeting of the UN London Group on Environmental Accounting.

The article was compiled to address the growing need for coherent, transparent and internationally comparable valuation of timber resources in Estonia. As the country prepares for routine reporting under the European Forest Accounts and continues to expand the use of SEEA-based approaches, it became essential to examine how different valuation methodologies behave under national conditions and what implications they carry for economic, environmental and ecosystem accounts. Estonia's forest sector plays an important role in the national economy, and the increasing demand for integrated environmental–economic information further underscored the need to clarify methodological choices, strengthen linkages between accounting frameworks, and reduce inconsistencies arising from fragmented data sources and valuation practices. By systematically testing alternative methods and identifying their sensitivities, the work aimed to establish a more robust analytical foundation for future timber accounting, support alignment with evolving international standards, and contribute to the wider harmonization efforts discussed within the London Group and also undertaken in a frame of the UN SEEA CF revision.

The article presented Estonia's work on valuing timber flows and stocks in accordance with the European Forest Accounts (EFA) and brought linkages to the SEEA Central Framework, SEEA Ecosystem Accounting, and the System of National Accounts. Supported by a Eurostat development grant, Estonia has been designing a harmonized statistical framework for routine EFA reporting. The analysis aimed to test alternative valuation methods, examine their behavior under Estonian conditions, and identify issues where international guidance or harmonization would be beneficial.

The article assessed four principal valuation approaches recommended in the EFA guidelines or used internationally. The first approach, the stumpage price method, was tested in two variants: one relying on observed roadside prices and actual harvesting costs provided by the State Forest Management Centre, and a second based on the National Accounts modelling approach that uses species- and assortment-specific prices and modelled costs. The second major approach was the net income or net present value method, which estimates the present value of expected future resource rent, using age-class-specific growing stock data, species-specific stumpage prices, and a nationally determined discount rate. A third approach, based on unit resource rent, was examined as a possible national supplementary method, though its use is not recommended for timber valuation within the SEEA Central Framework or the EFA. In addition, the study reviewed other methods described in the EFA manual, including the consumption value method and the age-constant method, although these are not currently feasible in Estonia due to the absence of age-class-differentiated stumpage prices or valuation coefficients.

Beyond the EFA framework, Estonia also explored valuation approaches derived from SEEA Ecosystem Accounting. These include measuring timber as a provisioning ecosystem service through the basic price of harvested output, the resource rent generated by forest activity, the annuity value derived from forest land, and simplified net present value approaches based on assumptions of sustainable removals.

The valuation results showed considerable variation across the different methods. Stumpage price methods, which closely reflect observed market conditions, produced the highest timber stock values. Net present value estimates were generally lower and were strongly influenced by the choice of discount rate as well as the age structure of forests. The unit resource rent method, which yielded significantly lower values, reflected the narrower economic surplus observed in the state forest accounts. These differences illustrated the sensitivity of timber valuation to methodological assumptions.

Several factors contributed to the divergence in valuation outcomes. Aggregation practices for timber assortments and species played a central role, as did differences in the treatment of forest categories, cost structures, and deadwood and residue volumes. Timber prices, which fluctuate considerably from year to year, also had noticeable effects on all valuation approaches. The choice of discount rate and the assumptions regarding asset lifetime proved to be especially influential when applying the net present value method.

The article examined also how EFA timber accounts connect with the System of National Accounts. While the SNA currently records forestry output primarily through enterprise-level financial data and a model, the linkage to physical timber flows is limited. Estonia demonstrated how EFA-derived values for harvested timber, net increment, and work-in-progress could support improved valuation of wood in the rough, forest tree growth, and cultivated biological assets within the SNA. The analysis highlighted that harmonized stumpage prices and consistent assumptions are essential, as these valuations serve as inputs to the timber balance tables, forestry economic aggregates, and work-in-progress calculations.

Within SEEA Ecosystem Accounting, timber extraction is treated as a provisioning ecosystem service. The Estonian analysis showed that market-based stumpage values, resource rent estimates and annuity values derived from forest land represent different but complementary perspectives. Stumpage values reflect observed exchange prices; resource rent expresses the income attributable to the natural asset, and annuity values indicate long-term land productivity. Net present value approaches applied to ecosystem assets produced a wide range of results depending on assumptions about sustainability and asset lifetime.

The presentation of an article on UN London Group meeting discussed the challenges for cross-framework harmonization. International standards such as SEEA CF, SEEA EA, EFA, and SNA allow considerable flexibility in valuation methods, leading to divergent outcomes among countries and even within a single country's accounts. Estonia concluded that harmonization requires clearly defined stumpage price concepts, fully documented methodological choices, and strong coordination between national experts working on forest statistics, ecosystem accounts and national accounts. Each country remains responsible for ensuring internal coherence and transparency.

To support international methodological clarification, Estonia asked the London Group to reflect on four issues: whether consistent use of timber valuation methods across accounting frameworks is necessary; how harmonization can be strengthened without restricting national flexibility; whether the choice of valuation method affects the interpretation and policy relevance of the results; and how discount rates and asset lifetimes should be selected for the sake of international comparability.

In conclusion, the Estonian contribution showed that timber valuation outcomes depend significantly on methodological choices, data quality and parameter selection. Decisions regarding discount rates, species-specific asset lifetimes and aggregation procedures are particularly influential. The article emphasized the need for integrated national workflows across EFA, SEEA CF, SEEA EA and SNA, supported by shared terminology and transparent assumptions. While harmonization is desirable, it must be anchored in strong national methodological governance. Further work on sustainable income concepts may help enhance the policy relevance and coherence of timber-related ecosystem accounts.

The revision of the SEEA CF was one of the objectives of the 31th London Group, the key message to the group revising the SEEA Central Framework was on the importance of providing clearer and more operational guidance on the valuation of renewable natural resources such as timber. The Estonian experience demonstrates that outcomes vary widely across the methods currently allowed in the SEEA CF, particularly due to differences in price aggregation practices, treatment of forest categories, assumptions on asset lifetimes, and discount rate selection. While flexibility is valuable, the absence of more detailed methodological prescriptions creates challenges for national compilers seeking coherence between SEEA CF, EEA, EFA and the SNA. Strengthened guidance on core concepts—such as the definition and derivation of stumpage prices, the role of age structure in asset valuation, and the appropriate use of discount rates—would greatly enhance comparability, transparency and national implementation. Clarifying these areas would support countries in producing consistent and policy-relevant timber accounts, while also improving integration across accounting frameworks and reducing the need for ad-hoc national assumptions.

5.3 Compilation of technical descriptions

Technical descriptions were generated by the developer of methodology, and it comprised the MS Excel file and accompanied by the description for calculation

5.3.1 Methodological choice

To determine the monetary value of the timber stock using the net present value (NPV) based resource rent method, the present value of potential cash flows generated from the existing timber stock was calculated. The present value of the expected net revenues from the timber stock was estimated over the rotation period of each tree species by discounting future cash flows at the chosen discount rate. In valuing the timber stock in the EFA balance sheet, only revenues are taken into account; forest management costs are not considered.

5.3.2 Input data

Timber stock in physical units by tree species and age class. The assessment is based on NFI data on the distribution of managed stands across age classes according to the dominant species in 10-year intervals (Environment Agency 2025). The data consist of the area (1,000 ha) of managed stands in each age class by dominant species as presented in Table 7.

Table 7. Distribution of the area of stands in forests available for wood supply by age classes and dominant tree species (10 years age classes)

Vanuse-klass *Age class (a, years)*	Enamuspuuliik / *Dominant tree species*															
	Mänd *Pine*		Kuusk *Spruce*		Kask *Birch*		Haab *Aspen*		Sanglepp *Black alder*		Hall lepp *Grey alder*		Teised *Others*		Kokku *Total*	
	1000 ha	%	1000 ha	%	1000 ha	%	1000 ha	%	1000 ha	%	1000 ha	%	1000 ha	%	1000 ha	%
<= 10	16,5	3,6	25,6	8,7	65,1	12,1	31,2	27,5	15,4	23,0	54,4	26,7	2,6	9,4	210,8	12,4
11–20	22,2	4,8	36,8	12,5	56,4	10,5	18,9	16,7	8,3	12,3	46,7	22,9	4,3	15,7	193,5	11,4
21–30	26,6	5,8	31,7	10,7	76,8	14,3	11,8	10,4	6,6	9,9	34,7	17,0	6,1	22,4	194,4	11,4
31–40	28,3	6,2	38,2	12,9	61,3	11,4	5,3	4,7	5,6	8,4	31,7	15,6	3,9	14,3	174,4	10,2
41–50	33,2	7,2	47,4	16,1	63,6	11,8	7,2	6,3	7,5	11,2	18,0	8,8	1,9	6,9	178,7	10,5
51–60	49,4	10,8	32,7	11,1	77,5	14,4	12,5	11,1	8,6	12,8	13,5	6,6	1,4	5,0	195,6	11,5
61–70	59,8	13,0	25,8	8,7	69,5	12,9	13,2	11,7	6,6	9,8	4,4	2,1	1,2	4,6	180,4	10,6
71–80	70,7	15,4	22,7	7,7	41,3	7,7	7,4	6,6	4,7	7,0	0,3	0,2	1,4	5,2	148,5	8,7
81–90	53,2	11,6	14,2	4,8	16,0	3,0	3,1	2,7	2,7	3,9		0,0	0,8	2,9	89,9	5,3
91–100	38,6	8,4	8,5	2,9	6,7	1,3	1,3	1,2	0,8	1,2	0,2	0,1	1,6	5,7	57,7	3,4
101–110	20,2	4,4	5,7	1,9	2,4	0,4	0,8	0,7	0,2	0,2			0,9	3,4	30,1	1,8
111–120	16,3	3,6	3,4	1,1	0,2	0,0	0,5	0,4	0,0	0,1			0,8	2,9	21,1	1,2
121–130	7,2	1,6	1,1	0,4	0,0	0,0							0,2	0,6	8,4	0,5
131–140	7,0	1,5	1,2	0,4					0,2	0,2					8,4	0,5
141 <	10,6	2,3	0,3	0,1									0,3	1,1	11,2	0,7
Kokku *Total*	459,8	100	295,2	100	536,8	100	113,3	100	67,1	100	203,9	100	27,2	100	1 703,1	100

Source: Estonian Environment Agency, NFI 2023

To determine potential harvest volume, the per-hectare standing volume (m³/ha) of stands that have reached the permitted regeneration felling age of the dominant tree species is used (Table 8).

Table 8. Distribution of average growing stock per ha of stands available for wood supply by age classes and dominant tree species (10 years age classes)

Vanuse-klass *Age class (a, years)*	Enamuspuuliik / *Dominant tree species*							
	Mänd *Pine*	Kuusk *Spruce*	Kask *Birch*	Haab *Aspen*	Sanglepp *Black alder*	Hall lepp *Grey alder*	Teised *Others*	Keskmine *Average*
	m³/ha							
<= 10	5	7	7	14	12	18	8	11
11–20	47	65	69	111	93	106	71	80
21–30	104	154	143	199	173	184	141	151
31–40	151	229	183	296	257	232	187	203
41–50	197	275	215	338	272	250	213	239
51–60	246	300	244	374	304	293	255	268
61–70	284	306	273	407	327	312	292	294
71–80	299	325	280	441	313	310	259	305
81–90	324	337	298	447	328		246	325
91–100	309	334	263	535	281	211	257	311
101–110	289	321	273	359	385		335	298
111–120	290	308	238	297	214		283	292
121–130	279	318	234				258	283
131–140	259	337			313			272
141 <	228	204					217	227
Kokku / *Total*	241	222	180	218	194	146	170	203

Source: Estonian Environment Agency, NFI 2023

To estimate future potential harvest volume, the area of stands of the dominant species that have reached the permitted felling age is multiplied by the standing volume of mature stands.

Harvest volume is multiplied by the average stumpage price of the respective tree species. Stumpage prices were calculated using Version 2 described earlier in Section 5.1. Logging and extraction costs are calculated by Statistics Estonia using their internal models. The average stumpage price of a species is derived from assortments' stumpage prices weighted by the species' assortment shares in total harvest volume.

Potential harvest volume is multiplied by the average stumpage revenue to obtain the income expected after N years. The time to final felling (N) is determined as the difference between the species-specific felling age and the mean age of stands in the respective age class (e.g., 15 or 25 years).

The income expected after N years is discounted to present value using the chosen discount rate. The discount rate applied corresponds to the average discount rate used by the State Forest Management Centre (RMK) in valuing biological assets over the past five years as described 6.2.7.3.

The present values of future revenues calculated for each tree species and age class are aggregated to obtain the total net present value of existing stands by species.

The species-specific total net present values are summed to obtain the NPV of future cash flows for the entire timber stock.

In valuing the timber stock using the NPV method, it is assumed that the existing timber resource will be fully utilized over the coming decades. The main limitation of this approach lies in the assumptions about future cash flows, which may turn out to differ substantially from actual developments. The advantage of the NPV method is that it accounts for the utilization of the existing timber stock in accordance with the timing of species-specific maturity and harvest cycles. If the method changes technical description has to be changed accordingly.

6 Developing the methodologies and compilation the data for forest activity accounts (EFA B tables).

The 2025 work on B tables focused on improving the compilation of forestry activity accounts while clarifying their relationship with National Accounts (NA). For EFA B tables, the main progress was in refining the workflow to ensure consistency with physical and monetary data from A2b. Output of forest trees and intermediate consumption of trees were recalculated using stumpage price-based values from A2b, creating a direct link between physical flows and monetary aggregates.

In parallel, National Accounts integration was addressed. EKOMAR business statistics were integrated with adjustments for shadow economy and own-account production, improving coverage and accuracy there. The project analyzed differences between EFA and NA results, revealing discrepancies mainly due to increment and mortality assumptions and assortment allocation. A future workflow was proposed to avoid duplication: EFA provides physical and monetary flows (net increment, removals) as input for NA, while NA adds components such as FISIM, own-account production, and balancing adjustments. This approach ensures coherence between forestry accounts and broader economic aggregates. These integration aspects were discussed internationally, with Estonia presenting intermediate results at the UN London Group meeting, contributing to the dialogue on harmonizing EFA and SNA practices.

Together, these developments strengthen the analytical value of B tables and create a clear pathway for linking EFA with National Accounts, supporting transparency, comparability, and policy relevance. Although EFA B tables were filled in and reported to Eurostat also after the previous grant project, some uncertainties remained which were handled during this grant project.

Technical descriptions and metadata were updated to document assumptions and ensure reproducibility. Revisions to 2022 data and compilation of 2023 tables reflected these improvements.

6.1 Compilation of data for the reporting years 2023 and revising 2022

The compilation started by analyzing available variables in EKOMAR. Output and intermediate consumption were considered separately. It was seen that some of the necessary variables were readily available and for some categories additional assumptions and calculations were needed. A thorough analysis of the coverage of EKOMAR for NACE A.02 was done in the previous grant, and it was seen that the coverage is very good, therefore it could be used as an important data source for B table

Sales revenues of the live forest tree plants and tree seeds, non-wood products and services characteristic of the forestry and logging activity were readily available and used as a good proxy for output. For the output of other products from connected secondary activities in the local KAU secondary sales revenue from NACE 16 activity of forestry enterprises was used. The output of wood in the rough was calculated using formula described in the EFA guidelines – physical quantity of logs, thin logs, fuel wood and pulp wood were multiplied with road-side price; differences of wood species and assortments were considered. Output of other products was calculated as a discrepancy between National Accounts' output and all above-mentioned categories. It is important to note that Other products include also aggregates calculated in National Accounts – own consumption construction, own consumption machinery and software, own production research and development and shadow economy of forestry.

A similar approach was applied for intermediate consumption and its subsections. Detailed figures for intermediate consumption of different products were available from EKOMAR; FISIM was calculated in National Accounts. The value of Other products was calculated as a discrepancy between National Accounts intermediate consumption and EKOMAR based products. Intermediate consumption of other products included also own production research and development, shadow economy and possible corrections from balancing process of supply and use tables.

The gross value added was calculated as a difference between output and intermediate consumption. Subcategories of gross value added and gross fixed capital formation and also other changes in inventories were available from National Accounts.

6.1.1 Differences between National Account and EFA results

As the A2b and B tables combine physical and monetary data, they provide a good basis for comparing the monetary data in the EFA with that in the National Accounts, and substantial discrepancies were revealed. After analyzing the data, it became clear that the main reason for these differences was the inconsistencies in the physical data that form the basis of the calculations. It can be seen in Table 9 that increment differed by 1 million

m³ and mortality by 1.2 million m³, resulting in a 2.2 million m³ difference in net increment. Reasons behind different physical increment information is described in paragraph 0 and will be handled in coming year in cooperation with National Accounts.

Table 9. Monetary and physical values in EFA and NA, 2023

	EFA **Uses 2.second approach. available since 2024**	**NA (uses 1st approach)**	**Discrepancy**
Output (million eur)	1552.5	1147.1	405.4
Intermediate consumption (million eur)	1331.1	782.4	548.7
Gross value added (million eur)	221.4	364.7	-143.3
Surplus (million eur)	7.4	150.7	-143.3
Increment (million m3)	11.6	12.6	-1
Mortality (million m3)	3.4	2.2	1,2
Net increment (million m3)	**8.2**	**10.4**	**-2,2**
Removals (million m3)	11.6	11.7	-0,1
Work in progress (million m3)	-3.4	-1.3	-2,1
Work in progress (million eur)	-157	-38	-119.3

Mortality differed due to the choice of methodological detail – the National Accounts formulas used a standard value that was established when the work-in-progress calculation logic was developed. But most recent updated mortality data was used for EFA compilation.

In addition, due to the choice of assortment shares results differed: the NA used the most recent updated results provided to them by the Environment Agency yearly, while the EFA relied on the 2014 version, which had better coverage of various assortments. Although this aspect does not have a very large impact on the results, it still contributes to the total difference between the accounts.

Another difference between the NA and the EFA is that NA shows the discrepancy between net increment and harvest under the output of forest trees. In contrast, the EFA records the value of net increment under the output of forest trees and the value of harvested trees under intermediate consumption. In principle, this should not affect gross value added if net increment and harvest were calculated on the same basis. However, since they were not, gross value added in the EFA was 143 million euros lower in 2023 than in the NA.

The same calculation logic was used to update 2022 data and revised data were transmitted to Eurostat.

Differences between European Forest Accounts and National Accounts persist due to different increment models, mortality assumptions, and valuation approaches. EFA applies newer National Forest Inventory-based methods, while National Accounts use older models. Steps for better alignment have been identified, but full integration will take time and depends on decisions by National Accounts after EFA developments are finalized, as well as on resources and cooperation. The aim is gradual integration into National Accounts (as gradual integration is standards procedure) rather than immediate harmonization.

6.1.2 Estimates for increment according to National Forest Inventory

Gross Annual Increment (GAI) according to the stand-level increment model calculated for all volume sample plots of NFI based on formula:

$$Z_M = (a_1 + a_2 \cdot H100 + a_3 \cdot OnSaar) * \left(\frac{M}{A \cdot b_1 + M}\right)^{c_1}$$

Where ZM – average gross annual increment of stand per ha, H100 – height index, M – growing stock per ha of stand, A – age of stand, a1, a2, a3, b1, c1 – tree species' specific parameters; OnSaar = 1 if plots situate in Hiiu, Saare or Lääne County.

GAI data is disaggregated according to dominant tree species, management category, and major ownership groups. EstEA provides yearly estimates of GAI to Estonian Statistical Office. The model reflects the biophysical characteristics of stands but not the changing growing conditions (droughts, wet/dry seasons, disturbances. There is no stand-level mortality/natural losses model, therefore the average fixed mortality rate is based on NFI data for 2000-2018. This mortality rate was indirectly calculated using GAI, harvesting volumes, and stock changes over the longer period. This approach underestimates actual mortality.

- Second approach, which has been applied for EFA (and also for the compilation of 2024 report), gives for the first time the annual estimates which were produced based on measured increment of single trees on permanent volume sample plots of NFI. The single year estimate is based on a 5-year average (typical approach in NFI) GAI and mortality on re-measured sample plots. Every permanent sample plot is measured after 5 years (on the 6th year) which provides the opportunity to calculate stemwood volume growth on tree and sample-plot level. The relevant estimate represents average annual volume growth in 5 years. To avoid high fluctuation of estimates caused by variation, the 5 most recent re-measurements are included in the final estimate. It is not sensible to disaggregate the results according to the dominant tree species (too high variation).
- EstEA, in cooperation with Tartu University Institute of Mathematics and Statistics, develop the NFI dynamic models for GAI and mortality based on NFI single tree re-measurements in 2025-26.

6.2 Compilation of data for the reporting years 2023 and revising 2022

Table B1 and B2 were compiled for 2023 and 2022. Data was transmitted to Eurostat in the end of September. Descriptions of the methodologies used for the compilation are described in chapter 7.

Major difference between previously compiled 2022 and updated 2022 was in the value of output and intermediate consumption of "Other products" as the calculation was updated by using the most recent information from National Accounts – in the updated 2022 dataset this variable includes also shadow economy and own accounts consumption of various products.

As assortments of harvest were updated and therefore also the stumpage price value, it affected the value of output of forest trees, intermediate consumption of trees and work-in-progress. Consequently, gross value added, and surplus value were updated due to the changes in output and intermediate consumption.

6.3 Compiling technical descriptions

Technical descriptions regarding the input data and calculation rules were made. Calculations are done in MS Excel and to ensure compliance in time series, then the files include links to input data and formulas so that the calculations can be done using them on the same basis. In the future it is possible to discuss on automatizing some of the calculation processes.

6.4 Analysing the inclusion of forestry accounts into the national accounts domains on an annual basis.

To ensure consistency between the EFA and the NA, it is important to agree on a methodology to be used in the future and to establish a workflow that prevents the same calculations from being performed by different divisions. The suggested workflow was described in more detail in a previous grant project, but the overall recommendations by the EFA compilers were as follows:

- Compilation of physical A tables

- Compilation of monetary A table
- Output of wood in the rough and forest trees and intermediate consumption of trees (and work-in-progress) will be calculated using data from table A2b, physical amounts and prices – these would be sent to national accounts for further adjustments
- EFA compiler receives output and intermediate consumption adjustments, components of gross value added, FISIM, components of gross fixed capital formation, other changes in inventories from national accounts
- Other categories of output and intermediate consumption will be calculated using national accounts and EKOMAR detailed data

During the GNI verification visit in 2023 Estonia received an action point AP A4, which stated that National Accounts is required to validate their estimates for forest industry against forestry accounts. If significant differences were to be discovered, NA would have to revise their estimates accordingly. As these accounts were still in early development at this time, NA team members were also included into the project. This was done to guarantee the consistency between the two domains.

As the methodology used for the forestry accounts is consistent with NA purposes, it makes sense to incorporate the estimates also into NA. This would be the case regardless of the size of the differences in the final estimates. Once the estimates are finalized, NA can introduce them into their respective domains. As NA needs to have longer time series consistent over time, some additional extrapolations for back years not covered by forestry accounts needs to be produced.

NA also needs to have quarterly estimates in addition to annual. As forestry accounts provide annual estimates, NA will need to produce a time series benchmarked to forestry accounts. Once all the necessary preparations are finished NA can begin to include forestry accounts into their domains on an annual basis.

7 Metadata and methodological documentation

Describing quality and metadata is a core requirement of official statistics and also for EFA implementation.

Agreed principles:

- Metadata must document:
  - Methodologies
  - Data sources
  - Transformations and adjustments
  - Assumptions (e.g., discount rate, assortment model, mortality model)
  - Accessibility and clarity
  - Quality indicators
- Metadata must meet the standard of official statistics, given that forest accounts will be produced regularly under EU regulation.

In Statistics Estonia we produce quality and metadata reports about every statistical process which output data are published in our statistical database. Quality and metadata reports must be compiled to ensure the transparency, clarity and understandability of the statistics.

For Forest Accounts Statistics Estonia has compiled ESMS-based quality and metadata report (https://stat.ee/en/find-statistics/methodology-and-quality/esms-metadata/10306). The base for the report is compiled by metadata expert based on the information available from existing sources. Afterwards the owner of a Forest Accounts' statistical process complemented the report with specific information. After reaching the agreement on the content of metadata the report was translated into English. Then the Publication Team published the report on Statistics Estonia's website.

Statistics Estonia is in the middle of the transition period and therefore publishing the SIMS reports on our website is under development. For that reason we update our ESMS-reports (they are publicly available on Statistics Estonia's website and have to be up to date) and at the same time compile SIMS-reports.[5]

Until 2025, our reports have been based on the Euro-SDMX Metadata Structure (ESMS).

In 2017 the European Commission recommended all member states to implement SIMS in order to streamline and harmonise user and producer reports in the ESS, decrease the reporting burden on NSOs by creating the framework that enables once for all purposes reporting, where concepts that are common to user and producer reports are reported upon once for both purposes, create an integrated and consistent reporting framework where the reports can be stored in a single database; create a flexible and up to date system where future extensions are possible by adding new concepts.

The transition to SIMS-compliant metadata will be completed by 2026.

All ESMS elements will be mapped to SIMS concepts, and a change log will be maintained for all metadata updates. While the structure of SIMS is fixed, the implementation approach allows flexibility in technical tools used for version control and publication, provided they meet Eurostat’s transparency requirements. SIMS-compliant reports will be published on Statistics Estonia’s website by the stated deadline. Until the transition is complete, ESMS reports will remain publicly available and updated quarterly to ensure continuity and accessibility.

[5] In order to ensure comparability of the statistics between member states of the European Union we follow the European Statistical System (ESS). In the ESS there are 3 structures for compiling quality and metadata reports: Single Integrated Metadata Structure (SIMS) and it's underlying reporting structures EURO-SDMX Metadata Structure (ESMS) and ESS Standard for Quality Reports Structure (ESQRS). All of them are output-oriented way of viewing statistical processes but describe other stages of statistical production (e.g design, collection, processing, dissemination) as well. ESQRS is a producer-oriented structure comprising more quality indicators and it's level of detail might be too specific for general users. ESMS is a user-oriented structure which main focus is on the methodology. SIMS is so called all-inclusive report which comprises both ESMS and ESQRS metadata elements (concepts).

8 Communication and dissemination

8.1 International knowledge exchange

Estonia's participation in the 31st UN London Group on Environmental Accounting was a strategic component of the Eurostat grant implementation. The methodological paper presented—"Timber flows and stocks: comparison of monetary valuation methods"—addressed one of the grant's goals: developing harmonized, transparent approaches for valuing timber resources under the European Forest Accounts (EFA) framework and ensuring coherence with SEEA and the System of National Accounts (SNA).

The contribution demonstrated Estonia's analytical capacity to test multiple valuation methods—stumpage price, net present value, and resource rent—under national conditions, highlighting sensitivities to discount rates, species aggregation, and cost structures. This work provided evidence on the feasibility of routine valuation workflows and clarified how physical flows (increment, removals) can be integrated with monetary accounts and economic aggregates. By presenting these findings internationally, Estonia not only showcased progress achieved under the grant but also positioned itself as an active contributor to global methodological development.

Importantly, hosting the London Group meeting in Estonia enabled the involvement of national experts on-site, creating a unique opportunity for cross-disciplinary dialogue between statisticians, forestry specialists, and economists. This local engagement strengthened capacity building, facilitated knowledge transfer, and ensured that Estonia's methodological choices were critically reviewed in an international setting while grounded in national expertise. Feedback from the London Group reinforced the relevance of Estonia's approach. Discussions focused on the need for clearer international guidance on stumpage price concepts, discount rate selection, and harmonization across SEEA CF, SEEA EA, EFA, and SNA. Estonia's experience—documented through comparative results and sensitivity analysis—was recognized as valuable input for the ongoing revision of the SEEA Central Framework. This engagement thus fulfilled multiple grant objectives:

1. Dissemination and visibility, by presenting EU-funded work in a global forum;
2. Methodological alignment and capacity building, by validating Estonia's routines against international standards and involving local experts;
3. Risk mitigation, by obtaining expert feedback that strengthens the robustness of national methods and reduces uncertainty in future reporting.

In summary, the London Group presentation was not an ancillary activity but an integral part of the grant's work to ensure transparency, comparability, and policy relevance of forest accounts. It demonstrated Estonia's ability to operationalize complex valuation methods, confirmed the feasibility of integrating these methods into routine production, and contributed to shaping international guidance that will benefit all EU Member States. More details on this presentation and discussion is given in chapter 5.2.9.

Statistics Estonia contributed to the revision of the SEEA Central Framework through active participation in the SEEA Technical Committee meeting (UN premises) discussion, providing analytical insights on timber flows and stock valuation. The contribution highlighted practical challenges in applying current SEEA CF guidance, notably large result variations arising from differences in stumpage price derivation, forest classification, asset lifetimes, and discount rates, which hinder comparability across SEEA CF, SEEA EA, EFA, and SNA. Estonia proposed improvements in three key areas:

Clearer principles and examples for stumpage price derivation, supported by worked examples and metadata requirements;

Better integration of forest age structure into asset valuation, to reflect long-term productive capacity;

More structured guidance on discount rates, including a 2% international baseline, practical alternatives, and sensitivity analysis.

The Technical Committee welcomed these inputs as relevant and useful for future guidance. This activity supported international methodological dialogue, increased the visibility of EU-funded work, and demonstrated Estonia's commitment to transparent and comparable environmental-economic accounting.

On the methodological seminars held in the framework of grants colleagues from other NSI-s (Statistics Lithuania, Central Statistical Bureau of Latvia, Central Statistics Office Ireland, Swiss Federal Statistical Office, Statistics Sweden, Statistics Finland and LUKE) (see the minutes in annex 4 and 5) enhancing the communication on methodological issues among the experts.

Forest accounts was also one of the exchange topics on trilateral Baltic countries exchange activities on the enhancements of environment statistics in April 2025, were forest accounts methodological developments were communicated.

The results of WP1 are published in Statistics Estonia's database with explanatory notes and metadata. A user-oriented article was prepared for the release to ensure clarity and prevent misinterpretation.

8.2 Publication and dissemination of forest accounts data

The dissemination strategy included:

Regular publication of forest accounts starting in 2026, ensuring continuity and accessibility.

Integrated channels: Statistics Estonia's online database, explanatory articles, and visual dashboards where feasible.

Contextual information: Metadata explaining calculation methods, revisions, etc.

The first major step was the publication of EFA tables in the online database, accompanied by ESMS metadata.

To support interpretation, Statistics Estonia prepared an article. This article marked the first public-facing release of forest accounts data and aimed to bridge technical results with broader policy and public interest. Statistics Estonia approached dissemination with the dual aim of transparency and usability, recognizing that publishing raw figures without context could lead to misinterpretation. Early discussions with stakeholders—including representatives from the Ministry of Climate—highlighted the risk that users might compare EFA data directly with other data available without understanding methodological differences such as increment revisions or assortment models. To mitigate this, the team agreed that clear metadata, explanatory notes, and a user-oriented article could accompany data release.

The prepared article was structured in three parts:

Economic contribution of forestry: It presented production figures, gross and net value added, investment levels, and employment data for 2023, illustrating the sector's role in the national economy.

Balance between harvest and growth: Using physical and monetary indicators, it documented net changes in forest volume, harvest levels relative to growth, and valuation of timber capital. This section emphasized sustainability concerns and the importance of maintaining long-term forest capital.

Forests beyond timber: The article linked forestry to ecosystem services such as carbon sequestration, non-timber products, and recreation, highlighting the multifunctional value of forests and their ecological significance what EFA does not cover.

By combining narrative explanation with detailed tables, the publication provided readers with a holistic view of Estonia's forestry sector and its economic weight. This approach ensured that new forest accounts were not only technically robust but also accessible and relevant to policy, researchers, and the general public.

The activity fulfilled the grant's objectives by building trust and transparency, reducing the risk of misinterpretation and reinforcing the credibility of environmental-economic statistics.

9 Conclusion

All WP1 deliverables (D1.1–D1.4) have been completed in line with the Eurostat grant agreement. The report ensures transparency, reproducibility, and compliance with SEEA and EFA standards. Methodological improvements, metadata documentation, and workflows for routine production have been implemented to support sustainable annual compilation starting in 2026.

ANNEX 1. European forest accounts, results for 2022

Table 1. A1 (a) Area of wooded land, in 1000 ha, Reference year = 2022

Assets (stocks and flows)		Opening area (December 2021)	Afforestation and other increase	Deforestation and other decrease	Statistical re-classification (+/-)	Balancing item (+/-)	Closing area (December 2022)
Code	Description						
1	Forest	2447,41	2,13	1,21	0,00	-1,58	2446,75
1.1	Forest available for wood supply	1988,90	1,73	0,98	-15,68	-1,28	1972,69
1.2	Forest not available for wood supply	458,51	0,40	0,23	15,68	-0,30	474,06
2	Other wooded land						
2.1	Of which available for wood supply						
3	Other land with tree cover available for wood supply						

Table A2 (a) Timber on wooded land, in 1000 m^3 over bark, reference year = 2022

Assets (stocks and flows)		Opening stocks (December t-1)	Net increment	Removals	Irretrievable losses	Statistical re-classification (+/-)	Balancing item (+/-)	Closing stocks (December t)
Code	Description							
1	Forest	511 116,01	9 100,00	12 013,00	1 996,32	0,00	-2 066,00	504 140,69
1.1	Forest available for wood supply	399 451,83	8 200,00	12 013,00	1 996,32	-4 902,76	-1 614,46	387 125,29
1.2	Forest not available for wood supply	111 664,18	900,00	0,00	0,00	4 902,76	-451,31	117 015,63
2	Other wooded land	2 434,97					47,38	2 482,35
2.1	Of which available for wood supply	2 302,92					30,71	2 333,63
3	Other land with tree cover available for wood supply						800,00	0

Table A2b Monetary value of timber stock calculated with the Net Income Method, 2022, million euros

Code	Description	Opening stocks (December T-1)	Net increment	Removals	Irretrievable losses	Revaluation	Statistical reclassification(+/-)	Balancing Item	Opening stocks (December T)
1	Forest	15 837,00	383,00	561,00	93,00	-120,00	-229,00	-75,00	15 142,00
1.1	Forest available for wood supply	15 837,00	383,00	561,00	93,00	-120,00	-229,00	-75,00	15 142,00
1.2	Forest not available for wood supply	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2.	Other wooded land	63,00				0,00		1,00	64,00
2.1	Of which available for wood supply	63,00				0,00		1,00	64,00
3	Other land with tree cover available for wood supply	0,00		22,00					

Table B1 Economic aggregates for forest and logging industry, 2022, million EUR

	Variable	Result of method 1
1	**Total output (at basic prices) [P.1]**	1 763,53
1.0	Of which output for own final use [P.12]	14,49
1.1	Goods characteristic of the forestry and logging activity	1 122,11
1.1.1	Trees, tree plants and forest tree seeds	404,38
1.1.1.1	Live forest tree plants (02.10.11) and tree seeds (02.10.12)	1,17
1.1.1.2	Forest trees (02.10.30)	403,21
1.1.2	Wood in the rough (02.20.1)	715,55
1.1.2.1	Logs	583,38
1.1.2.2	Fuel wood (02.20.14 and 02.20.15)	132,17
1.1.4	Non-wood products (02.30)	2,18
1.2	Services characteristic of the forestry and logging activity	278,20
1.3	Other products from connected secondary activities in the local KAU	9,52
1.4	Other products (*)	353,70
2	**Total intermediate consumption [P.2]**	1 459,65
2.1	Goods input	654,21
2.1.1	Trees, tree plants and forest tree seeds *6	561,65
2.1.2	Energy, lubricants *7	92,52
2.1.3	Fertilizers and soil improvers	0,04
2.1.4	Plant protection products and pesticides *8	0,00
2.2	Services input	292,14
2.2.1	Services characteristic of the forestry and logging activity *4	278,20
2.2.2	Regular maintenance and repair of equipment *9	
2.2.3	Maintenance of buildings (*)	
2.2.4	Financial services (FISIM) [P.119]	13,93
2.3	Other goods and services used as inputs (*)	513,31
3	Gross value added (at basic prices) [B.1g]	303,88
3.1	Consumption of fixed capital [P.51c]	61,80
3.2	Net value added (at basic prices) [B.1n]	242,08
3.2.1	Other taxes on production [D.29]	4,94
3.2.2	Other subsidies on production [D.39]	1,54
4	Factor income	238,68
4.1	Compensation of employees [D.1]	130,34
5	Net operating surplus [B.2n] and Mixed income [B.3n]	108,34
5.1	Net property income [D.4] *10	-8,36
5.2	Net entrepreneurial income [B.4n]	99,97
6	Gross fixed capital formation (excluding deductible VAT) [P.51g]	89,46
6.1	Buildings, structures and land improvements	36,78
6.2	Machinery and equipment	49,41
6.3	Plant resources yielding repeat products	0,00

	Variable	Result of method 1
6.4	Other GFCF(*)	3,27
7	Net fixed capital formation (excluding deductible VAT) [P.51n]	27,66
8	Changes in inventories [P.52]	-215,70
8.1	Work-in-progress on cultivated biological assets [AN.1221]*11	-178,00
8.2	Other changes in inventories (*)	-37,70
9	Capital transfers (net) [D.9]	3,13
10	Total labor input [L] (in 1000 harmonized AWU) *12	5,66

Table B2. Output of the forest and logging industry by type, 2022, million EUR

Code	Description	31	32	33	99	41
		Own final use [P.12]	Market	Nonmarket	Total	*of which:* Households [S.14]
2	Output (at basic prices) [P.1] Method 1	14,49	1749,04		1763,53	

ANNEX 2. European forest accounts, results for 2023 A1 (a) Area of wooded land, in 1000 ha, reference year = 2023

Table 1. A1 (a) Area of wooded land, in 1000 ha, Reference year = 2023

Assets (stocks and flows)		Opening area (December 2022)	Afforestation and other increase	Deforestation and other decrease	Statistical re-classifi-cation (+/-)	Balancing item (+/-)	Closing area (December 2023)
Code	Description						
1	Forest	2446,75	1,09	0,87	0,00	7,18	2454,15
1.1	Forest available for wood supply	**1972,68**	**0,88**	**0,70**	**-6,96**	**5,79**	1971,69
1.2	Forest not available for wood supply	**474,07**	**0,21**	**0,17**	**6,96**	**1,39**	482,46
2	Other wooded land						
2.1	Of which available for wood supply						
3	Other land with tree cover available for wood supply						

Table A2 (a) Timber on wooded land, in 1000 m^3 over bark, reference year = 2023

Assets (stocks and flows)		Opening stocks (December t-1)	Net increment	Removals	Irretrievable losses	Statisti-cal re-classifi-cation (+/-)	Balancing item (+/-)	Closing stocks (December t)
Code	Description							
1	Forest	504 141	9 100	11 564	2 445	0	1 858	501 090
1.1	Forest available for wood supply	387 125	**8 200**	**11 564**	**2 445**	**-3 449**	**1 427**	379 294
1.2	Forest not available for wood supply	117 016	**900**	**0**	**0**	**3 449**	**431**	121 796
2	Other wooded land	2 482					**-29**	2 453
2.1	Of which available for wood supply	2 334					-70	2 264
3	Other land with tree cover available for wood supply			700			700	0

Table A2b Monetary value of timber stock calculated with the Net Income Method, 2023, million euros

Code	Description	Opening stocks (December T-1)	Net increment	Removals	Irretrievable losses	Revaluation	Statistical reclassification(+/-)	Balancing Item	Opening stocks (December T)
1	Forest	15 142	383	541	114	385	-161	67	15 161
1.1	Forest available for wood supply	15 142	383	541	114	385	-161	67	15 161
1.2	Forest not available for wood supply	0	0	0	0			0	0
2.	Other wooded land	64				7		-2	69
2.1	Of which available for wood supply	64				7		-2	69
3	Other land with tree cover available for wood supply			21				21	0

Table B1 Economic aggregates for forest and logging industry, 2023, million EUR

	Variable	Result of method 1
1	**Total output (at basic prices) [P.1]**	1 552,52
1.0	Of which output for own final use [P.12]	15,09
1.1	Goods characteristic of the forestry and logging activity	1 100,81
1.1.1	Trees, tree plants and forest tree seeds	409,46
1.1.1.1	Live forest tree plants (02.10.11) and tree seeds (02.10.12)	1,25
1.1.1.2	Forest trees (02.10.30)	408,21
1.1.2	Wood in the rough (02.20.1)	689,83
1.1.2.1	Logs	544,62
1.1.2.2	Fuel wood (02.20.14 and 02.20.15)	145,21
1.1.4	Non-wood products (02.30)	1,51
1.2	Services characteristic of the forestry and logging activity	248,06
1.3	Other products from connected secondary activities in the local KAU	14,93
1.4	Other products (*)	188,73
2	**Total intermediate consumption [P.2]**	1 331,13
2.1	Goods input	622,54
2.1.1	Trees, tree plants and forest tree seeds *6	543,09
2.1.2	Energy, lubricants *7	74,16
2.1.3	Fertilizers and soil improvers	3,78
2.1.4	Plant protection products and pesticides *8	1,51
2.2	Services input	275,46
2.2.1	Services characteristic of the forestry and logging activity *4	248,06
2.2.2	Regular maintenance and repair of equipment *9	
2.2.3	Maintenance of buildings (*)	
2.2.4	Financial services (FISIM) [P.119]	27,40
2.3	Other goods and services used as inputs (*)	433,13
3	Gross value added (at basic prices) [B.1g]	221,39
3.1	Consumption of fixed capital [P.51c]	67,66
3.2	Net value added (at basic prices) [B.1n]	153,73
3.2.1	Other taxes on production [D.29]	6,45
3.2.2	Other subsidies on production [D.39]	2,96
4	Factor income	150,24
4.1	Compensation of employees [D.1]	142,83
5	Net operating surplus [B.2n] and Mixed income [B.3n]	7,42
5.1	Net property income [D.4] *10	-13,20
5.2	Net entrepreneurial income [B.4n]	-5,78
6	Gross fixed capital formation (excluding deductible VAT) [P.51g]	101,49
6.1	Buildings, structures and land improvements	43,87
6.2	Machinery and equipment	52,13
6.3	Plant resources yielding repeat products	0,03
6.4	Other GFCF(*)	5,46
7	Net fixed capital formation (excluding deductible VAT) [P.51n]	33,83

	Variable	Result of method 1
8	Changes in inventories [P.52]	-142,36
8.1	Work-in-progress on cultivated biological assets [AN.1221]*11	-157,30
8.2	Other changes in inventories (*)	14,94
9	Capital transfers (net) [D.9]	3,88
10	Total labor input [L] (in 1000 harmonized AWU) *12	5,65

Table 5. Output of the forest and logging industry by type, 2023, million EUR

Code	Description	31	32	33	99	41
		Own final use [P.12]	Market	Nonmarket	Total	of which: Households [S.14]
2	Output (at basic prices) [P.1] Method 1	15,09	1 537,43	0,00	1 552,52	

ANNEX 3 European forest accounts, minutes of the kick-of meeting

2025-01-31

Minutes

Participants:

Statistics Estonia: Kaia Oras, Grete Luukas, Swen Peterson, Aki Kadulin,

Estonian Environment Agency Taivo Denks, Mati Valgepea, Krisela Uussaar

Ministry of Climate: Tanel Niklus

Agenda

Introduction: Forest Accounting

Interim developments and discussions on process and expert involvement

Activities to ensure a regular data flow

Plan for future activities

Discussion on collaboration

Introduction: Forest Accounting

Kaia Oras provided an overview of the focus of the grant, planned activities, and outsourced tasks. She presented a detailed breakdown of all sub-activities and planned collaborations for each:

T.1 Development of methods and data for forest land accounting (EFA A1a tables)

T.2 Development of methods and data for timber stock accounting (EFA A2a tables, physical accounts)

T.3 Development of methods and data for timber stock accounting (EFA A2b tables, monetary accounts)

T.4 Development of accounting methods and data for forestry activities (EFA B tables)

T.5 Development of data management processes and metadata for forest accounting

Presentation slides outlining activities and cooperation points were attached to the memo.

Process and Expert Involvement in Accounting

Kaia Oras introduced the activities and plans related to the monetary tables of forest accounting (A2b and B).

The A2b table for 2023 will be compiled, and the 2022 table will be updated if necessary.

The methodology proposed at the end of the previous grant will be analyzed, technical descriptions will be prepared, and the methodology will be updated according to the EFA handbook guidelines.

The analysis and preparation of the monetary forestry tables will be carried out in collaboration with the National Statistics Office's (SA) national accounts team.

For the forestry sector's B tables, the 2023 account will be compiled, and the 2022 account will be updated as needed. The roadmap proposed in the previous grant will be analyzed and implemented. Overlaps and differences with national accounting will also be clarified.

This includes:

- Accounting for forestry service production
- The use of raw timber in the forestry sector
- Production of growing forests
- Analysis and implementation of methods for changes in intermediate consumption and unfinished production stocks
- Analysis of base data for stump price calculations (RMK prices, logging costs)

Analysis of value-added components (taxes on production, production subsidies, and employee compensations)

Kaia Oras raised the question of whether additional expertise is needed in Estonia beyond Paavo Kaimre (Estonian University of Life Sciences) for monetary tables (T.3 Timber Stock Accounting, EFA A2b).

Tanel Niklus (Ministry of Climate) supported the selected direction and activities of the grant but did not suggest additional experts beyond Paavo Kaimre. He also supported the development of metadata descriptions (T.5).

Taivo Denks (Environmental Agency's Forest Department) found the plans logical and reasonable and also supported the planned grant activities.

Planning the Workflow for Data Management and Metadata in Forest Accounting

A separate discussion was held on the workflow for forest accounting data management and metadata development. It was emphasized that for the successful implementation of the accounting process, the following must be described:

Input data sets (balance and stock tables)

Administrative data sources (NFI and other auxiliary sources)

Compilation steps

These descriptions and process diagrams will be developed in cooperation between EstEA and SA's data acquisition team. The plan is to amend the data transfer agreement to include administrative data on forest land area and timber stock starting in 2026.

Mati Valgepea (Environmental Agency) stated that additional funding for data preparation might not be needed. He also noted that further methodology development for physical tables for Estonian Environment Agency might not be needed at this stage since this was already done in the previous grant. If methodological improvements are needed, they might be in larger scope than this grant allows.

He emphasized that EstEA needs an example of how statistical production is documented in case of the use of administrative registers.

A key question raised was whether the National Statistics Office (SA) requires a copy of the SMI base data or direct access to raw measurement results from the forest.

Kaia Oras responded that the solution for data management (whether SA receives a data copy, access, or another solution) must be decided in cooperation with SA's data management department during 2025. This decision is also a key objective of the metadata development task (T.5).

According to Eurostat's comments from autumn 2024, SA must build a competence base for forest accounting, as SA is responsible for producing official statistics in this field. This means that SA must have the ability to answer data-related questions comprehensively and understand data sources at a level that allows them to explain changes and assess quality.

Further Discussion on Data Access and Transparency

Mati Valgepea noted that access to the raw NFI base data is highly restricted, even for EstEA employees, and that previous cases (e.g., National Audit Office) were only granted data copies, not direct access.

Kaia Oras stressed the need for an informed discussion and maximum transparency regarding data management.

The exact data access requirements for SA will be determined during the development process.

If SA only needs to understand and record the calculation rules, then providing raw data copies may not be necessary.

The project will identify technical solutions for data integration and define the level of detail for included data.

Training and Collaboration Needs

Mati Valgepea suggested that if SA wants to fully understand the accounting calculations, a training session is necessary.

Kaia Oras agreed that a training session on NFI methodology and forest accounting A-tables calculations is needed.

Tanel Niklus (Ministry of Climate) asked for clarification on SA's legal framework for using data from different registers.

Kaia Oras explained that the EU Regulation 691/2011 makes forest accounting mandatory for member states starting in 2025.

Since SA is responsible for national statistics, it must ensure the quality of forest accounting data, including balance sheets for forest land and timber stock.

Future Steps

A physical meeting is planned soon for SA to familiarize itself with NFI raw data and A-table calculations for forest area and timber stock.

The initial meeting is scheduled for February 14.

The Environmental Agency needs guidelines on how to document data, calculations, and methodologies.

A public article on forest accounting will be written, potentially in collaboration with the Ministry of Climate, the Environmental Agency, and/or researchers.

Note: The Statistics Estonia does not question EstEA's data quality, expertise, or methodologies. The need for descriptions stems from compliance with international statistical standards (GSPBM) to ensure comparability.

ANNEX 4 Minutes of the methodological seminar on the application of the European Forest Accounts (EFA) in Estonia

Date: May 26, 2025

Location: Statistics Estonia, Tallinn

Organizers: Statistics Estonia in cooperation with the Estonian Environmental Agency

Eurostat Grant Reference: 2024-EE-EGD

List of Participants:

Statistics Estonia:

Kaia Oras, Swen Peterson, Aki Kadulin, Grete Luukas, Veiko Adermann, Argo Ronk, Robert Müürsepp, Annemari Muru

Estonian Environmental Agency (EstEA): Marek Irdla, Mati Valgepea

Ministry of Climate, Forest Department: Tanel Niklus (external), Margus Lambing, Kristi Parro (external), Kristiina Räst

Estonian University of Life Sciences: Paavo Kaimre

Federal Statistical Office of Switzerland (BFS): Franz Murbach

Statistics Finland: Helmi Polmio

Natural Resources Institute Finland (LUKE): Aarre Peltola

Statistics Sweden (Statistikenheten): Constantino Sebastian

Central Statistical Bureau of Latvia: Inese Medne, Andra Lazdina, Jekaterina Drobiseva, Intars Abrazuns, Sigita Purona-Sida, Anita Krampe

Statistics Lithuania: Linas Politika

Statistics Ireland: Niamh Shanahan

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1. Opening and Welcome

Chair: Kaia Oras (Statistics Estonia)

Kaia Oras opened the seminar by emphasizing its importance as both a methodological checkpoint and a strategic launch for Estonia's 2025 work programme under the European Forest Accounts (EFA). She outlined the dual purpose of the event: to consolidate achievements from the previous grant years (2022–2024) and to define technical and organizational priorities for the current year. Special attention was drawn to Estonia's role as an active contributor to EU-wide methodological harmonization, and the need for timely data delivery for EFA reporting in late 2025.

2. Physical forest accounting (EFA Tables A1a, A2a)

Presenter: Mati Valgepea (Environmental Agency)

Mati Valgepea provided an overview of the national methodology for compiling physical accounts based on the National Forest Inventory (NFI). Estonia employs a systematic sampling framework that includes permanent and temporary plots, enabling the collection of annual forest data and facilitating five-year rolling averages to reduce sampling errors.

Key technical elements discussed:

Land use and forest classifications are harmonized with SEEA and LULUCF standards.

The inventory includes measurements of tree species, diameter at breast height (DBH), height, and stand structure. Distinctions are made between commercial forests, restricted-use protected forests, and strictly protected conservation zones.

Outstanding challenges and needs for future:

Improve temporal attribution of forest change (e.g., afforestation and deforestation) by integrating geospatial layers and plot-level change analysis.

Address the gap between opening/closing stock estimations and change flows using improved balancing item methodologies.

Incorporate data on standing and lying deadwood into the A tables, with attention to statistical significance given sample size constraints.

Estimations are more complicated about afforestation and deforestation as we use the statistical sampling we have, we don't have those total areas. We have only sample based.

Estimations cannot directly follow the changes on a sample plots. There is an issue that we will not kind of add up from it from information we get via NFI directly. Changes are often actually much lower when the actual error limits. We are working on the issue. We have a development project. We will talk to University Institute of Mathematics and Statistics how to put those things together.

3. Monetary Valuation of Timber Stock (EFA Table A2b)

Presenters: Grete Luukas, Paavo Kaimre, Aki Kadulin

The session provided a comprehensive overview of alternative valuation methods tested for monetary forest accounting. Presenters stressed the importance of methodological rigor in selecting a valuation model that both reflects economic reality and is feasibility with existing data.

Valuation methods evaluated:

Stumpage Value Method:

Method 1: Based on a weighted average of roadside prices and a uniform harvesting cost from the State Forest Management Centre (SFMC).

Method 2: Incorporates harvest costs by assortment and species, modelled in Statistics Estonia. This method yielded ~20% lower values, better capturing the economic variability of different timber types.

Net Income (NPV) Method:

Takes stand age and expected future revenues into account, discounted to present value using 2.3% (closing stock) and 3.2% (opening stock).

Relies on detailed NFI data and species-specific growth/yield projections.

Preferred due to its ability to value both mature and immature stands more accurately.

Resource rent method:

Uses actual financial reports from SFMC to calculate the net return on timber after forest management costs (average rent ~€34.27/m³).

Technical Issues highlighted in discussion:

Overestimation risk when applying average stumpage values to young or low-value stands.

Limited data from private forest owners presents a methodological risk.

Application of the method for deadwood: Standing deadwood to be priced at fuelwood value; lying deadwood assigned a value of zero.

Need to align methods with National Accounts (SNA 2025) and SEEA EA standards.

Next Steps and Goals for 2025:

Final decision on the national valuation method for 2023 data reporting.

Run additional sensitivity analysis on discount rates and harvest scenarios.

Improve model documentation and metadata.

Enhance valuation framework with better integration of ecosystem services, if feasible.

4. International Contributions and Comparative Insights

Sweden (Constantino Sebastian):

Presented results from testing seven valuation methods including stumpage value, net income, capitalized cost, and tax assessment approaches.

Demonstrated the impact of regional diversity and species composition on valuation estimates.

Noted a significant sensitivity of net income values to discount rate adjustments (variation of ±30–80%).

Emphasized need for efficient and scalable methods due to national deadlines.

Switzerland (Franz Murbach):

Recommended shifting from age-class based valuations to diameter-class based methods, due to their stronger correlation with timber quality.

Noted that age may not accurately reflect commercial maturity, especially in mixed stands.

Lithuania:

Shared insights from pilot tests using stumpage value and net income methods.

Highlighted reliance on state forest data, with limited private sector pricing information.

Reported challenges in disaggregating forest stock into maturity classes due to lack of granular age and productivity data.

Emphasized the need for harmonization with national accounts and interest in aligning with Estonia's approaches, especially for forest asset valuation and integration of resource rent concepts.

Feedback from Kristi Parro (Ministry of Climate):

Stressed the importance of aligning forest accounts with national climate goals and biodiversity strategies.

Emphasized the need for transparency in the valuation methods to support policy-making.

Encouraged integration of ecosystem service values beyond timber, including carbon sequestration and habitat provision.

Noted that enhanced communication and cooperation between statisticians and policymakers would strengthen the usability of EFA data in national planning.

Cross-Country Consensus:

There is a trade-off between detail and timeliness.

Harmonization should not override the need for national specificity and relevance.

More dialogue is needed to agree on the comparability of national valuation approaches.

5. B Table Economic aggregates and harmonization

Presenter: Grete Luukas

Grete Luukas introduced Estonia's efforts to compile EFA B1 tables on output, intermediate consumption, gross value added, and gross fixed capital formation. The B tables use EKOMAR and other enterprise-level economic data sources to reflect forest sector activity.

Discussion Points:

Mapping between A2b physical asset data and B1 economic flows remains a technical priority.

Price x quantity methods need to be reconciled with existing enterprise accounting categories.

National accounts input is required to ensure that valuation approaches align with official GDP and asset measures.

2025 Workplan:

Automate linkages between physical and monetary datasets.

Clarify treatment of timber removals and output valuation.

Harmonize gross capital formation definitions with Eurostat standards.

6. Goals for 2025 and Beyond

Facilitators: Kaia Oras, Argo Ronk, Swen Peterson

Planned Strategic Actions:

Finalize routines for annual forest account reporting.

Standardize metadata and methods documentation across agencies.

Strengthen collaboration with the Ministry of Climate and Statistics Estonia's national accounts team.

Explore integration with ecosystem service accounts and carbon stock metrics.

Disseminate results via national portals and in Eurostat's forest account publications.

Technical Research Priorities:

Refine stumpage value models by incorporating spatial dimensions (distance to market).

Validate NPV method using long-term felling and income data.

Improve mortality and decay modelling for standing deadwood.

7. Conclusions

The seminar marked a key milestone in Estonia's forest account development under the Eurostat grant framework. It confirmed the Net Income Method (NPV) as the technically preferred approach for timber stock valuation but acknowledged ongoing validation and harmonization tasks.

Participants committed to:

Finalize 2023 reporting using selected valuation methods.

Continue methodological dialogue with peer countries.

Report both physical and monetary accounts on time in accordance with Eurostat guidelines.

ANNEX 5 Minutes of the final methodological seminar on the European Forest Accounts

Date: 27 November 2025

Organiser: Statistics Estonia

Participants:

Statistics Estonia: Kaia Oras, Grete Luukas, Annemari Muru, Reana Parve, Argo Ronk, Susann Kivi, Kaia-Liisa Tabri

Ministry of Climate – Tanel Niklus, Kristi Parro,

Estonian Environmental Agency – Madis Raudsaar, Mati Valgepea, Feliks Sirkas,

State Forest Management Centre – Martin Koks,

Estonian University of Life Sciences - Aki Kadulin, Paavo Kaimre,

Estonian Private Forest Centre - Arpo Kullerkupp,

Statistics Lithuania - Linas Politikas,

Central Statistical Bureau of Latvia - Kristina Bagocuniene, Alise Kokare, Jekaterina Drobiseva, Andra Lazdina, Sigita Purona-Sida,

Central Statistics Office Ireland - Niamh Shanahan,

Swiss Federal Statistical Office - Franz Murbach,

Statistics Finland - Helmi Polmio

Agenda

10:00–10:10 — Welcome

Chair: Kaia Oras

• Opening of the seminar and overview

Segment 1

10:10–10:55 — Physical Accounting of Wooded Land and Timber Stock (EFA Tables A1a, A2a)

Moderator: Kaia Oras

• Data compilation for 2022–2023 – Environmental Agency (EstEA), Mati Valgepea

• Establishment of routine procedures, metadata and documentation – Mati Valgepea, Madis Raudsaar, Feliks Sirkas, Argo Ronk, all participants

• Discussion and questions

Segment 2

10:55–11:40 — Monetary Valuation of Timber Stock (EFA Table A2b)

Moderator: Kaia Oras

• Methodological overview & progress – Paavo Kaimre; comments: Grete Luukas

• Stock calculations – Paavo Kaimre; comments: Grete Luukas

• Discounting of future flows – introduction: Paavo Kaimre; presenter: Aki Kadulin; comments: Grete Luukas

• Flow items calculations (increment, removals, losses) – Paavo Kaimre, Aki Kadulin; comments: Grete Luukas, Paavo Kaimre

11:40–12:00 — Discussion

Moderator: Kaia Oras

• Possible Inputs from other compilers: Statistics Sweden (tbc), Statistics Lithuania (tbc), Statistics Finland (tbc), Statistics Latvia (tbc)

• Possible intervention from users/policy side: Forestry Department, Ministry of Climate – Kristi Parro (tbc), Tanel Niklus (tbc)

• Development needs and research collaboration (incl. cohesion with ecosystem accounts)

Segment 3

12:00–12:30 — Economic Aggregates of Forest and Logging Industry (EFA Tables B)

Moderator: Kaia Oras

• Proposed methodology and progress – Grete Luukas

• Harmonization with national accounts – Grete Luukas, Robert Müürsepp (tbc)

• Discussion with compilers: Statistics Sweden, Statistics Lithuania, Statistics Finland (tbc), Statistics Latvia (tbc)

Segment 4

12:30–12:50 — Routine Procedures, Metadata and Documentation (2025 and beyond)

Moderator: Kaia Oras

• Establishment of routine procedures – Helena Evert

• Metadata and methodological documentation – Reana Parve

• Publication and dissemination of forest accounts data – Kaia Oras

• Feedback from compilers: Statistics Sweden (tbc), Statistics Lithuania (tbc), Statistics Finland or Luke (tbc), Statistics Latvia (tbc)

12:50–13:00 — Conclusions

Minutes of the final methodological seminar on the European Forest Accounts

Opening of the seminar

The seminar was opened by Kaia Oras, who welcomed participants and introduced the agenda. The focus was on finalising methodologies for the European Forest Accounts (EFA), completing 2025 development works and preparing for routine annual production starting in 2026.

Segment 1

Project Overview

Kaia Oras presented the timeline of Estonia's multi-year EFA development, emphasising:

- Five work streams implemented in 2025:

1. Wooded land physical account
2. Timber stock physical account
3. Monetary valuation
4. Technical documentation
5. Data management, metadata and dissemination framework

- Early challenges with valuation and monetary tables.
- Active participation in EU-and UN level methodological development.

Kaia informed also that the results will be finalised in December, followed by Estonian publication of forest accounts and a short explanatory user article.

1. Physical accounts: wooded land and timber stocks was presented by Mati Valgepea (Estonian Environment Agency) as follows:

Structure and Data Sources

- Physical accounts (A1 and A2) rely primarily on National Forest Inventory (NFI).
- Additional inputs: LULUCF reporting and timber balance.

Land-Use Change Challenges

- NFI underestimates afforestation/deforestation.
- Inconsistency between opening/closing stocks and flows.
- Yearly LULUCF revisions recalculate full time-series.

New Modelling Approach

- Iterative proportional fitting method applied to reconcile land-use change flows with total forest area.

10-year average flows recommended for stability.

- New results match LULUCF forest land data but not FRA ones.

Increment and Mortality

- Shift from static stand-level models to remeasured plot-level estimates.
- Improved realism and sensitivity to actual forest dynamics.
- Future goal: dynamic increment/mortality models.

Removals and Losses

- Continue to require expert judgement (wood balance, industrial data).
- Not fully automatable.

1.2. Establishment of routine procedures, metadata and documentation was presented and discussed

Kaia Oras gave an introduction on a work carried out in a frame of the grant. Statistics Estonia is buildi¬ng capability for routine validation starting from 2026. Independent reproduction was needed to validate data, ensure transparency, allow methodological robustness, and build confidence for routine annual production and international reporting. Purpose of validation & independent reproduction is to ensure accuracy and transparency of the ¬data. Physical forest accounts (wooded land and timber stocks) rely heavily on National Forest Inventory (NFI) data. Independent reproduction allows Statistics Estonia to ensure how NFI data are processed and perform if needed the calculations for opening/closing stocks, net increment and other flow items. This ensures the transparency in complex tables that involve multiple calculations and adjustments.

Kaia added that this also ensures reproducibility. One of the key principles of official statistics is that results must be reproducible by independent teams. Reproduction of tables demonstrates that the methodology and scripts can consistently generate the same results, increasing confidence in the outputs for policy and international reporting.

Establishment of routine procedures, metadata and documentation was presented by Argo Ronk (Statistics Estonia)

Validation & independent reproduction achievements were described as follows:

- A1 (wooded land): fully reproduced from NFI data.
- A2 (timber stock):
  - Opening/closing stocks: reproducible.
  - Net increment: partly reproducible; scripts under refinement.
  - Removals/losses: cannot be reproduced without expert input.

Establishment of the routine procedures, metadata and documentation were discussed by

Mati Valgepea, Feliks Sirkas and Argo Ronk

Discussion on methodological gaps during reproduction

Statistics Estonia identified:

- Which variables are fully reproducible (e.g., opening/closing stock)
- Which variables require expert judgment (e.g., removals, irretrievable losses), this helps clarify where expert input is necessary and which parts can be fully automated, guiding future improvements.

Support Routine Annual Production was discussed

  - From 2026 onwards, forest accounts will be produced annually.

- Discussion on establishing routine production processes, is the methodology robust, the workflow reliable.
- Discussion how data capture and calculations can be consistently applied each year maintaining the transparency regarding ad-hoc interventions.

Segment 2. Monetary Valuation of Timber (A2b) were introduced by Kaia Oras and presented by Paavo Kaimre, Grete Luukas and Aki Kadulin

Paavo Kaimre presented the history and the progress of the stock and flow calculations. • Discussion: Kaia Oras, Aki Kadulin, Grete Luukas

2.1 Methods Tested

- Stumpage value
- Unit resource rent / net income
- Net present value (NPV)
- Consumption value

2.2 Selected Method: Net Present Value assumptions were presented and discussed. Selected method was chosen because it:

- Reflects age structure and expected future harvest timing.
- Avoids overvaluation characteristic of simple stumpage-price methods.
- Fits Estonian market and accounting principles.

2.3 Key Parameters for the calculations were described

- Species and age-class distribution
- Regeneration felling ages
- Assortment distribution
- Prices (RMK or Statistics Estonia)
- Discount rate (critical; tested 2%, RMK rate, and a 5-year moving average)

Results for (2023) were presented as well. Estimated stock value (NPV method): ≈ €15.1 billion.

2.4 Flow parametres, increment and removals logic was discussed

Key Points on Flow Items Calculation

2.4.1. Approach and Methodology

Physical flows (increment, removals, irretrievable losses) are calculated based on A tables (physical accounts).

Monetary valuation of these flows is done by multiplying physical quantities by stumpage prices.

Stumpage price determination:

Based on RMK (State Forest Management Centre) data.

Adjusted for assortments and harvesting costs.

For EFA Statistics Estonia uses an approach aligned with national accounts.

2.4.2. Increment and Mortality

Increment estimates come from National Forest Inventory (NFI) measurements and models.

Mortality is included in calculations but requires expert judgment for accuracy.

Paavo and Grete discussed and emphasized that increment and removals must be consistent with physical accounts and harmonized with monetary valuation.

2.4.3. Removals and Irretrievable Losses

These flows are complex because:

They combine data from different sources (NFI, wood balance, expert estimates).

Require assumptions about assortments and market conditions.

Expert input remains essential; full automation is not feasible.

2.4.4. Harmonization Challenges

Different guidelines (Eurostat, UN SEEA, OECD) allow flexibility, but harmonization is a national responsibility.

Flow valuation depends heavily on:

Input data quality.

Aggregation level.

Applied assumptions (e.g., discount rates, assortment shares).

Comments from Kaia Oras

Acknowledged complexity but emphasized compliance over simplicity.

Stressed the need for methodological consistency with national accounts and EFA standards.

Highlighted that work-in-progress valuation and proper treatment of flows are mandatory for macroeconomic balancing and GNI calculations.

2.4.6. Key Conclusions

Use physical flows from A tables as the basis for monetary flows.

Apply stumpage prices adjusted for assortments and costs.

Maintain transparency through metadata and methodological documentation.

Institutional cooperation (Statistics Estonia, Environment Agency, RMK, universities) is critical for improving models and ensuring quality.

2.3. International input

Lithuania (Linas Politika)

- Uses cadastral administrative valuation.
- Interested in piloting Estonia's NPV methodology.

2.4. Ministry of climate: policy needs

Presenter: Kristi Parro

The Ministry emphasised:

- Reliable, timely, harmonised forest data is crucial for decisions on climate, biodiversity, harvesting levels, and resource planning.
- Traceability of timber will become a key requirement.
- Data must be:
  - Rapidly accessible
  - Methodologically transparent
  - Interoperable across institutions
- Remote sensing must play an increasing role.

Segment 3.

Summary: Presentation on economic aggregates of Forest and Logging Industry was presented by Grete Luukas. Contribution Robert Müürsepp

Discussion: Kaia Oras, Paavo Kaimre; Aki Kadulin

3.1. Purpose and Scope

The session focuses on B tables in the European Forest Accounts framework, which present economic aggregates for forestry and logging activities (NACE 02).

These tables link physical data (A tables) with monetary data, ensuring consistency between environmental accounts and national accounts.

3.2. Structure of B Tables

Output:

Divided into products and services (e.g., timber, logging services).

Includes primary logging activity and secondary activities (e.g., wood processing by some enterprises as secondary activity).

Net increment value from A tables are integrated here.

Intermediate Consumption:

Shows inputs used for production (e.g., removals, energy, services).

Removal values from A tables are integrated here.

Gross Value Added (GVA):

Calculated as Output – Intermediate Consumption.

Indicates the economic contribution of forestry to GDP.

Other Components:

Compensation of employees, consumption of fixed capital, investments and changes of inventories.

Data sourced mainly from national accounts and business registry.

3. 3 Data Sources and Methodology

Primary sources:

Enterprise financial reports (via e-STAT and business registry).

National accounts data for macroeconomic aggregates.

Physical data from A tables for removals and increment.

Linkage with A tables:

Net increment and removals influence valuation of work-in-progress, output intermediate consumption and gross value added.

Monetary valuation uses stumpage prices and assortment models for net increment and removals but roadside prices for the output of wood in the rough.

3.4. Key Issues Discussed

Differences between EFA and National Accounts:

Output and intermediate consumption treatment differs:

EFA includes net increment in output and removals in intermediate consumption.

National accounts apply a subtraction method (net increment minus removals) in the output.

Result: discrepancies in output and intermediate consumption and as net increment value is different in national accounts and EFA then also discrepancies in GVA and operating surplus.

Impact of Assortment Models:

Outdated assortment statistics (last full update in 2014) affect accuracy of monetary valuation. Theoretical models do not take into account real time market situation (demand/supply for different assortments)

Need for updated models to reflect current market structure.

Work-in-Progress Valuation:

Essential for compliance with EU and SEEA standards.

Represents growing stock normalized for one year, influencing GDP and GNI calculations.

3.4.1. Discussion

Main reason for differences between EFA and national accounts

Grete Luukas explained that the discrepancies between European Forest Accounts (EFA) economic aggregates and national accounts figures mainly arise from different versions of increment data:

EFA uses revised increment and mortality estimates based on the latest National Forest Inventory (NFI) methodology, which incorporates improved measurement techniques and updated models.

National accounts still rely on older increment and mortality data, as their system has not yet integrated these revisions.

Implications

This affects:

Output and intermediate consumption calculations.

Valuation of work-in-progress (growing stock normalized for one year).

Gross Value Added (GVA) and operating surplus figures.

Kaia Oras commented that harmonization is essential because these aggregates influence:

GDP and GNI calculations.Estonia’s EU membership fee and compliance with SEEA and Eurostat standards.

Mati Valgepea’s argued on why it is difficult in general to become comparable:

Mixing timeframes creates noise

Increment data is based on 10-year averages, while enterprise economic data reflects a single year.

Combining these leads to inconsistencies and historical influences that distort interpretation.

Price assumptions are unrealistic:

Valuation of growing stock depends on stumpage prices that do not reflect the entire stock, especially immature trees.

Complexity in linking physical and monetary data:

Different periods, assumptions, and valuation methods make it hard to streamline from physical units to macro-level aggregates.

Result: High uncertainty and methodological complexity until better data and harmonized approaches are available.

Possible next steps

Align methodologies by:

Updating national accounts with revised increment and mortality data.

Establishing a renewed data exchange workflow between Statistics Estonia and the Environment Agency.

Document changes in metadata and provide clear explanations to users for transparency.

Comments and Recommendations

Kaia Oras emphasized compliance with international standards and integration with national accounts.

Highlighted importance of explaining methodology to users for transparency.

Kristi Parro (Ministry of Climate): Stressed the need for reliable, harmonized data for policy decisions on climate, biodiversity, and sustainable harvesting.

Called for automation and traceability in data systems.

Robert (National Accounts): Confirmed that EFA results will influence GNI inventory and EU membership fee calculations. Urged alignment of methodologies and timely data exchange.

Future Actions

Update assortment models and improve valuation methods.

Develop further workflow between National Accounts and EFA compilers.

Enhance metadata and publish methodological notes for transparency.

Move toward automation and harmonization of physical and monetary accounts

Part 4

Data capture, metadata, and dissemination

4.1 Establishment of routine procedures – Helena Evert

Data Capture

- Annual data capture will rely primarily on:
  - NFI basic data delivered by the Environment Agency under a planned contract.
  - Additional datasets (wood balance inputs, assortment, roadside prices).
- Statistics Estonia emphasised the importance of:
  - Clear data structures
  - Stable input formats
  - Early availability of all required variables

A formal data-sharing agreement between Statistics Estonia and the Environment Agency is planned for 2026 and two types of data are planned to be exchanged:

1. Basic NFI data (large datasets).
2. Aggregated data products for specific variables that involve expert estimates.

In order to ensure transparency and reproducibility of calculations for official Statistics Estonia has developed scripts to reproduce A tables (wooded land and timber stock) from National Forest Inventory (NFI) data. Results were handled in first segment of the meeting (point 1). Stock variables can now be calculated but removals and irretrievable losses, which require expert judgment and cannot be fully automated.

Iti s planned to store data in in Oracle-based systems at Statistics Estonia by creating the workflow: Import raw NFI data → Apply agreed formulas/scripts → Generate EFA tables → Validate results. Metatadata and file structure standards (formats, classifiers, extraction timeframes) are currently in definition phase to ensure consistency.

The plan is to provide the technical solution to integrate raw NFI data directly into routine workflows, enabling reproducible annual tables generation.

4.2. Discussion regarding routine production starting in 2026.

This segment summarises the discussion regarding routine production starting in 2026.

Objective for the establishing of the regular, automated process for producing European Forest Accounts (EFA) tables starting in 2026 was agreed while designing the workflows of the project.

Challenges were discussed. Both agencies manage data at the same level of granularity and maintain corresponding metadata in their databases. Mati Valgepea from EstEA raised the question: what is the optimal approach to data management that ensures high quality while preventing duplication at the national level? His suggestion was to decide on optimal level of aggregation for shared data in order to minimize the efforts in Statistical Office.

Annemari Muru emphasized that while the question of optimal data management is important, it is not the focus of the current meeting. She suggested that the 2026 data stream agreements be addressed in a dedicated discussion between the agency and the statistical office, ideally involving the ministry as well, to ensure that policy-makers' needs are fully considered.

Key points on routine statistical data production were discussed.

Discussion Summary

Context:

Statistics Estonia requested access to basic National Forest Inventory (NFI) data to independently reproduce European Forest Accounts (EFA) tables and ensure transparency.

Mati Valgepea's Position:

Mati questioned whether it is necessary to provide aggregated data if Statistics Estonia can calculate the tables themselves from NFI. He highlighted concerns that sharing full NFI datasets may be inefficient because:

1. Only about 5% of NFI data fields are relevant for EFA tables.
2. Managing large datasets requires specialized forestry expertise, which Statistics Estonia may not have.

He also raised the issue of duplication of effort, as both agencies might produce similar aggregates from the same base data, potentially leading to unnecessary public spending.

Statistics Estonia's View (Kaia Oras):

Statistics Estonia emphasized the need for access to basic data to ensure transparency and reproducibility. Statistics Estonia requires clear metadata and calculation scripts to maintain consistency and transparency.

Annemari Muru's Position:

Annemari noted that no agreement can be reached at this stage and proposed further discussion. She stressed that:

- The question of optimal data management is important but not the focus of the current meeting.
- Future negotiations should involve both agencies, the statistical office, and preferably the ministry to ensure policy-makers' needs are addressed.

Underlying Issues for Future Contracts:

- Define the appropriate level of detail (basic vs aggregated).
- Clarify responsibilities for calculations.
- Establish metadata requirements for transparency.
- Balance efficiency (avoid duplication) with transparency (enable independent verification).
- Ensure compliance with statistical law while managing resource constraints.

4.2 Metadata• Metadata and methodological documentation was introduced by Reana Parve

For Forest Accounts Statistics Estonia has compiled ESMS-based quality and metadata report (https://stat.ee/en/find-statistics/methodology-and-quality/esms-metadata/10306). The base for the report is compiled by metadata expert based on the information available from existing sources. Afterwards the owner of a Forest Accounts' statistical process complemented the report with specific information. After reaching the agreement on the content of metadata the report was translated into English. Then the Publication Team published the report on Statistics Estonia's website.

Describing quality and metadata is a core requirement of official statistics and also for EFA implementation.

Agreed and followed implemented principles were outlined as follows:

- Metadata documents:
  - Methodologies
  - Data sources
  - Transformations and adjustments
  - Assumptions (e.g., discount rate, assortment model, mortality model)
  - Accessibility and clarity
  - Quality indicators

Metadata meets the standards of official statistics, given that forest accounts is now produced regularly under EU regulation.

Statistics Estonia produces quality and metadata reports about every statistical process which output data are published in our statistical database. Quality and metadata reports must be compiled to ensure the transparency, clarity and understandability of the statistics.

In order to ensure comparability of the statistics between member states of the European Union we follow the European Statistical System (ESS). In the ESS there are 3 structures for compiling quality and metadata reports: Single Integrated Metadata Structure (SIMS) and it's underlying reporting structures EURO-SDMX Metadata Structure (ESMS) and ESS Standard for Quality Reports Structure (ESQRS). All of them are output-oriented way of viewing statistical processes but describe other stages of statistical production (e.g design, collection, processing, dissemination) as well. ESQRS is a producer-oriented structure comprising more quality indicators and it's level of detail might be too specific for general users. ESMS is a user-oriented structure which main focus is on the methodology. SIMS is so called all-inclusive report which comprises both ESMS and ESQRS metadata elements (concepts).

Until 2025, our reports have been based on the Euro-SDMX Metadata Structure (ESMS).

In 2017 the European Commission recommended all member states to implement SIMS in order to streamline and harmonise user and producer reports in the ESS, decrease the reporting burden on NSOs by creating the framework that enables once for all purposes reporting, where concepts that are common to user and producer reports are reported upon once for both purposes, create an integrated and consistent reporting framework where the reports can be stored in a single database; create a flexible and up to date system where future extensions are possible by adding new concepts.

Statistics Estonia is in the middle of the transition period and therefore publishing the SIMS reports on our website is under development. For that reason we update our ESMS-reports (they are publicly available on Statistics Estonia's website and have to be up to date) and at the same time compile SIMS-reports.

4.3. Dissemination • Publication and dissemination of forest accounts data – Kaia Oras

Statistics Estonia described the carried out dissemination activity on UN London Group

Statistics Estonia plans for dissemination:

- Regular publication of forest accounts in 2026 onwards.
- Integrated dissemination through:
  - Statistics Estonia’s online database
  - A short article explaining new accounts
  - Visual dashboards where possible

Discussion: Kaia Oras, Grete Luukas and Tanel Niklus (Ministry of Climate), Robert Müürsepp were cautious:

Publishing raw figures without context could lead to misinterpretation.

Users might compare EFA data with national accounts or other sources without understanding:

Different calculation methods (e.g., increment revisions, assortment models).

Why discrepancies exist between EFA and GDP/GNI figures.

They stressed the need for:

Clear metadata and explanatory notes on methodology.

Highlighting limitations and revisions in the published tables.

Possibly adding a user-oriented article explaining what the new account is and how to use it.

Closing of the meeting

The seminar concluded with agreement on:

- Adoption of the NPV method with a 5-year discount-rate average.
- Strengthening metadata and data capture procedures.
- Preparing for full routine EFA production in 2026.

Kaia Oras thanked all participants and closed the meeting.

ANNEX 6 Technical documents prepared by EstEA

Overview of the technical documents:

1.Technical description for compiling forest accounting tables A1a (wooded land) and A2a (wood) based on Statistical Forest Inventory (NFI) data. (Tehniline kirjeldus metsa arvepidamine ja metsavarude andmetabelite koostamiseks NFI andmete põhjal.)

Purpose

The document outlines the methodology and instructions for compiling forest accounting tables A1a (wooded land) and A2a (wood) based on Statistical Forest Inventory (NFI) data. It covers definitions, calculation principles, data sources, and reporting requirements for Estonia's forestry accounts.

Key Components

1. Wooded Land (Table A1a)

Categories reported:

Forest land (>0.5 ha, trees >5 m, canopy >10%), split into:

Available for wood supply (no major restrictions).

Not available for wood supply (legal ecological management restrictions).

Other wooded land (>0.5 ha, canopy 5–10% or shrubs >10%), optionally reported.

Estimation principles:

Uses last 5 years of NFI measurements (e.g., 2018–2022).

Area estimates based on plot areas within systematic sample network.

Changes (afforestation, deforestation) derived from land-use transition matrices (LULUCF categories).

Reported items: opening area, increases, decreases, statistical reclassification, closing area (in 1000 ha).

2. Timber Resources (Table A2a)

Definitions: Volume of living and dead trees (including stems and usable deadwood) measured over bark.

Reported items: opening stock, net increment, removals (harvest), irretrievable losses, statistical reclassification, balancing item, closing stock (in 1000 m^3).

Calculation principles:

Aggregation by tract using weighted averages of plot-level data.

Volume models for live trees based on height, age, and species-specific parameters.

Deadwood volumes measured on inventory plots.

Net increment = growth – mortality (estimated from repeated measurements).

Removals and losses based on expert estimates and NFI harvest data.

Methodological Notes:

Land-use change adjustment: Uses Iterative Proportional Fitting Procedure (IPFP) to align transition matrices with area changes, description as seen in future.

Balancing item: Corrects discrepancies between opening/closing stocks and estimated flows.

Data sources: NFI plots, geo-layers (EELIS, Estonian Nature Information System), expert judgment for removals and losses.

Limitations: High variability for "Other wooded land" → reporting not recommended.

2. National GHG reporting (LULUCF sector).

NFI methodological document prepared for Statistics Estonia:

EstEA provided NFI calculation methodology which includes basic methodological setup for calculation of NFI estimates. Document includes:

- Setup principles of NFI sample plot network (clusters of plots, types of plots and clusters)
- Basic rules for calculation of area estimates,
- Calculation models for single tree and stand level calculations,
- Calculation rules for several forest/tree parameters,
- Calculation scheme for error estimates.

Other References:

FRA (Global Forest Resources Assessment) and SEEA (System of Environmental-Economic Accounting) definitions.

ANNEX 8 Acronyms

€	Euro (currency, also abreviated EUR)
ALS	Airborne laser scanning
AN.121	Materials and supplies (Inventories, Non-financial assets (AN) classification of ESA2010)
AN.1221	Work-in-progress on cultivated biological assets (Non-financial assets (AN) classification of ESA2010)
AN.123	Finished goods (Inventories, Non-financial assets (AN) classification of ESA2010)

AN.213	Uncultivated biological assets (Non-financial assets (AN) classification of ESA2010)
AWS	Available for wood supply (opposite: NAWS)
AWU	Annual work unit
BAL	Balancing item (EFA methodology and transmission tables)
BEA	Bureau of Economic Analysis, United States Department of Commerce
CFC	Consumption of fixed capital (transactions in products (P) classification of ESA2010)
CIF	Cost, insurance and freight (ESA2010)
CPA	Classification of products associated to NACE
CPA 02.10.30	Forest trees, Classification of products (CPA 2.1) associated to NACE Rev.2
CPA 02.20.1	Wood in the rough, Classification of products (CPA 2.1) associated to NACE Rev.2
CRT	Common reporting tables
D.1	Compensation of employees (distributive transactions (D) classification of ESA2010)
D.29	Other taxes on production (distributive transactions (D) classification of ESA2010)
D.39	Other subsidies on production (distributive transactions (D) classification of ESA2010)
D.4	Property income (distributive transactions (D) classification of ESA2010). Components are in particular D.41 Interests, D.42 Distributed income of corporations, D.43 Reinvested earnings on foreign direct investment, D.44 Other investment income, D.45 Rent
D.52	Changes in inventories (transactions in products (P) classification of ESA2010)
D.9	Capital transfers (current transfers in cash and kind (D.5-D.8) classification of ESA2010)
dito	idem, same as above
EELIS	Estonian Nature Information System
ECE, UNECE	United Nations Economic Commission for Europe
EFA	European Forests Accounts
EFA A1a	Wooded land, Area of wooded land, in 1000 ha
EFA A1b	Wooded land, Area of wooded land, in million national currency
EFA A2a	Timber, timber on wooded land, in 1000 m3 over bark
EFA A2b	Timber, timber on wooded land, in million national currency
EFA B1	Economic aggregates of the forestry and logging industry
EFA B2	Output of the forestry and logging industry by economic type and institutional producing sector
EFA B3a	Supply of wood in the rough by all industries, in million national currency
EFA B3b	Use of wood in the rough by all industries, in million national currency
EFA C1a	Supply of wood in the rough by all industries, in 1000 m3 over bark
EFA C1b	Use of wood in the rough by all industries, in 1000 m3 over bark
EGSS	Environmental Goods and Services Sector (module of SEEA)
EKOMAR	Structural business statistics, annual economic data questionnaire (Statistics Estonia)
EO	Earth Observation
ESA	European System of Accounts (actual methodology framework is ESA2010, compliant to SNA2008)
eSTAT	Statistics Estonia (National Statistical Institution for Estonia)
EstEA	Estonian Environment Agency
EU	European Union
EUR	Euro (currency, also abreviated €)
Eurostat	Statistical office of the European Union
FAO	Food and Agriculture Organization of the United Nations (also UNFAO)
FAWS	Forests available for wood supply (opposite: FNAWS)

FISIM	Financial intermediation services indirectly measured (output component P.119 of producers of financial services and couterpart in P.2 Intermediate consumption for all sectors using financial services, ESA2010)
FL	Forest Land
FNAWS	Forests not available for wood supply (opposite: FAWS)
FOB	Free on board (ESA2010)
FTE	Full time equivalents (jobs in FTE)
FRA	Global Forest Resources Assessments (FAO, Food and Agriculture Organization of the United Nations
GAI	Gross annual increment
GFCF	Gross fixed capital formation (transactions in products (P) classification of ESA2010)
GHG	Greenhouse Gas (inventory)
GIS	Geographic Information System
ha	Hectare (10000m2)
IE	Included elsewhere
IPCC	Intergovernmental Panel on Climate Change (of the United Nations)
ITGS	International trade in goods statistics
IOT	Input-Output Tables (ESA2010)
ITTO	International Tropical Timber Organization
JFSQ	Joint Forest Sector Questionnaire (Eurostat)
KAU	kind-of-activity unit; local KAU: local kind-of-activity unit
kha	Thousand hectares (see also ha)
LEV	Land Expectation Value
LOSS	Irretrievable losses (EFA methodology and transmission tables)
LUKE	Luonnonvarakeskus (Natural Resources Institute Finland)
LULUCF	Land Use, Land-Use Change and Forestry, United Nations, Climate Change
m3	Cubic meter
M	Mortality
MCPFE	Ministerial Conference on the Protection of Forests in Europe
MDE	micro-data exchange
MFA	Material flow accounts (module of SEEA)
MSI	Tartu Ülikooli matemaatika ja statistika instituudi, Tartu University Institute of Mathematics and Statistics
n	year (under review) (also noted 'T')
n/a	not available
n-1	previous year (under review) (also noted 'T-1')
NA	National accounts
NACE	Statistical classification of economic activities of the EU (actual relevant classification for EFA is NACE Rev.2; replacement with NACE Rev.2.1 will take place by 2029)
NACE 02	Division 02 'Forestry and logging' of the NACE Rev.2 (and NACE Rev.2.1)
NACE 16	Division 16 'Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials' of the NACE Rev.2 (and NACE Rev.2.1)
NACE A	Section A 'Agriculture, forestry and fishing' of the NACE Rev.2 (and NACE Rev.2.1)
NAI	Net annual increment (EFA methodology and transmission tables)
NAI	Net annual increment (EFA methodology and transmission tables)
NAWS	Not available for wood supply (opposite: AWS)
nec	not elsewhere comprised

ned	not elsewhere defined
NFI	National Forest Inventory
NID	National Inventory Document
NPV	Net Present Value
OB, o.b.	Over bark (opposite: under bark)
OLTC	Other land with tree cover
OWL	Other wooded land
P.1	Output (transactions in products (P) classification of ESA2010). Output types are in particular P.11 Market output, P.12 Output for own final use, P.13 Non-market output
P.2	Intermediate consumption (transactions in products (P) classification of ESA2010)
P.51c	Consumption of fixed capital (transactions in products (P) classification of ESA2010)
P.51g	Gross fixed capital formation (transactions in products (P) classification of ESA2010)
P52_PRO	Changes in inventories in work-in-progress on cultivated biological assets (standing timber, EFA Table B1)
RCLAS	Statistical reclassification (EFA methodology and transmission tables)
RE, RE95	Relative error, relative error at 95% confidence interval
REVAL	Revaluation (EFA methodology and transmission tables)
RMK	Riigimetsa Majandamise Keskus (State Forest Management Center, Estonia)
RMOV	Removals (EFA methodology and transmission tables)
RMOV	Removals (EFA methodology and transmission tables)
S.1	Total economy (classification of institutional sectors of ESA2010)
S.11	Non-financial corporations (classification of institutional sectors of ESA2010)
S.14	Households (classification of institutional sectors of ESA2010)
SE	Statistics Estonia (National Statistical Institution for Estonia), also abreviated eSTAT
SEEA	System of Environmental-Economic Accounts
SMI	Silvicultural management intensity indicator, SMI /NFI also: Statistilise metsainventuuri
SNA	System of National Accounts, United Nations (actual methodology framework is SNA2008)
STK	Stocks (EFA methodology and transmission tables): STK_OP: Opening stocks, STK_CL: Closing stocks
SUT	Supply and Use Tables (ESA2010)
T	year (under review) (also noted 'n')
T-1	previous year (under review) (also noted 'n-1')
UB, u.b.	Under bark (opposite: over bark)
UNECE, ECE	United Nations Economic Commission for Europe
UNFAO	Food and Agriculture Organization of the United Nations (also FAO)
US, USA	United States of America
VAT	Value added tax