ForestNavigator

Workshop Report

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3rd and final Stakeholder Workshop

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Abstract

This workshop report summarizes the key findings and insights from the third stakeholder workshop of the Horizon Europe ForestNavigator project. The third workshop reunited former participants with some new representatives to feed into co-development processes. The workshop focused on 1) gaining feedback on relevant forest policy scenarios, 2) gaining feedback on forest scenarios, and 3) gaining feedback on the design, content, functionalities, and dissemination strategy for the ForestNavigator portal. This report outlines key outputs of workshop sessions, as well as implications for final project work and dissemination.

Keywords

Forestry, stakeholder engagement, forest management, forestry policy pathways, forestry policy coherence, forest mitigation, forest adaptation, data delivery, portal design

Dissemination level

PU	Public, will be published on CORDIS	✓
SEN	Sensitive, limited under the conditions of the Grant Agreement	

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Glossary

BDS	Biodiversity Strategy
BECCS	Bioenergy with Carbon Capture and Storage
CA	Climate Analytics
CO2	Carbon Dioxide
CRCF	Carbon Removal Carbon Farming
DG CLIMA	Directorate General for Climate Action
E3M	E3Modelling
EC	European Commission
ENEA	Italian National Agency for New Technologies, Energy & Sustainable Economic Development
EO	Earth Observation
EU	European Union
GDP	Gross Domestic Product
GFZ	Helmholtz-Zentrum für Geoforschung
GHG	Greenhouse Gas
HWP	Harvested Wood Product
IEEP	Institute for European Environmental Policy
IFER	Institute for Forest Ecosystem Research
IIASA	International Institute for Applied System Analysis
LULUCF	Land Use, Land Use Change, and Forestry
MS	Member State
NFI	National Forest Inventory
NRL	Nature Restoration Law
SDM	species distribution model
WS	workshop (as in WS1, WS2, WS3)
WUR	Wageningen Social & Economic Research

Workshop summary

The third ForestNavigator Stakeholder Board workshop (WS3) deepened engagement with stakeholders and focused on end results and processes for the project. The full agenda of the workshop, including its objectives and session descriptions, can be found in Annex 1.

Key project outputs were presented and/or discussed, including:

- The G4M-X climate-sensitive meta-model, MESMER-L-X emulator, an ecosystem services tool, and New EU Forest monitoring GHG data.
- Four national case studies comparing NFI vs. Earth Observation (EO) data, finding that both data sources are complementary, though EO data namely struggles with detection of small-scale harvest/thinning.
- Wood demand/MAGNET modelling results and baseline EU scenario data (Italy, Czechia, Ireland, Sweden) released on Zenodo.

Stakeholders discussed policy pathway alternatives to the reference policy pathway after being presented with the details of the Medium-Term Climate Ambition, Forest Resilience, and Near-term Boost in Sink policy pathways. Discussion revealed feedback, including:

- In discussion of three alternative forest policy storylines, concerns were raised on bioenergy demand assumptions, Natura 2000 compatibility, feasibility of rapid management change, and carbon leakage accounting.
- Partners agreed to consider incorporating exported-wood-product accounting and regional differentiation in response to related discussion.

Stakeholders reviewed the development of the ForestNavigator Portal and the beta version of the Pathways Explorer in detail. They provided detailed feedback for clarity and usability of the project, including updates to design functionalities (e.g., inclusion of select-all/none toggles on some data visualisations, user selection of axis-scaling options, etc) and important aspects to be defined in indicator definitions (e.g., clear definition of whether some values consider under or over bark, etc.).

In closing, stakeholders received a first glance of upcoming output and results, including the iBIS biodiversity results, G4M-X/disturbance impact assessment, HWP substitution report, and reconciled EU carbon stock data. Remaining events were outlined for the final year of the project.

Workshop session summaries

Project achievements in the last year

WS3 opened with welcomes from ForestNavigator's co-Principal Investigator, Fulvio Di Fulvio from the International Institute for Applied Systems Analysis (IIASA), Alice Ludvig on behalf of the host institution (BOKU), and the workshop facilitator Sylvia Schmidt from Climate Analytics (CA). After a tour de table, Fulvio Di Fulvio (IIASA) began to highlight new results, briefly summarized next.

A report has been published on the methodology behind the harmonized forest area, harvest, and stock variable calculations, and the data will be made available through the Data Explorer once an associated publication is approved. The project accomplished the development of the G4M-X climate change-sensitive meta-model (see Fig. 1 below), a MESMER-L-X emulator application, and an ecosystem services tool.

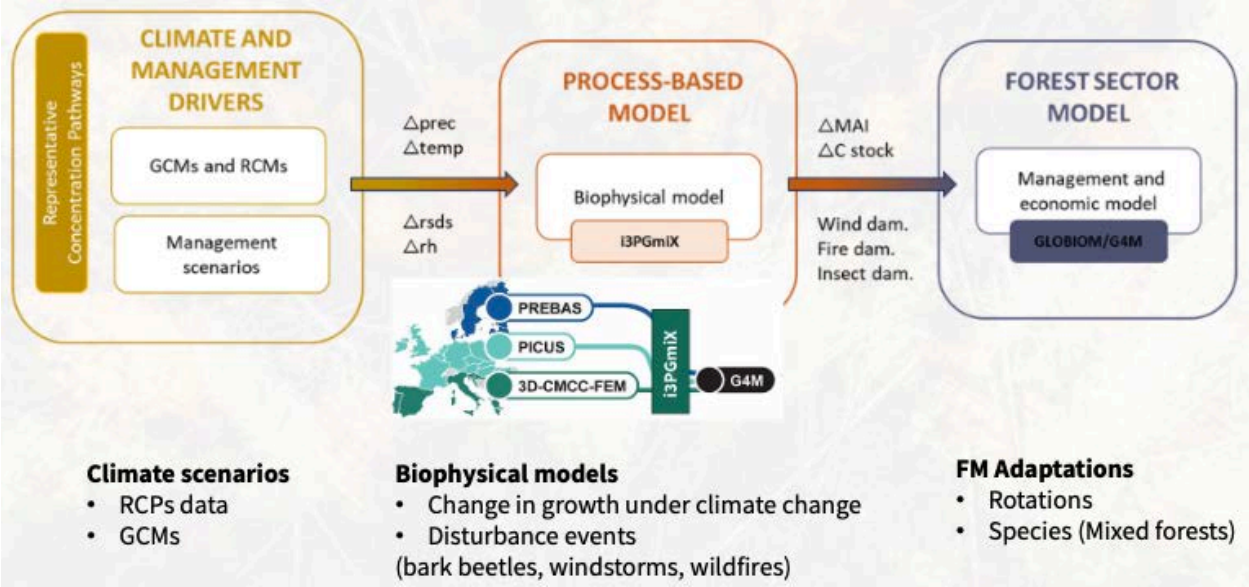

Fig 1. Presentation of the G4M-X climate change sensitive meta-model and its development (Source: WP6).

The MESMER-L-X development captures direct air temperature responses to forest area change and composition changes. The emulator can produce direct alterations of local temperature from six types of forest change, including afforestation, deforestation, conversion of broadleaf or needleleaf, and afforestation with broadleaf or needleleaf. Application of the emulator found cooling benefits from conversion of afforestation with broadleaf trees, and that afforestation temperature feedback is more beneficial in northern and Central Europe [i].

The ecosystem services tool was developed by applying the iBIS biodiversity model to enhance and test the iBIS species distribution model (SDM) under stylized scenarios for managing EU forests under future climates. It also inferred and projected biodiversity impacts for European forest-associated species. This considered Annexes I & II of Article 12/17 and the EU Red lists of species, integrating SDMs involving nested, structural, and climate covariates to test variable selection for

[i] Yao, Y., Sieber, P., Hauser, M. *et al.* Conversion from coniferous to broadleaved trees can make European forests more climate-effective. *Nat Commun* 16, 9536 (2025). https://doi.org/10.1038/s41467-025-64580-y

different species with four algorithms. The tool is still in development, but results are expected to show that species' habitat suitability is highest in no-management scenarios, then decreases with increasing management intensity (impacts varying among species groups), and lowest with high-intensity management.

Fabio Eboli from the Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA) presented the methodology and results on evaluation of recreational and cultural forest services, quantifying multifunctional values of forests. Considering urgent EU priorities to address climate change and biodiversity loss, forest owners must balance competing pressures for forest management including short-term income loss when prioritizing non-timber services. Findings can contribute to design schemes such as payments for ecosystem services to support sustainable forest management while incentivising cultural and recreational values. The deliverable report will be available soon after a pending academic publication.

Willem Jan van Zeist from Wageningen Social & Economic Research (WUR) presented an assessment of wood demand scenarios on the forest sector through scenarios implemented in the macro-economic MAGNET model. These results in high wood demand scenarios suggest higher value-added growth in wood products and the primary forestry sector is possible, but with a lower contribution to total Global Domestic Product (GDP) of the forest sector by 2050 in the baseline is only partly elevated in a high bioeconomy scenario. Forest sector employment declines in the baseline scenario, which could be partially offset by investments in capital and labour intensification. The deliverable report (5.4), which details these results, is published on the ForestNavigator website.

Fulvio Di Fulvio (IIASA) announced the availability of results data, such as the EU baseline scenario data, for the four case study countries (Italy, Czech Republic, Ireland, and Sweden) on Zenodo. An online report documents the establishment of these results, including a gradual decline in EU27 forest land. Finally, results of harvested wood product (HWP) carbon pool contribution have been updated via the Wood Carbon Monitor model, offering a basis for HWP pool calculator calibration in the policy modelling toolbox available online.

Keynote on policy developments in the land sector

Jurij Krajčič from the European Commission (EC) Directorate General on Climate Action (DG-CLIMA) presented a new element for the implementation of the EU Carbon Removals and Carbon Farming Regulation (CRCF). DG CLIMA is advancing measures to support MS and land managers in adopting improved land management practices. The CRCF establishes a certification framework for carbon removal activities, with the aim of creating greater confidence in high-quality carbon removals and encouraging increased public and private investment in the land sector.

Recognising that public funding alone is insufficient to meet these objectives, the CRCF is intended to help mobilise complementary private finance. Work is underway to establish the CRCF Buyers' Club and a CRCF knowledge hub. The LULUCF-CRCF knowledge hub will be an online service, which could facilitate best monitoring across value chains. This hub could provide monitoring tools, data, and technical resources to improve transparency and reduce the costs for monitoring and verification. His presentation resulted in discussions on the effectiveness of CRCF subsidies given

concurrent RED subsidies, national inventory actions, and improved forest management methodology. Stakeholders also emphasised the following:

- One of Europe's biggest challenges is an innovation gap, to address this CRCF should encourage MS collaboration rather than focus on support monitoring.
- There is a concern for double financing if MS can co-finance projects.
- Concerns were also raised about reported lobbying efforts to allow geological carbon removal credits within the Emissions Trading System (ETS), while land-based credits may continue to be treated differently due to permanence considerations.
- The importance of improving understanding how to attract voluntary finances for nature and carbon projects while ensuring such investments do not facilitate greenwashing or offset ongoing environmental harm.
- Emphasized the importance of biobased products and longer product lifetimes in GHG inventories. Several MS, for example Italy, have advanced recycling systems that are not adequately reflected currently.

EU Forest monitoring and its application for national GHG monitoring

Near real-time geodatabase updates have been achieved with use cases of Earth Observation (EO) data to update national Greenhouse Gas (GHG) inventory data, as demonstrated both in a public webinar in February and an online report which was shared with workshop participants ahead of time. Alexandra Runge from the Helmholtz-Zentrum für Geoforschung (GFZ) presented her work on updated EU forest monitoring, including EO data. This data is available on the ForestNavigator Data Explorer. Alexandra Runge (GFZ) also presented the results of four EU-national case studies, comparing national GHG monitoring based on National Forest Inventory (NFI) data and EO data. The discussion continued as summarised below.

- Emil Cienciala, from the Institute of Forest Ecosystem Research (IFER), noted that the Czech National Forest Inventory (NFI) is transitioning to continuous inventory and data delivery for annual outputs, rather than in 10-year cycles. This case study highlighted the benefit of independent EO verification. Limitations for EO in detecting small harvests and thinning were found. Considering these limitations, both methods can complement one another in application.
- The group discussed the examination of disturbance (i.e., planned or unplanned human interventions on forest which disturb carbon) versus harvest data quality recorded using this methodology by country. In the Italian case study, harvest data was challenging to find and may have resulted in a worse matching of data results, as compared to the Czech case study. Czechia's national harvest statistics appear to be more comprehensive than similar harvest data available for Italy.
- On gaps between estimated disturbances and reported national harvesting in the Italian case study, Alexandra Runge (GFZ) shared that available data was collected from two NFI cycles (2005/2015, including regional uncertainty levels), FAOSTAT, ISTAT (until 2012/2015), and EO data from different sources and time periods. All datasets were integrated to provide a picture of the last 20 years. The uncertainty levels were high (~50%), but the variety of datasets increased robustness.
- The time lags between observation, data collection, and publication generate higher organizational interest in tracking data sources and use. Alexandra Runge (GFZ) noted that exact values matched several times in this exercise, suggesting shared sources.
- Generally, within this methodology, thinning cannot be added back into datasets because it is not available from EO data sensors. This was possible in the Czechia case study because a project partner had an independent data source (model estimation based on the reported harvest quantities) for it.

EU forest policy scenarios

Julia Bognar from the Institute for European Environmental Policy (IEEP) presented progress toward the ForestNavigator forest policy reference scenario. Fulvio Di Fulvio (IIASA) added that the EU reference scenario is a conservative estimate, based on feedback from WS2 and the Policy Steering Committee. The reference scenario considers that the EU would be unable to maintain a carbon sink under a conservative growth of forest and wood harvest. Several key discussions are outlined below.

- There are trade-offs in scenario options, whether prioritizing climate mitigation or adaptation in forest management. Longer rotations are preferred for mitigation but imply lower prioritization of adaptation - shorter rotations can increase resilience against extreme weather events, droughts, and floods, however longer rotations increase the potential amount of carbon that can be stored.
- The group discussed trade-offs between optimizing the defined 2040 EU climate targets or long-term adaptive and sustainable forests, which remain sinks in the longer term. ForestNavigator explores EU targets for 2040, as well as forestry beyond 2040. Participants shared anecdotes about short versus long-term goal prioritization also being unclear to national politicians and between ministries.
- A participant proposed that adaptable processes need to be considered, so that we can react quickly to changes in verification of potential carbon removal opportunities and technologies (e.g., Direct air carbon capture and storage, BECCS). While forestry does not

contribute much to Germany's carbon sink and would not be able to support its future sink, for example, wood products offer carbon sink opportunities. The biggest asset in Germany may be the integration of cascading use of wood for long-term storage.

After this general discussion, Julia Bognar (IEEP) presented three other storylines, alternative to the finalized EU forest policy reference pathway, and prompted attendees to give feedback on each. All storylines are designed to be implemented in EU-level and national modelling frameworks. Alternative scenarios consider climate risks and natural disturbances under a moderate climate change framing (i.e., Representative Concentration Pathway 4.5), to test robustness without considering highly extreme and unlikely scenarios. The feasibility for national contexts will be later reviewed to ensure that EU-level results are aligned with implementation realities. Feedback was prompted on each storyline based on its a) plausibility, b) associated risks/barriers, c) enabling conditions needed to achieve the storyline's objective, d) coherence of storylines (e.g. whether elements are missing or there are contradictions), and e) policy relevance/usefulness. The storyline descriptions and relevant prompts were shared with participants before the workshop. Discussion on each scenario is summarized in subsections below.

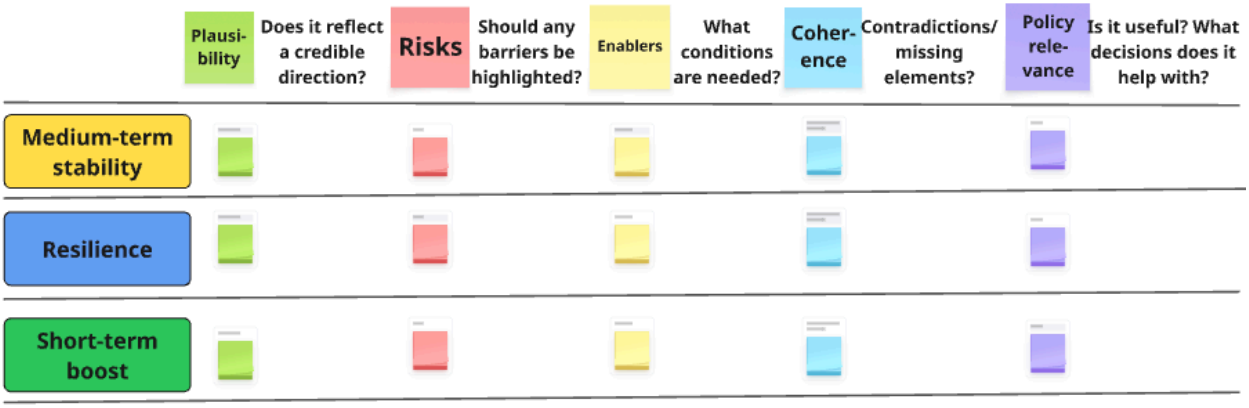

Fig 2. An online Miro board display, prompting feedback on each of the alternative storylines (Source: WP8).

Medium-term climate ambition

Long-term sink stability & lower bioenergy demand

This storyline aims to strengthen the long-term climate contribution of forests in the 2040–2050 timeframe by reducing harvest pressure. The main mechanism to do so is the inclusion of a lower bioenergy demand pathway, while material demand is broadly aligned with the Policy Reference level. Gradual adaptation to climate change is assumed, with a relatively slow pace of management turnover and species transition.

- Some participants criticized the assumption that lower bioenergy production is correlated with forest absorbing more carbon. The scenario rather assumes that harvesting will decline if bioenergy demand, a primary driver, declines. The scenario includes other factors as well. Disturbances also affect the sink. Because this storyline is very close to the reference scenario, with strong bioenergy, this scenario seeks to explore a stable future harvest without harvest increase. In the ForestNavigator models, bioenergy is usually the strongest contributor to harvest and demand. It is included also considering that when combined with construction demands, bioenergy demand dominates. This scenario keeps harvest stable, somewhat lower in comparison to the reference scenario, through bioenergy, to allow a lower harvest element for comparison with the reference scenario.

- There were questions regarding why this storyline includes low energy demand, when forecast studies stress increases in future bioenergy demand, increased demand of roundwood, and increased implementation of cascade approaches in circularity. Fulvio Di Fulvio (IIASA) offered that they could leverage circularity in this scenario, for example, to keep the same bioenergy demand increases as in the reference scenario, but with circularity reducing pressure for wood hardness.
- Increased demand in this scenario could be satisfied and/or come from within the EU or externally. This would include a degree of leakage. A participant noted results suggesting leakage would send a policy message that leakage reduction is needed. Andrey Lessa (IIASA) then shared that they can implement short rotations of plantations and diversion of residues to material use within the models.
- Bioenergy is not efficient for electricity, as it is less flexible. German pathways therefore do not consider bioenergy for electricity, but rather for heat production. Therefore, they suggest shifts of increasing bioenergy for heat and decreasing its use for electricity.

Forest resilience

Wood construction and circular use with faster adaptation

This storyline explores whether EU forests can contribute to climate objectives while enabling a more materials-oriented bioeconomy. It assumes a moderate increase in wood demand for construction relative to the EU forest policy reference scenario, combined with stronger cascading and circular use (i.e., more efficient use and longer product lifetimes). It also assumes a more proactive approach to forest management, with faster adaptation measures (e.g. rotation choices and management decisions) aimed at maintaining resilience under increasing climate risks.

- The assumption that shorter rotation periods entail greater forest resilience was called into question by participants. This can increase forest ecosystem pressure. Unevenly aged forests, including different age classes and species is considered a cornerstone for forest adaptation. Partners clarified that increased harvest is a relevant option for greater forest resilience in monoculture forests specifically, and this choice considers faster species change to imply a faster approach for adaptation. If rotations are continued everywhere, at the current harvest level, for example, conversion is assumed to new species in areas at 1-2% in the forest area per year. If we need to adopt a species, redirect harvest, and increase harvest in an area, then 3-4% of the area change can be achieved per year. This the basis of this assumption for short rotations to increase forest resilience in certain areas.
- In regard to how the amount of uneven aged EU forest is considered, a faction of uneven forest is assumed in most EU MS. Models then can replace that assumed fraction by MS. Participants shared that most forest in southern Europe is unevenly aged, especially in Balkan countries Italy and Spain.
- The assumption that shorter rotations in monoculture forests, rather than increases in tending, leads to more climate-adaptive species mixes was discussed. Participants asked whether an increased rate of change in forest management systems is also included in the scenario.
- The participants questioned whether the storyline sufficiently accounts for the constraints arising from the Habitats and Birds Directives in Natura 2000 sites. Accelerated harvesting and the replacement of monoculture stands with more climate-adapted species may be restricted where these activities could undermine site-specific conservation objectives, deteriorate protected habitats or significantly disturb protected species. The storyline should therefore clarify how Natura 2000 areas are represented in the modelling and whether assumptions concerning increased harvesting and faster species conversion are adjusted according to the conservation requirements applying in these areas.

Near-term boost in sink

Maximized 2030-2040 sink through strong demand reductions

This storyline explores a pathway that maximizes the forest carbon sink in the near-term, with a focus on the 2030–2040 period. It assumes strong reduction in harvest pressure through a reduction in bioenergy demand and reduced material demand. Adaptation is driven reactively by disturbances, which makes this storyline useful to examine trade-off between short-term gains in the carbon sink and longer-term forest resilience.

- Carbon leakage scenario assumptions were of interest to participants.
- Partners agreed to consider including accounting for exported wood products, based on interest shared by participants.
- Scepticism was shared about the plausibility of the rapid speed of change in some MSs. Employment would be an economic concern in some cases with such a high rate of change. The feasibility of adaptation and societal rate of change had been discussed substantially within the consortium, in terms of industry change. For species, mixed forests might be used more, as EU demand is currently more focused on conifer tree wood. If species are adapted to more broadleaved wood, the industry will need to adapt at regional scale, which partners will consider.
- A participant noted that regeneration rates should be further taken into account. Species change could hypothetically be achieved through planting as well.
- Some EU regions have observed change in preference toward hardwood. Beechwood is being used for plastics. This is being monitored to consider future trends.
- There could be recycling impacts for the sawmill industry, for example, in that this would decrease available wood for them. This would imply more secondary wood use. EU product demand should be considered given these aspects. Partners shared that modelling assumptions on disintegrated demands would be discussed on day two. Recycling rate and cascade assumption representations will be reviewed.
- ForestNavigator models, which run by MS, cannot capture the details of all MSs. To reduce modelling complexity, MS groupings are employed in these storylines. The project also includes national level projections which could adapt the storylines for accommodation for regional differences and assumptions.
- Hardwood sawmills have specialized in technology to buy cheaper industrial roundwood, which introduces direct competition with energy and paper production, for example. This does not apply to early thinning, which rather goes to energy.

Partners concluded from all storyline sessions that regional level differentiation can be further considered. The prompts for further feedback on each storyline were posted in the room on a whiteboard which remained available throughout the workshop duration, for participants to add notes to. An online, Miro, whiteboard was also designed with a section for further feedback on each of these storylines and announced to all participants. Participants were reminded that the reference scenario aims to mimic the current policy situation. Though this would reflect differently in each MS, ForestNavigator partners can differentiate the alternative policy scenarios from the reference for comparison.

Poster session

Four stakeholders volunteered to provide posters on their work (see Table 1). Poster summaries were presented to the plenary as flash talks for an overview of topics at the start of the session, before open dialogue. Full posters are available in Annex 3.

Table 1: Titles of posters submitted to the poster session, which were presented and discussed on Day 1 (Source: WP1).

No.	Poster Title
1	ILEX: a Mass Flow Model for the forestry sector in Italy
2	EUSTAFOR: Managing State Forests Responsibly 20 years
3	Aboveground biomass of shrub vegetation in Slovakia
4	Mitigation seems a failure. Focus on adaptation instead!

EU Pathways of mitigation potential

Fulvio Di Fulvio (IIASA) gave an overview of the WS2 scenario co-development, including how the input collected was applied in the construction of the scenarios to be presented.

Alternative woody biomass use pathways

Achilleas Zarkaliou from E3 Modelling (E3M) presented the scope of Task 7.1, Forest, bioenergy, and biomaterials: Synergies and trade-offs. He described the base, low, and high bioeconomy scenarios and the impact of each on wood harvest, including their connection to trade, and on forest carbon stock. All substitution effects are projected to decrease after 2025, following progressive decarbonization.

Andrey Lessa (IIASA) presented the socioeconomic indicator results of scenarios, including Gross Domestic Product (GDP) and workforce decline resulting from productivity increases. Results show an increase in intensive management and a decrease in multifunctional management. Fulvio emphasized that not only does the total carbon change under Land Use, Land Use Change, and Forestry (LULUCF), but also BECCS. There is a break-even point between the baseline, high, and low scenarios around 2060-2070 where circularity increases. In the high scenario, the break-even point occurs earlier, and this is anticipated through the medium term. In the low scenario, the break-even point is comparatively delayed. Discussion followed the presentation as summarized below.

- The deployment of BECCS is calculated through endogenous modelling in PRIMES, a module of the overall energy system, model suit. There is a combustion efficiency which is entered into BECCS assumptions for biomass extracted from forest. The conversion efficiency number integrated in PRIMES was not available at hand but will be included in relevant final reporting. This value depends on the biomass type and power supply module. Between scenarios, the assumption in forest bioenergy is changed, allocating different shares from energy crops, agricultural residues, and other sources, while keeping total EU bioenergy demand constant. BECCS are attributed to forest biomass in these three scenarios so that there is a lower deployment of forest biomass bioenergy and BECCS compared to the high scenario, which has higher BECCS implementation associated with forest bioenergy. One participant offered to check and share the specific factor used for combustion efficiency of carbon to bioenergy cascading to BECCS within their work, if useful. There was specific interest in understanding differences in assumptions as compared with national models.

- Participants were interested in the impact of changing energy prices, considering current energy crises as well as the implementation of the Nature Restoration Law (NRL).
- Historical forest material uses may not be important. Options for long lifetime usage exist in the construction sector. Packaging like the IKEA model includes material lifetimes of 3-5 years. Textiles, plastics, and bioplastics all have short-term lifespans of 5 years maximum. Real material use options for short-term products rather than long-term visions for energy may be particularly relevant for Southern Europe, due to its fire risk.
- For Southern Europe, intensification and reduction of the rotation period means lower fire risk and positive environmental impacts. This is, however, dynamic.
- One graph displayed a constant pattern of change, which was criticized as potentially unrealistic from the viewpoint of participants. Radical changes in the next years, until 2030, may be unrealistic. Some participants assume further system inertia.
  The degree to which BECCS storage was considered was questioned, as often only BECCS production is considered rather than its storage. For example, if BECCS was implemented in all German wood-burning plants, Germany's potential storage would be at capacity within a year. Project partners agreed to check the total EU storage capacity of BECCS. The scenarios utilize BECCS to adhere to 2050 EU climate targets. Other carbon capture options are comparatively more expensive in the midterm.
- There may be some impact from forest harvest on energy prices, but results suggest more impact from heavy industries, like cement, which ForestNavigator does not explore.

Fulvio Di Fulvio (IIASA) explained that the scenarios presented aim to compare the prioritization of short-term versus long-term solutions. The assumptions included in the scenarios will continue to be revised, especially in terms of market adaptation. In some scenarios, a fast transition, for example, is applied to explore effects, even though we know sectoral transitions will be slower. By including scenarios with some 'shocks' as rapid changes, results will allow more differentiation with the baseline scenario. Andrey Lessa (IIASA) also added that these scenarios are exploratory, meant to find results of hypothetical 'what-if' situations in which some push the limits of possible transition. The baseline scenario is meant to be realistic, in comparison with these alternative scenarios.

Biodiversity & environmental goal pathways

Tord Snäll, from Skogforsk, presented scenario components relevant to forest management according to the EU biodiversity strategy and NRL. This entailed discussion on two alternative scenarios as well as the baseline EU forest scenario. For harvesting, the Biodiversity Strategy (BDS) & NRL sets harvests about 12% lower than the increase projected in the baseline scenarios, but still 4.5% higher than today. Results suggest that the EU BDS will increase exports until 2100 compared to today but stay ca. 6% below baseline in the second half of the century. In this period, the combined BDS and NRL will further decrease exports and reach no-net exports. Forest carbon stock increases most in the BDS and NRL scenario, as compared to other scenarios. In general, small differences between scenarios in the second half of the century should be interpreted carefully since projected levels during this period are highly uncertain.

The results in terms of total carbon stock, with leakage corrected, came as a surprise, displaying approximately 100% of carbon leakage. Results from research performed last year showed 70% of harvest leakage. Fulvio Di Fulvio (IIASA) stated that carbon leakage prediction is subject to high uncertainty. Tord Snäll (Skogforsk) showed projections of old harvest and forest age as indicators, but progress regarding biodiversity has been slow. The discussion is summarized below.

- Participants discussed the definition of harvest leakage in relation to carbon leakage and the uncertainty associated to both.
- Historically, regions that the EU imports most goods from have been boreal and temperate regions with similar stocks to Europe and usually have low-intensity management.
- There were discussions on the assumption that limiting harvest puts the forest into restoration. A restored forest can plausibly be resilient and deliver more wood harvest in the future, by 2050 perhaps rather than in the short-term (i.e., 2030, 2040).
- On how abandoned or unmanaged areas are considered, Fulvio Di Fulvio (IIASA) shared that the models include categories for strictly protected areas, unmanaged and strictly protected areas, areas with some protection (<25%), close-to-nature management areas (<50% protection), multifunctional management with <75% increment, and intensely managed areas (>100% increment). According to these categorizations, the models apply limits on harvesting in that area. Harvesting category assumptions are calibrated by MS according to historical productions and historical mapping according to management types. Even with close-to-nature management, for example, not all areas will apply the maximum 50% harvest potential. In some areas, close-to-management land may include almost no harvest, depending on the historical calibration and future wood demand projections.
- If wood is exported from the EU, LULUCF emissions need to be considered. A participant mentioned preliminary work on the effects of sulfuryl fluoride pesticide use on German exported wood, which has a carbon dioxide (CO2) equivalent 5000 times higher. This could pose disastrous GHG budget effects and increase beetle risks in wood exports. The ForestNavigator project is not considering wood product leakage in terms of EU exports because of model incompatibility with the complexity of this. Including semifinished products is complicated.

Climate change adaptation pathways

Andrey Lessa (IIASA) presented progress and preliminary results on Adaptation strategies and resilience under climate change and natural disturbances, and the associated scenarios. How climate change impacts are integrated into GLOBIOM was briefly described within the presentation. Biophysical impacts in the exercise included decreased forest growth in the water-limited Mediterranean and Eastern Europe as well as increased forest growth in temperature-limited boreal zones. The climate scenarios resulted in changes of about 10% in harvested wood volume. Salvage logging after disturbance events as well as planned harvests contribute to this increase in harvest volume, which reduces the carbon sink. Alternatively, fully displacing planned harvest after a disturbance event leads to a lower decrease in forest sinks. This also applies to trade, where increased productivity leads to increased exports. In terms of carbon, there are considerable differences in results across scenarios. In the low-demand scenario, carbon reaches the highest level. In the low-demand scenario, there is also more carbon stored in deadwood stock. There is an increase in disturbances toward the end of the century, with more serious damage in the low-demand scenario as there is more standing stock in that scenario by the end of the century. Where there are stronger negative impacts from climate and disturbances, there is more adaptation, for example through expansion of mixed forests and this scenario. These scenarios include computed socioeconomic indicators and biodiversity, which includes taxonomic groups for mammals, birds, and amphibians, though the work is still in progress. Adaptation and mixed forest conversion takes time, with benefits becoming evident toward the end of the century. It can be inferred that it's important to start converting areas with highly vulnerable species like spruce and Scots pine as soon as possible. Salvage logging also appears to be a good option for long lifetime products which store carbon. Discussion after the presentation is summarized below.

- The connection between increased damage and wood price is due to lower availability of sawlogs. When demand is overshot, the wood price decreases. Scenario results show increased coniferous wood and broadleaf wood prices in the long term.
- Climate change impacts act as shocks to supply. Some regions have a comparative advantage in dealing with supply shocks, for example Scandinavia sees harvesting shifts more proportionally compared to the baseline scenario. We assume that demand is independent from disturbances but can be adjusted in terms of imports and exports by MSs. For example, each MS holds an assumption that roundwood will be imported or exported depending on their demand.
- Geopolitical shocks can be modelled with demand elasticity changes, from which wood price is a consequence. There are no plans to implement changes similar to current geopolitical shock events, but it is assumed that any such shock would result in a change in who the EU imports from. Amid a trade shock, the EU could replace wood from the United States with Canadian or Brazilian wood, for example. Partners assume that in this exercise the model would simply change the country it takes imports from.

Andrey (IIASA) closed the session stating that the future projections display more disturbances, but also more forest regeneration. The scenarios show that towards the end of the century, the carbon sink declines, but this sink decline is limited by regeneration occurring. Different models sometimes display large differences in results, so uncertainty is considerable.

ForestNavigator Portal Development

Kanwal Nayan Singh (CA) started the session by reintroducing participants to the ForestNavigator Portal, namely the Data Explorer, which was publicly launched earlier this year. Key displays, functionalities, and data content of the Pathways Explorer were presented, which is in its beta version and not yet public. The Pathways Explorer is the Portal component which will host results of the EU forest policy reference pathways and forest alternative pathways, which have been discussed throughout WS3. The group was given access to the Pathways Explorer via pre-workshop materials, to prompt feedback on beta functionalities and content so far. Feedback prompts were referred to as the group was split into two groups, for smaller discussions and more opportunity for each participant to speak.

Between both discussion groups, stakeholders identified several additional functionalities or amendments to current functionalities which they would consider improving understandability and usability of results displayed in the Pathways Explorer. Elements suggested included:

- A .csv file download functionality would be most relevant for expert users
- Addition of legend checkboxes for a ‘select all’ button and an ‘unselect all’ button.
- Functionality for users to select the order of indicators displayed in graphs
- Automatic updates to graphs and figures on the upper and lower webpage when users change indicator selections
- A comparison functionality to display indicator value differences between two scenarios
- Allowing users to select whether graph axis scales a) stay constant when users change indicator/scenario selection, or b) change to optimize visualization of each selection
- Further precise data download options, to avoid value estimation of chart displays

Most feedback prompting focused on whether any information, text or data displays was unclear or confusing. Participants were also asked whether any relevant information was missing. The groups responded with the following points:

- Further overview and explanation of all the scenarios and models is needed
- Participants noted a preference toward descriptions next to indicators rather than 'hidden' behind the 'i' icon, which requires a user to hovers over it
- Shading symbology or a mask layer could offer differentiation in displaying observations (e.g., 2020 and earlier) versus projections (e.g., after 2020)
- Axes should include descriptive titles and units, for example, 'forest based GHG removals in Megatons CO2' as y-axis label
- Clarification of indicator titles, for example 'LULUCF' title could be rethought to clearly state that this indicator doesn't include not all emissions
- Descriptions should be available next the drop-down selection, rather than only when hovering over an 'i' icon, which one participant referred to as 'hidden'
- Legends should aim to use of full words rather than abbreviations
- Use guidance would be useful for non-expert users
- The 'Species richness' indicator definition could be further clarified
- The 'emissions' indicator definition should be expanded to explain that it includes total and LULUCF emissions (e.g., forest plus HWP) in terms of forest land and LULUCF
- A message should appear to explain when figures appear empty because of baseline values, which indicators are computed against
- Explanation could be useful in cases where forest emissions are shown to reach zero (e.g., Austria's forest emissions). Participants discussed whether this could be due to inclusion of salvage logging, which decreases the living biomass pool with deadwood accumulation that compensates living biomass losses, or dead standing trees
- The 'Removals' indicator, which refers to carbon emissions in the atmosphere, could be better described and additional guidance could suggest users explore other similar indicators, such as 'harvest' within the category 'losses' in this case, considering different users may assume what they're interested in is labelled differently
- 'Harvest' indicator description should state that this considers over bark
- Split between logging residues and solid wood could be displayed in 'heavy' categories
- 'Harvest' description should state whole timber yield and salvage logging is included
- 'Extraction' was discussed as a potential alternate title to 'losses'
- 'Observed' is preferred over 'historical', to avoid assumptions excluding recent past

In terms of design and content, participants discussed that a ForestNavigator copyright image next to graphs would increase the ease of citing the tool. Downloaded .png files could also include the scenario title and any other selected indicators relevant for the download. Technical errors identified by participants will be resolved before the Pathways Explorer public launch. A participant noted interest in projections of total increment growth, which Fulvio Di Fulvio (IIASA) confirmed is available for the G4M model and could hypothetically be uploaded to the Portal. Project partners explained that continuing ForestNavigator Portal updates after project end would

require rerunning the models and continual uploading of new observation data, but a participant stated they would prioritise the Portal over some other similar tools.

Several applications for the Portal were discussed, including cross-checking LULUCF sector national level results, reference images for academic presentations, academic teaching, for comparisons with modelled pathway results from other projects, and to compare with other raw data after downloading raw data from the Explorer.

Sylvia Schmidt (CA) encouraged sign-ups for additional Portal updates, by participants or their colleagues. All were also encouraged to continue to submit feedback. The Pathways Explorer will be launched this summer. After its publication, there will be webinars in the fall which focus on capacity building on the Portal.

Closing and next steps

Willem-Jan (WUR) presented updates on the future policy pathway impacts on global wood trade. ForestNavigator aims to identify storylines that are more appropriate for countries as well as grouping countries to identify regional-specific storyline realities. Short-term industry adaptation will be taken into consideration. The final pathway for construction of wood demand will be updated to reflect this. Andrey Lessa (IIASA) adds that in some situations rate of adaptation can be increased by exceeding planned harvest.

Participants expressed interest in forest employment, including green jobs as well as wood industry jobs, which are being discussed in Forest Europe. Non-wood related jobs, beyond recreation, are growing in Portugal, Italy, France and Spain. Value chain impacts from forest management on wood supply-related jobs were also of interest. Fulvio Di Fulvio (IIASA) shared that employment in forestry results will include wood supply and other forest industries. A participant flagged that an assumption for the US to increasingly depend on imports seemed incorrect, as the Trump administration is increasing exports of high-quality hardwood. Partners responded that they would gain results from a business-as-usual pathway, without any specific assumptions on US trade, using trade versus non-trade analysis to highlight uncertainty of these scenarios.

The workshop concluded with an announcement of the project's anticipated forthcoming milestones, which include i) iBIS biodiversity model results; ii) a G4M-X climate-change-sensitive meta-model and an assessment of the impacts of natural disturbances on forest mitigation potential; iii) a report on the contribution to mitigation of substitution potentials of harvested wood products; iv) data on reconciled EU forest carbon stocks; and v) a tool for EU forest management costing and the calculation of green jobs.

Next steps for engagement

Following the workshop's conclusion, participants received all relevant pre-materials, presentations, a feedback survey, and a feedback survey for further Portal feedback. As was the process with WS1 and WS2 reports, after internal review to draft the report, participants will receive the WS3 draft report and have an opportunity to suggest amendments before it is publicised. Stakeholders are prompted to suggest changes if they feel that the report

leaves out any significant discussion or suggestions, or if any discussion may appear underexplained or misrepresented.

In the remaining months of the ForestNavigator project, stakeholders have several opportunities to engage further:

- After Portal suggestions captured in WS3 are resolved, CA plans to reach out to the Portal interest group members to prompt an additional round of feedback before the launch of the Pathways Explorer in summer 2026.
- ForestNavigator final dissemination event will take place on 13 October, 2026 in Brussels.
- ForestNavigator will hold a second Forest Policy Modelling Forum event on 14-15 October 2026.
- Approximately two further episodes of the *Forest Talks* webinar series are planned for fall 2026, which will also support further dissemination and capacity building for both the Data Explorer and Pathways Explorer.
- The forest community and stakeholders are encouraged to follow the project LinkedIn page, follow the YouTube channel for access past and future recordings, and sign-up for the newsletter to ensure they hear of all further opportunities and events.

Annex I - Agenda

Funded by the European Union

ForestNavigator

ForestNavigator

3rd Stakeholder Workshop

Project: **ForestNavigator** – Navigating European Forests and forest bioeconomy sustainably to EU climate neutrality

Project start date: 01.10.2022 Project duration: 48 months

Date and location

Date: 27-28 April 2026
Location: BOKU University, Ilse-Wallentin-Haus ILWA,
Peter-Jordan-Straße 82, Rooms SR21, 22, and 23
1180 Vienna, Austria

Hotel location (for those who opted for the group booking):
IBIS Styles Wien City
Döblinger Hauptstraße 2, 1190 Wien, Austria

Objectives

1. Present, disseminate, and build capacity for the uptake of project outputs, including data for GHG inventories, exploratory and policy pathway results, and the ForestNavigator Portal
2. Prompt feedback on the exploratory pathway results, policy pathways for the EU, and the Pathways Explorer
3. Unite the Forest Navigator community in discussions on research interests and needs

About

The workshop will host a general discussion on forest research responding to EU policy needs. It will also specifically engage participants in its work on:

- Near real-time EU forests and bioeconomy monitoring to support GHG inventory development
- Robust pathways of the EU forest GHG balance, considering relevant EU environmental legislation and objectives such as the reviewed 2030 and 2050 climate targets
- Establishment of the ForestNavigator Portal, a decision-making platform
- The recreational and cultural value of EU forests under alternative management options

Agenda

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ForestNavigator

27 April 2026, 12:00-18:30		
TIME	ITEM	Speaker(s)
12:00-13:00	**Welcome** The group is welcomed with a tour de table and recap of project accomplishments, including the assessment of recreational and cultural values in alternative EU forest management.	Sylvia Schmidt (CA), Alice Ludwig (BOKU), Fulvio Di Fulvio (IIASA), Fabio Eboli (ENEA)
13:00-14:00	**Lunch**	
14:00-14:45	**Keynote speech on the EU Carbon Removals Carbon Farming (CRCF) Regulation**	Jurij Krajcic (EU DG CLIMA)
14:45-15:15	**EU forest monitoring and application for national GHG monitoring** The development of near real-time monitoring toward GHG inventories and data availability is presented and discussed.	Alexandra Runge (GFZ)
15:15-15:45	**Coffee break**	
15:45-16:15	**EU Reference forest policy scenario** The EU Forest Policy reference pathway is presented and discussed, reflecting on previous input captured. A break-out group exercise on alternative policy pathways is introduced for the next session.	Julia Bognar (IEEP)
16:15-16:55	**EU Reference forest policy scenarios - break-out group discussions** Alternative policy pathways are discussed in smaller groups, including policy compliance, enhanced policy and transformational levers.	Julia Bognar & Krystyna Springer (IEEP)
16:55-17:15	**EU Forest policy scenarios – closing** Break-out group discussion summaries are presented. The policy roadmap in development is briefly noted before closing Q&A.	Julia Bognar (IEEP)
17:15-18:30	**Poster session** 2-minute pitches are given before the open networking session	Sylvia Schmidt (CA)
19:30	**Dinner** (optional) at Weingut Feuerwehr-Wagner (Grinzinger Straße 53)	

28 April 2026, 9:00-13:45		
TIME	ITEM	Speaker(s)
9:00-9:15	**Welcome back**	
9:15-10:45	**EU pathways of mitigation potential** Alternative EU forest pathways on i) alternative woody biomass use, ii) biodiversity & environmental goals, and iii) climate change adaptation are presented and discussed.	Andrey Lessa & Fulvio Di Fulvio (IIASA), Tord Snäll (SLU), Achilleas Zarkaliou (E3M)
10:45-11:15	**Coffee break**	
11:15-12:15	**Forest Navigator Portal & Pathways Explorer** The Portal, especially the beta Pathways Explorer, is presented, before smaller groups discussions are prompted.	Kanwal Nayan Singh (CA)
12:15-12:45	**Closing, upcoming work & next steps**	Fulvio Di Fulvio (IIASA), Willem-Jan van Zeist (WUR)
12:45-13:45	**Lunch**	