ForestNavigator

D8.1 Report and dataset on policy review and EU reference policy scenario

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Abstract

This deliverable (D8.1) supports the development of ForestNavigator policy pathways by providing (i) a structured assessment of policy coherence in the EU forest policy framework and (ii) a quantified Reference Policy Scenario for EU forests and the forest sector.

A stakeholder- and expert-based Policy Coherence Matrix was created to evaluate synergies, conflicts, and trade-offs between forest-relevant objectives and policy instruments at two levels. A horizontal assessment was performed of EU-level instruments and a vertical assessment of EU objectives against Member State instruments in four case-study countries (Czechia, Ireland, Italy, and Sweden). Findings highlight that coherence depends on policy design and Member States' governance capacity, monitoring systems, and cross-sector coordination. Particular policy gaps were identified for circularity in the forest-based bioeconomy (cascading and recycling of wood products), a clearer definition of ecological limits for sustainable biomass extraction and forest management, and stronger integration of mitigation, adaptation, and biodiversity objectives.

Building on this policy assessment, the deliverable defines and operationalises a Reference Policy Scenario based on implemented/adopted measures, notably NECP-aligned (WEM/WAM) assumptions and selected CAP measures, implemented through an EU modelling layer (GLOBIOM–G4M-X) and national models (CBM variants and Heureka). Results indicate that under existing policies, the EU forest sink can be broadly maintained under reference (no disturbance) conditions, but becomes substantially more uncertain once climate change and disturbances are included under RCP4.5 (moderate warming), as outcomes are sensitive to climate model assumptions and disturbance dynamics. The Reference Policy Scenario provides a benchmark for identifying gaps to EU mitigation expectations and informs the design and testing of more ambitious policy pathways under Task 8.2.

Keywords

EU forest policy, policy coherence, horizontal coherence, vertical coherence, policy coherence matrix (PolCA), National Energy and Climate Plans (NECPs), Reference Policy Scenario, Carbon sink, harvest dynamics, afforestation, deforestation, climate change impacts, natural

disturbances (wind, bark beetle, wildfire, drought), RCP4.5, Monitoring Reporting Verification (MRV, governance and implementation capacity, biodiversity safeguards, LULUCF Regulation, Nature Restoration Regulation, Bioeconomy and circularity/cascading use of wood

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Abbreviations

3BT	3 Billion Trees Pledge
BASE	Baseline Scenario
AWS	Available for wood supply
BAU	Business-as-Usual
CAP	Common Agricultural Policy
CBM	Carbon Budget Model
CBM-CFS	Carbon Budget Model of the Canadian Forest Sector
CLU	Climate Units
CO_2	Carbon Dioxide
CRCF	Carbon Removals and Carbon Farming Certification Framework
CSDDD	Corporate Sustainability and Due Diligence Directive
CSRD	Corporate Sustainability Reporting Directive
CSP	CAP Strategic Plan
CtN	Closer to Nature
CzSO	Czech National Statistic Office
DOM	Dead Organic Matter
EC	European Commission
EQO	Environmental Quality Objectives
ETL	Elasticity of Transformation Location
ETL2	Allocation of available cropland among alternative crop types
EU	European Union
EUDR	EU Deforestation Regulation
FAOSTAT	Food and Agricultural Organisation Corporate Statistical Database
FMF	Forest Monitoring Framework
GAEC	Good Agricultural and Environmental Conditions
GHG	Greenhouse Gas
HWP	Harvested Wood Products
GAI	Gross Annual Increment
ha	Hectares
G4M-X	Global Forest Model
GCM	General Circulation Model (Global Climate Model)
GFDL	Geophysical Fluid Dynamics Laboratory
GFDL-GCM	Geophysical Fluid Dynamics Laboratory – General Circulation Model
GLOBIOM	Global Biosphere Management Model
ISIMIP3	Inter-Sectoral Impact Model Intercomparison Project Phase 3
kha	Thousand hectares
LULUCF	Land use, land use change, and forestry
MAT	Mean Annual Temperature
MMAI	Maximum Mean Annual Increment
MS	Member State
NAI	Net Annual Increment
MRV	Monitoring, Reporting, and Verification
NECP	National Energy and Climate Plans

NFP	National Forestry Programme
NRR	Nature Restoration Regulation
NFI	National Forest Inventory
NBS	Nature-Based Solution
NUTS	Nomenclature of Territorial Units for Statistics
$MtCO_2e$	Metric Tons of Carbon Dioxide Equivalent
P	Total annual precipitation
PolCA	Policy Coherence Assessment
PRIMES	Price-Induced Market Equilibrium System
RCP	Representative Concentration Pathway
RED	Renewable Energy Directive
REF	Policy Reference Scenario
SFM	Sustainable Forest Management
SMD	Soil Monitoring Directive
UKESM	UK Earth System Modelling Group
UNFCCC GHGI	United Nations Framework Convention on Climate Change Greenhouse Gas Inventory
WAM	With additional Measures
WEM	With existing measures
WP	Work Package

Executive summary

This report provides two complementary foundations for ForestNavigator's Work Package 8: (i) a structured assessment of policy coherence within the EU forest policy framework, covering both horizontal EU-level coherence and vertical EU–Member State alignment; and (ii) a quantified Reference Policy Scenario that translates implemented and adopted measures into EU-wide and national modelling pathways. Together, these components of the coherence assessment clarify how current policies interact, by reinforcing signals or generating tension, and trade-offs are likely to arise. Additionally, the Reference Policy Scenario provides a transparent benchmark against which more ambitious policy pathways can be assessed.

The coherence assessment examines how forest-relevant policy instruments interact with forest-relevant objectives, focusing on policy design and intended impacts. It combines:

- a horizontal assessment of interactions between EU objectives and EU instruments; and
- a vertical assessment of interactions between EU objectives and Member State instruments in the four case-study countries: Czechia, Ireland, Italy, and Sweden.

The assessment applies an expert- and stakeholder-based Policy Coherence Matrix using a seven-point interaction typology ranging from strong conflict to strong synergy. Stakeholders scored interactions using the Nilsson/Griggs typology (−3 to +3, with 0 = neutral and "/" = unknown). The horizontal assessment was conducted through a participatory stakeholder workshop on the EU forest policy framework, followed by an opportunity to revise scores via email. The vertical assessment was complemented by written input from ForestNavigator national experts in Czechia, Ireland, Italy, and Sweden.

The findings underscore that the coherence of the EU forest policy mix cannot be evaluated on policy design alone. Coherence is ultimately strengthened (or weakened) through Member States' implementation capacity, legal interpretation, and governance coordination. Instruments such as the Renewable Energy Directive (RED) III, the EU Deforestation Regulation (EUDR) and the Nature Restoration Regulation (NRR) may be formally aligned with EU objectives, but their effects depend on national systems for enforcement, permitting, compliance checks, and monitoring. The vertical assessments highlight the importance of this governance dimension: Italy shows comparatively high alignment supported by integrated strategies and binding frameworks, while Sweden relies more heavily on voluntary measures and exhibits uneven regional implementation. Ireland and Czechia illustrate that, even where strategic objectives exist, operational instruments and monitoring, reporting, and verification (MRV) mechanisms may lag.

A recurring conclusion is that MRV-type instruments (e.g., the Forest Monitoring Framework, Soil Monitoring Directive, and Sustainable Taxonomy) act as enabling infrastructure for policy coherence by making trade-offs more visible and supporting adaptive management. However, MRV capability remains uneven across Member States. More broadly, stakeholders emphasised the need for integrated approaches that combine instruments: no single instrument can simultaneously deliver mitigation, adaptation, biodiversity, forest health and bioeconomy objectives. Coherence, therefore, depends on how the policy mix functions as an integrated system, including the mainstreaming of biodiversity safeguards into climate and bioeconomy instruments. The assessment also identified several policy gaps relevant for future pathway design, including limited attention to circularity and cascading use, weak operationalisation of ecological boundaries, and insufficient integration of adaptation, mitigation and biodiversity objectives. Methodologically, the results should be understood as reflecting informed perceptions of intended policy effects and emerging instruments, rather than measured implementation outcomes.

Based on the coherence analysis, stakeholder input, and the capacity of the models to represent policies and measures, we identified a Reference Policy Scenario. This Scenario establishes a consistent, model-ready representation of the forest sector trajectory under existing policy measures and serves as a benchmark against which more ambitious policy pathways can be evaluated. The Reference Scenario is built primarily on NECP LULUCF measures (WEM/WAM), together with selected measures that can be represented within the modelling framework. It also reflects key EU-level safeguards affecting feasibility, such as sustainability constraints relevant to bioenergy sourcing, protection assumptions for sensitive areas, and CAP conditionality.

The Reference Scenario is implemented through two modelling layers:

- an EU-level modelling layer (GLOBIOM–G4M-X), which produces an EU-wide, supply–demand-consistent pathway for wood demand, land-use change, and forest dynamics; and
- national models that assess feasibility and constraints while preserving national forest structure and management realities (CBM implementations for Czechia, Ireland and Italy, and Heureka for Sweden).

The scenario is assessed under RCP4.5 using two climate models (GFDL and UKESM) to span a plausible range of future conditions.

Under current policies, the Reference Scenario indicates that EU forest removals can be stabilised at approximately current levels under favourable conditions, but can also decline under stronger climate-mediated impacts. In the best-case outcome, medium-term removals remain around ~270 $MtCO_2eq$/year by 2050 (forest land plus harvested wood products (HWP)). However, once climate change and disturbance effects are incorporated under RCP4.5 (including drought, bark beetle, windstorms, and wildfire), the forest sink becomes substantially more uncertain. Results vary considerably depending on the global circulation model applied and assumptions regarding CO_2 fertilization. Disturbance-intensive trajectories can markedly reduce removals, with some futures indicating the possibility of the forest sector becoming a net emissions source. The analysis further shows that climate change and natural disturbances amplify interannual variability in deadwood and litter pools relative to living biomass, while impacts on HWP storage are not fully captured where disturbance-driven harvest temporarily exceeds demand.

Overall, the Reference Scenario indicates that stabilising removals around current levels is feasible under existing policies. However, achieving the anticipated 2050 LULUCF contribution levels above 300 $MtCO_2$/year would likely require additional measures beyond NECP WEM/WAM assumptions, together with a more explicit integration of adaptation measures.

A key practical insight emerging from the analysis is that consistent application of EU-wide policy requires national implementation and reality checks. EU-level modelling frameworks provide coherent policy and demand pathways, but national models are essential for identifying feasibility constraints and which assumptions require adjustment to reflect local forest structure and practice. The results also indicate that a small number of drivers, notably harvest levels and forest-area change, shape most outcomes, while climate change and disturbances primarily influence outcomes through increased *risk* (through volatility and shocks), rather than gradual average change alone.

The Reference Policy Scenario and its cross-scale modelling provide the starting point for developing and testing a set of ambitious policy pathways, including explicit consideration of synergies and trade-offs across climate mitigation, climate adaptation, biodiversity and bioeconomy objectives.

1. Introduction

This deliverable supports the development of ForestNavigator policy pathways by addressing two linked needs. First, it provides a structured assessment of how the current EU and Member States' forest policy landscape aligns with the project's core objectives, highlighting potential conflicts, trade-offs, and policy questions that are likely to shape future pathways. Second, it establishes a coherent Reference Policy Scenario, a model-ready representation of "current policies and their implementation," to serve as the quantitative starting point for more ambitious policy pathways.

Under the European Green Deal, the European Union has committed to achieving climate neutrality by 2050, a goal that requires not only a rapid reduction of greenhouse gas (GHG) emissions but also ensuring that any remaining emissions are balanced through CO_2 removals. Forests occupy a central position in this effort: they currently represent the primary option available for removing CO_2 from the atmosphere, while wood use may further contribute by durably storing carbon and substituting for fossil-intensive materials and energy (Nabuurs et al., 2017; Grassi et al., 2021). Beyond their role as natural carbon sinks, forests deliver a broad range of ecosystem services — including clean water and air, erosion control, and habitat provision — and are key actors in the circular bioeconomy (European Commission, 2021). However, meeting EU climate targets through forest management inevitably entails trade-offs, as increased focus on carbon sequestration or biomass production may conflict with national policies and with biodiversity protection and the provision of other ecosystem services (Blattert et al., 2023).

Despite the centrality of forests in EU climate ambitions, forest governance remains deeply fragmented, both at the EU and national scales. This fragmented multi-sectoral governance presents significant challenges to achieving policy integration, coherence, and cross-scale consistency (Gordeeva et al. 2025; Pitzen et al. 2023). Over the past decades, various policy fields — most prominently climate, energy, and bioeconomy — have gained increasing importance, creating additional, and at times competing demands, on forests and forest management. Emerging policies related to ecosystem conservation and restoration add further complexity to overall policy coherence. A concrete illustration of this challenge is found within the European Green Deal itself, where the objectives of the Renewable Energy Directive, the LULUCF Regulation, and the Nature Restoration Regulation impose demands on forest management that are not always easy to reconcile.

The climate mitigation role of forests is further complicated by multiple sectoral policies, spanning climate, energy, biodiversity/restoration, bioeconomy/circular economy, agriculture and trade, which can generate fragmented or contradictory policy recommendations if not aligned. This challenge is further intensified by the need for cross-scale alignment between national and EU-level policy frameworks (Siiskonen et al., 2025). In the context of climate and energy policy, this alignment is structured through National Energy and Climate Plans (NECPs), which provide national pathways based on existing policies and the level of ambition of each Member State, but do not inherently ensure coherence across the forest sector.

The forest sector has recently been observed to have had a declining contribution towards the EU mitigation objectives (Korosuo et al., 2023). It is therefore more than ever essential to understand how the forest-based CO_2 removals will evolve under the existing policies.

Against this backdrop, this deliverable combines a qualitative policy-coherence assessment with a quantitative modelling baseline. The coherence assessment aims to clarify where policy objectives and instruments reinforce each other, and where tensions are likely to emerge (for example, between mitigation, biodiversity protection, and bioenergy or material-use objectives). The modelling baseline then translates the subset of implemented measures that can be represented in the ForestNavigator modelling framework into a consistent reference pathway at EU and national scales. Together, these two components ensure that subsequent pathway design is grounded both in policy logic and in model-testable assumptions.

A policy-oriented analysis of the forest-sector mitigation should include two components. First, a structured coherence assessment to identify where policy objectives and instruments align and where trade-offs may occur across sectors and governance levels. Second, the establishment of a clear policy reference: a consistent, transparent baseline representing the trajectory of the forest sector under existing policy measures, against which the effects of additional, more ambitious policies can be systematically assessed. Such a reference scenario is a prerequisite for evaluating the impact of current policies and for identifying where and how increased ambition is needed (Forsell et al., 2019).

Accordingly, the deliverable is organised into two substantive parts. Part I presents the coherence assessment of the EU forest policy framework, combining a *horizontal* assessment (EU forest policy objectives against EU-level policy instruments) with a *vertical* assessment (EU forest policy objectives against Member State policy instruments in the case-study countries). Part II defines and operationalises the Reference Policy Scenario and reports the corresponding EU and national model results, thereby establishing a benchmark for identifying gaps to longer-term mitigation goals and informing the design of ambitious policy pathways under Task 8.2.

Based on the policy measures included in the Reference Policy Scenario, we provide a multi-scale, model-based assessment that establishes a reference pathway for forest sector mitigation in the EU and its Member States. This pathway serves as a benchmark against which the inclusion of more ambitious national and EU-level policies can be systematically evaluated, thereby contributing to a more integrated and evidence-based foundation for EU forest and climate policy. The coherence assessment complements and contextualises the modelling baseline with qualitative insights and clarifies where the current EU and Member States' policy mix is aligned by design, and where tensions and trade-offs are likely to arise across objectives and governance levels. Taken together, these two components ensure that the ambitious pathways developed in Task 8.2 are assessed not only against a quantitative reference trajectory, but also against the policy interactions and constraints that shape feasibility in practice.

2. Part I: EU Forest Policy Coherence Assessment

2.1. Theoretical background

Policy coherence

Coherence seeks to understand how well the elements of a policy mix are aligned and contribute to the achievement of policy objectives. For most researchers, coherence focuses on whether there are potential contradictions or conflicts between policy strategies and policy instruments. A policy mix should be free of contradictions or conflicts, which could hinder the achievement of overarching policy objectives. Thus, policy outputs must be consistent with multiple policy objectives and associated implementation arrangements (Di Gregorio et al., 2017). However, much debate in the literature challenges whether coherence merely aims at policy consistency as the absence of contradictions within and between policies (Rogge & Reichardt, 2013), or whether coherence aims for the synergic and systematic support towards the achievement of common objectives within and across individual policies (Jones, 2002). For the latter definition, strong coherence implies that complementarities, mutual support and synergies exist between elements of the policy mix.

Policy coherence is crucial for policy effectiveness. In light of multiple policy objectives, many of which are conflictual, as well as different levels of institutionalisation across policy fields, policy coherence is often discussed in regard to the EU's policy mix. The horizontally and vertically fragmented nature of the EU and its heterogeneous membership pose challenges for policy coherence (Kurze & Lenschow, 2018).

Nilsson et al. (2012) stipulate that coherence entails multiple geographic scales (e.g. local, regional, national, supra-national) and domains (e.g. sectors, policy areas). According to the authors, policy coherence can be achieved at three levels: vertically, horizontally, or internally. Vertical coherence refers to the alignment and collaboration across different government levels (e.g. between the EU level and Member State level) to work synergistically towards shared goals. Horizontal coherence refers to the coherence within one level between policy areas (e.g. between climate, energy, and biodiversity policies within the EU).

Concept of the policy mix

The term "policy package," also referred to as "policy mix," "policy bundling," or "policy portfolios", refers to cases where policymakers use bundles of instruments rather than using a single instrument to achieve specific objectives. Policy instruments are the building blocks of a policy package. A policy package contains abstract policy goals and concrete policy instruments: it is "a combination of policy measures designed to address one or more policy objectives, created in order to improve the effectiveness of the individual policy instruments, and implemented while minimising possible unintended effects, and/or facilitating interventions' legitimacy and feasibility in order to increase efficiency" (Givoni et al., 2013, p. 3).

The term ‘policy mix’ has been variously defined, with descriptions including a “set of government policies which, by design or fortune, have direct or indirect impacts” (Cunningham et al., 2009, p. 1) on outcomes, and “complex arrangements of multiple goals and means which…develop incrementally over many years” (Kern and Howlett, 2009, p. 395). Such mixes can incorporate a combination of policy instruments developed within an overarching strategy (Ossenbrink et al., 2019), or they could emerge more organically with little strategic direction, or amidst a changing strategic context.

Rogge & Reichardt (2016) initiated an interdisciplinary approach towards the development of the policy mix concept, recognising the challenges in operationalising a concept with various definitions. The motivation for providing a more coherent definition was to allow for empirical analysis of the complex characteristics and components of policy mixes and their impacts on desired policy outcomes. Rogge & Reichardt (2016) suggest that a policy mix comprises building blocks, which include:

- ‘elements’: including policy strategy and instruments
- ‘characteristics’: which describe the nature and performance of a policy mix
- ‘processes’: which describes the political problem-solving underpinning policy development

The analysis in this deliverable will focus mainly on the elements and characteristics of the policy mix and specifically focus on analysing relevant EU strategies, EU and Member States’ policy instruments, and their characteristics to understand the performance of the current policy mix.

Elements: instrument mix and policy strategy

Policy instruments are the tools or techniques of governance that translate objectives into action (such as regulations, economic incentives, informational schemes). The importance of a varied mix of policy instruments has been emphasised by analyses of renewable energy policies, energy efficiency policies, innovation policies, and climate policies (see Philibert, 2011; Rosenow et al., 2016; Van den Bergh et al., 2021; Kivimaa & Kern, 2016; Schmidt & Sewerin, 2019). Findings from such studies suggest that although individual policy instruments can facilitate the achievement of specific objectives, meeting large-scale objectives such as climate mitigation, biodiversity protection and restoration, or renewable energy transitions relies on embedding multiple instruments within a larger policy mix. Particularly for climate policy solutions in the forestry sector, desired changes in behaviour will result not just from one individual policy instrument, but a package of measures encouraging or discouraging a range of behaviours. Due to its multi-functional role, the forestry sector requires a complex mix of policy instruments and strategies within the framework of a holistic approach, from different points of view and different perspectives (Falloon & Betts, 2010; Arbuckle et al., 2013).

A second key element is the overarching policy strategy, which can be explored through the identification of policy objectives from, e.g. policy strategy documents, roadmaps, and action plans.

This deliverable focuses on instruments and policy objectives as two key interacting elements of the policy mix.

Characteristics: comprehensiveness, credibility, coherence

Characteristics can be used to describe the nature and performance of a policy mix. Policy mix characteristics consist of: comprehensiveness, credibility, and coherence (Rogge & Reichardt, 2016). Comprehensiveness captures how extensive and exhaustive the elements are. It is usually determined by how it addresses the market and other types of system and/or institutional failures. Credibility can be defined as the extent to which the policy mix is believable and reliable. This is often operationalised as the commitment from political leadership or through the operationalisation of targets. Policy coherence is defined as an attribute of policy that systematically reduces conflicts and promotes synergies between and within different policy areas to achieve the outcomes associated with jointly agreed policy objectives (Nilsson et al. 2012).

This deliverable focuses on policy coherence as a means of describing the performance of the EU's policy mix for forests.

2.2. Methodological approach

In this study, we measure policy coherence using the 7-point typology developed by Weitz et al. (2018). This conceptual basis used for science-based assessments of interactions between policies uses this typology, ranging from cancelling (-3), counteracting (-2), and constraining (-1) on the negative side to neutral (0), and enabling (+1), reinforcing (+2) and indivisible (+3) on the positive side (see Box).

Interaction scoring between policy objectives and instruments – based on Weitz et al. (2018)

Indivisible (+3): The strongest form of positive interaction, in which an instrument is inextricably linked to the achievement of an objective.

Reinforcing (+2): An instrument directly creates conditions that lead to the achievement of an objective.

Enabling (+1): The pursuit of the instrument's objectives indirectly enables the achievement of the objective.

Consistent (0): A neutral relationship where the instrument does not significantly interact with an objective, or the interactions are deemed to be neither positive nor negative.

Constraining (-1): A mild form of negative interactions occurs when the policy sets a condition or constraint on the achievement of the objective.

Counteracting (-2): The pursuit of the policy counteracts the objective.

Cancelling (-3): The most negative interaction where progress under the policy instrument makes it impossible to reach the policy objective and possibly leads to a deteriorating state of the objective.

2.2.1. Policy Coherence Matrix

Building on Weitz's scoring system, for the project IMAGINE under BiodivERsA3, Mortelmans et al. (2020) developed a methodological approach, known as the Policy Coherence Assessment approach (PolCA) approach. The PolCA method intends to achieve a tangible overview of how policy instruments and objectives in a given area interact with each other; systematically address and identify conflicts between instruments and objectives, and set the basis for improving synergies; reducing the complexity of interactions between policy objectives and instruments in a format that is fit for discussion with policymakers and key stakeholders in a relatively quick and concise manner; and assess how well a set of policy instruments perform regarding a set of objectives. The method utilises local knowledge and expertise from practitioners and policymakers.

The PolCA method is an expert-based method which utilises a Policy Coherence Matrix, which can be filled in by experts and stakeholders with the selected policy objectives and instruments in the area that is being assessed. This can be done through individual interviews or through a facilitated workshop session. Results can be analysed through simple summary tables. Mortelmans et al. (2020) stipulate that, if possible, it is preferable to carry out a PolCA in a participatory setting, such as an in-person workshop, as interactions between experts and stakeholders will yield additional input.

Mortelmans et al. (2020) provide an overview of the steps and outputs for the PolCA approach. In the next subchapter, an overview is provided of these steps and how they have been operationalised for this deliverable.

Working steps of Mortelman et al.'s (2020) PolCA approach for analysing policy coherence – adapted for the EU forest policy framework

Step 1: list of key policy objectives and instruments relevant to the forest policy landscape to consider for analysis.

A list of policy instruments and objectives is usually achieved through a literature review of legal documents, strategy documents, action plans, policy reports, multi-year plans, etc.

Step 2: Validate list of policy objectives and key policy instruments.

Validation is usually achieved through consultations with key experts with a "helicopter" view (i.e., a high-level overview) of relevant objectives and instruments.

Step 3: Construction of policy coherence matrix with instruments and objectives

A matrix is provided to stakeholders and experts which can be filled in individually by each respondent. The matrix is designed in tabular format with the main forest policy instruments in rows and the key policy objectives in columns.

The purpose of the matrix is to elicit stakeholders' views on how they perceive the potential interactions between the instruments and objectives. These views are given through an ordinal scoring system which reflects the degree to which the stakeholder believes there are strong/weak conflicts/synergies between policy instruments and objectives.

Stakeholders are instructed to fill in the blanks on the matrix table with an individual number reflecting the stakeholder's score. A score was given using a 7-item Likert scale ranging from -3 (strong conflicts) to +3 (strong synergies). The value 0 indicates neutral, not unknown. Should the stakeholder feel that they did not have enough knowledge to score a particular instrument against a particular objective, then a "/" symbol to indicate "don't know" was available to be filled in the blank.

The matrix can be constructed in a Microsoft Excel spreadsheet and includes a dropdown list of potential scores, which can be colour-coded to reflect the level of synergy or conflict the stakeholder felt exists between the instrument and objective. Table 1 provides an overview of the scoring system that was provided to stakeholders.

Table 1: Scoring system for coherence assessment provided to stakeholders

Score	Synergy/Conflict	Description
+3	Strong synergies	The instrument is fundamental to the achievement of the objective
+2	Moderate synergies	The instrument facilitates direct conditions that lead to the achievement of an objective
+1	Weak synergies	The instrument facilitates indirect conditions that lead to the achievement of an objective
0	Neutral	The instrument does not impact the objective in a meaningful way
-1	Weak conflicts	The instrument creates conditions that indirectly constrain the achievement of an objective
-2	Moderate conflicts	The instrument directly counteracts the achievement of the objective
-3	Strong conflicts	Policy instrument makes it impossible to achieve the objective or leads to a deteriorating state of the objective
/	Don't know	(stakeholder cannot assess synergies/conflicts)

Stakeholders were instructed that they did not need to consult any information before filling out the policy matrix table. However, an accompanying document was provided, which provided summaries of the policy instruments included in the matrix, providing the most relevant information related to forests. This document was meant to fill any information gaps stakeholders may have encountered in assessing coherence between policy instruments and objectives.

Step 4: Stakeholders fill in the coherence matrix and provide analysis

Two approaches were utilised for filling in the matrix table. The first approach took place in a session during the second workshop for the Forest Navigator Stakeholder Board in September

2024 (Task 1.3). Prior to the workshop session, stakeholders were offered the possibility to fill in the matrix and provide written feedback on the horizontal coherence between EU instruments and objectives, as well as on any potential missing objectives and instruments. During the workshop, initial results were presented to the stakeholders, and a discussion was facilitated to obtain participatory feedback in which both practitioners and policy experts could exchange views and ideas. After the workshop, stakeholders were offered the opportunity to alter their original scores should they feel the workshop discussion influenced any shifting views. A total of 11 matrices were completed by stakeholders.

The second approach organised online written feedback from the ForestNavigator project's national experts from Czechia, Ireland, Italy and Sweden on the vertical coherence between Member State instruments and EU objectives. National experts were encouraged to consult with other national policy experts should they feel the need for additional viewpoints.

Step 5: Analysis of Policy Coherence Matrix Data

The data collected from stakeholder board members and national experts were calibrated using simple Excel formulas to calculate average scores at the EU level and at the national level to determine how coherent EU-level and Member State-level instruments are.

2.3. Forest-relevant objectives and policies

To assess the coherence of the EU's forest policy framework, it is essential to first identify the core elements of the policy mix, namely, its policy objectives and instruments. As outlined in Section 2.1, these elements form the building blocks of a policy mix and are central to understanding how policies interact in practice. The objectives represent the strategic goals that policies aim to achieve, while the instruments are the means through which these goals are pursued.

The following section presents the selection of forest-relevant objectives and instruments that serve as the analytical foundation for the horizontal and vertical coherence assessments. The selection of policy instruments and objectives was carried out through a structured and transparent process, combining expert input, stakeholder feedback, and iterative refinement. The approach consisted of the following stages:

Step One: Initial Stakeholder Engagement

An initial workshop was held with the ForestNavigator stakeholders to co-create a comprehensive long list of relevant policy instruments as well as to engage in an initial brainstorming of categories of objectives. This phase ensured that a wide range of policy measures and priorities, reflecting diverse perspectives, were captured at the outset.

Step 2: Literature Review of Key Strategic Documents

In the case of forests, achieving multifunctionality in delivering multiple environmental, economic, and social services simultaneously, requires the elements of a policy mix to be consistent with

multiple objectives, including those related to providing timber and non-timber products, regulating climate change, conserving biodiversity, contributing to rural livelihoods and the bioeconomy, all without compromising the forest's long-term health and productivity.
Consequently, under the methodological approach of assessing policy coherence, it is imperative to identify the key strategic objectives of a policy framework for forests.

Based on a literature review, the EU's forest-relevant objectives and instruments were extracted from strategic documents including the EU Climate Law for 2030, the Forest Strategy for 2030, the Biodiversity Strategy for 2030, the Biodiversity Strategy for 2030, the Bioeconomy Strategy, the New Circular Economy Action Plan, and the Action Plan for Nature, People and the Economy.

Step 3: Helicopter Interviews with Policy Experts

These interviews were conducted with policy experts on an overview of the EU policy framework relevant to forests. The helicopter interviews served two main purposes: to identify and discuss relevant policy instruments to ensure a comprehensive policy tracker; and to elicit views on key objectives for multi-functional EU forests. From these interviews, a set of core policy objectives was identified. These were subsequently cross-validated with relevant EU strategy documents (e.g. the Forest Strategy, Biodiversity Strategy, Adaptation Strategy, EU Climate Law) to ensure alignment with policy priorities and frameworks.

These policy makers work at a strategic level and were pre-selected during the literature review. These interviews not only served to validate the initial list resulting from the literature review but also added missing objectives and instruments to the list that were previously not identified.

Step 4: Expert Evaluation and Policy Shortlisting

Once the helicopter interviews were completed, a long list of policy instruments and objectives was formulated to enter the validation phase. This long list of policy instruments was formulated into the Forest Navigator Policy Tracker, a database of public policies provided to both Forest Navigator partners and Forest Navigator stakeholders, with recent updates, summaries, and key information of interest.

The long list of instruments and objectives was reviewed by Task 8.1 experts as to whether the instrument/objective should be incorporated into the coherence assessment. Policy experts were asked to determine whether each individual policy instrument and objective should be "included", "excluded", or whether they were "unsure." Based on this evaluation, the list was narrowed down to the instruments and objectives considered most appropriate for inclusion in the coherence assessment.

For Member State-level policy instruments, validation was achieved through reviews by the Forest Navigator national experts as well as external validation from at least one other policy expert from each of the four Member States (Czechia, Ireland, Italy, Sweden).

2.3.1. EU Forest-Relevant Objectives

The forest policy objectives used in this coherence assessment are rooted in five core forest functions critical to delivering the EU's environmental, social, and economic goals: climate change mitigation, climate change adaptation, biodiversity conservation, sustainable forest ecosystem management, and the development of a sustainable and circular bioeconomy. Each function encapsulates multiple policy objectives that have been systematically derived through a combined review of strategic EU documents, interviews with high-level policy experts, and feedback from stakeholders across the forest and land-use policy landscape.

This section provides a structured analysis of how these objectives are grounded in the EU's principal strategies and action plans. The selected objectives not only reflect overarching EU priorities but also embody the evolving understanding of forests as multifunctional systems that deliver cross-cutting benefits (spanning climate, biodiversity, livelihoods, and the bioeconomy) while requiring careful balancing of trade-offs. The EU's increasingly systemic approach to land, forest, and climate governance is evident across the strategic documents assessed, which favour integrated, multi-objective solutions over siloed sectoral approaches.

Climate mitigation

Forests are central to the EU's efforts to achieve climate neutrality by 2050, as legally mandated under the European Climate Law (2021). The Law defines both a legally binding target for a net GHG emissions reduction of 55% by 2030 and a long-term vision for carbon neutrality, explicitly recognising the critical role of land-based carbon sinks. However, it also caps the contribution of net removals at 225 $MtCO_2eq$ for 2030, highlighting the need for strategic enhancement of the EU's land sink through restoration, protection, and better management of forest ecosystems.

Three key objectives have been identified under this function:

1. **Restoration of degraded carbon-rich ecosystems**: This objective aims to restore degraded forest ecosystems, particularly those with high carbon stocks, so they can recover their natural carbon sink function and resilience. This objective is heavily promoted under both the Forest Strategy for 2030 and the Biodiversity Strategy, where restoration is framed as both a biodiversity and climate imperative. Restoration measures can include (but are not limited to) enrichment planting, post-fire or post-disturbance recovery actions, and assisted regeneration.
2. **Protection of primary and old-growth forests**: This objective aims to protect intact, mature forests with large, irreplaceable carbon stocks, preventing them from being degraded, fragmented or converted. The objective aims to avoid the release of massive amounts of carbon stored and ensure continued, albeit slower, natural carbon sequestration. This objective is underscored in all major strategies as a "no regrets" measure for carbon and biodiversity. The Biodiversity Strategy commits to strictly protecting all such forests, while the Forest Strategy includes specific actions for mapping and protecting them.
3. **Incentivising sustainable forest management (SFM) to increase removals**: This objective aims to promote management practices in working forests that enhance

sequestration, maintain or increase forest carbon stocks, protect carbon stocks in soils, and ensure the sustainable supply of wood and non-wood products. The objective is closely featured throughout the Forest Strategy.

Note that afforestation and reforestation were identified by interviewees and in the strategy documents as falling under climate mitigation objectives as well. However, to avoid duplication, this objective was categorised once (as opposed to multiple times) under "enhancing forest sustainability and health."

Climate adaptation

Adaptation to climate change has gained strategic prominence, particularly under the EU Adaptation Strategy (2021), which seeks to make the EU climate-resilient by mid-century. Forests are portrayed as both vulnerable to climate risks (e.g., fires, pests, drought) and as nature-based solutions that reduce such risks.

The adaptation function includes two objectives:

1. **Promoting nature-based solutions to reduce climate risks**: This objective focuses on using forests and forest-related ecosystems as natural buffers to help reduce the impacts of climate change on people, infrastructure, and landscapes. The objective is a central pillar of the Adaptation Strategy. Forest restoration, afforestation on marginal lands, and biodiversity-friendly management are framed as cost-effective, no-regrets solutions that deliver co-benefits for water retention, erosion control, and microclimate regulation. Examples of measures could include restoring floodplain forests to reduce downstream flood risks or conserving riparian forests to stabilise riverbanks and protect water quality.
2. **Promoting Sustainable Forest Management (SFM) for resilience**: This objective aims to make forests more resilient to climate change, so they can continue to deliver ecosystem services, support rural livelihoods, and maintain their carbon sink function in a more volatile climate. The objective is consistent with the Forest Strategy's call for more climate-resilient silvicultural systems (e.g., continuous-cover forestry), as well as improved forest reproductive material tailored to future climate conditions. Measures can include implementing fire-smart management or favouring drought-tolerant species.

These objectives reinforce the need for transformative forest management practices, integrating ecological principles, risk reduction, and local adaptability.

Protecting and enhancing forest biodiversity

The EU Biodiversity Strategy for 2030 forms the backbone of the EU's nature agenda and strongly influences forest-related goals. Forest biodiversity is seen as foundational to climate resilience, ecosystem health, and the provision of ecosystem services.

The objectives under this function include:

1. **Increasing the favourable conservation status of species and habitats**: This objective focuses on improving the condition of forest species and habitats so that they are no longer

declining or under threat but are stable or recovering. Moving species and habitats towards favourable conservation states means they have sufficient population size, adequate habitat quality and extent, and good prospects for long-term survival. The objective is tied directly to the Action Plan for Nature, People and the Economy. The Biodiversity Strategy includes a target that at least 30% of unfavourable species/habitats must show improvement by 2030.

2. **Restoring degraded ecosystems**: This objective aims to bring back ecological integrity and functioning of forest ecosystems that have been damaged or degraded by human activities (e.g., intensive logging, drainage, pollution, fragmentation) or natural disturbances worsened by human pressures. Restoration can range from passive approaches (allowing natural regeneration) to active interventions (e.g. removing invasive species, reintroducing native trees).
3. **Strengthening protection of forest areas**: This objective focuses on increasing the area, quality, and effectiveness of protected forest areas with high biodiversity value. This includes expanding formal protections, improving the management of existing protected areas, and ensuring connectivity between protected and semi-natural areas. tied to the Biodiversity Strategy's 30% protection and 10% strict protection targets, with forests identified as priority ecosystems.

Enhancing the sustainability and health of forests

Ensuring the ecological health and long-term sustainability of forests is increasingly recognised as a foundational requirement for meeting the EU's wider objectives on climate neutrality, biodiversity conservation, and rural development. Forest health encompasses a forest's structural integrity, resistance to disturbance, species composition, and capacity to regenerate — all of which determine its resilience to climate change and ability to provide ecosystem services. The EU has explicitly linked healthy, multifunctional forests to its Green Deal goals, highlighting that degradation, pests, fires, and unsustainable management not only jeopardise biodiversity and carbon sinks but also undermine the socio-economic contributions of forests. Consequently, forest health is not viewed in isolation but embedded in a broader vision of sustainability, productivity, and resilience, which underpins both the EU Forest Strategy for 2030 and the Biodiversity Strategy for 2030.

Three key objectives are framed under this function:

1. **Improving monitoring, reporting, and verification (MRV) of forest conditions**: This objective aims to strengthen the systems used to assess and track forest conditions over time, including forest area, health, carbon stocks, biodiversity, ecosystem services, and disturbances. A recurring priority across EU strategies, particularly the Forest Strategy and Biodiversity Strategy, the objective aims to ensure that data on forests is regularly collected, scientifically robust, transparently reported, and independently verified. This MRV ambition reflects a recognition that poor forest health monitoring impairs both policy enforcement and adaptation planning.
2. **Increasing the quality of forests through sustainable forest management (SFM)**: This objective focuses on improving the ecological, social, and economic quality of existing forests through SFM practices. This means managing forests not just for timber yield, but

for multiple functions while ensuring long-term forest health, including biodiversity conservation, carbon storage, water regulation, recreation, and cultural values. Measures can include promoting mixed species and uneven-aged forests, retaining deadwood and habitat features, reducing soil damage and nutrient loss, or implementing fire risk management. The Forest Strategy promotes "closer-to-nature" forestry as a means of maintaining ecological integrity and forest functions over time.

3. **Increasing the quality and quantity of forests through afforestation and reforestation**: This objective aims to expand forest cover (quantity) and improve the design and ecological value (quality) of forest areas, through both afforestation (planting on non-forested land) and reforestation (restoring deforested or degraded land). The objective is supported by the Forest Strategy for 2030, which integrates principles of biodiversity-friendly and climate-resilient planting. The Strategy emphasises the use of native species in afforestation efforts, restoration of degraded lands, and long-term growth and maintenance, thus directly contributing to improved forest health and resilience.

These objectives reflect a strategic evolution in EU forest policy, moving beyond timber yield and carbon metrics toward an integrated approach where forest health is both an outcome and enabler of sustainable land use.

Sustainable and competitive bioeconomy

The Bioeconomy Strategy, Circular Economy Action Plan, and Forest Strategy collectively frame forests as a cornerstone of the transition to a sustainable, circular, and low-carbon economy. However, they also acknowledge the importance of ecological boundaries, resource efficiency, and maintaining forest carbon sinks.

Objectives under this function include:

1. **Strengthening and scaling up the bio-based sectors**: This objective focuses on increasing the role of forests in supplying raw materials for the bioeconomy, particularly in construction, chemicals, textiles, and furniture. The objective aims to develop competitive, sustainable forest value chains that create jobs, add value locally, and reduce fossil resource dependence. The EU Forest Strategy strongly promotes the substitution of carbon-intensive materials with long-lived wood products, especially in the built environment. A central goal is to transform the construction sector into a carbon sink.
2. **Unlocking investments and markets**: This objective aims to facilitate public and private investment in sustainable forest-based value chains and open up new markets for innovative wood-based goods and services. Stimulating investment in the forest-based bioeconomy is essential for scaling up sustainable business models. The EU's Circular Bioeconomy Thematic Investment Platform aims to de-risk private investment and mobilise public finance toward sustainable forest-based value chains. The Forest Strategy also encourages new income streams for forest owners
3. **Understanding ecological boundaries**: This objective aims to ensure that forest biomass extraction respects ecological limits to maintain forest health, biodiversity, carbon stocks and ecosystem services. This means understanding how much and what type of forest harvest is sustainable, under current and future climate and ecological conditions. A key

novelty of the updated Bioeconomy Strategy (2025), the Commission has pledged to improve sustainability monitoring and biomass assessments. The Bioeconomy Strategy explicitly calls for improved data on the sustainable supply of biomass, the resilience of ecosystems under changing climate conditions, and the cumulative environmental impacts of land-use change and resource extraction. The Strategy calls for the development of monitoring systems and ecological thresholds to ensure that bio-based expansion respects planetary boundaries.

4. **Ensuring sustainable use of wood-based resources**: This objective aims to promote responsible and efficient use of wood, following the cascading principle by prioritising long-lived, high-value products over short-lived or low-value uses (such as energy), while maintaining sustainable harvest levels and forest regeneration. The Forest Strategy reiterates the need to minimise the use of quality roundwood for energy, discourage whole-tree harvesting for bioenergy, and phase out harmful subsidies.
5. **Boosting circularity of bio-based products**: This objective aims to enhance the reuse, recycling, and upcycling of wood-based materials to reduce pressure on forest resources, improve material efficiency, and minimise waste. The New Circular Economy Action Plan links wood product design with climate mitigation, encouraging durability, recyclability, and reuse to maximise carbon storage and reduce resource input needs. Promoting eco-design, digital product passports, and end-of-life reuse infrastructure for wood-based materials are all core actions.

An overview of forest-relevant policy instruments included in the coherence assessment is provided below. A more detailed synopsis of these instruments is provided in Appendix I.

2.3.2. EU Forest-Relevant Instruments Included in the Horizontal Coherence Assessment

In line with the policy mix framework, where instruments represent the operational tools used to achieve strategic objectives, the selected instruments reflect key EU-level interventions with direct relevance to forest-related climate, biodiversity, sustainability, and bioeconomy goals (summarized in *Table 2*). This targeted selection ensures that the coherence analysis focuses on the most influential and relevant components of the forest policy mix.

While the assessment aims to provide a comprehensive overview of policy coherence, a number of instruments were excluded based on their limited relevance or practical constraints in engaging stakeholders. Measures under National Energy and Climate Plans (NECPs) and Common Agricultural Policy (CAP) Strategic Plans were not included due to the volume and diversity of measures across countries, which would have made it impractical for stakeholders to assess them within the scope of the coherence matrix. Including these would have significantly increased the complexity and burden of the exercise, potentially reducing the consistency and reliability of stakeholder inputs.

Additionally, some cross-cutting or enabling EU-level instruments were excluded where their contributions were already represented indirectly through other included instruments. For instance, both the Corporate Sustainability Reporting Directive (CSRD) and the Corporate Sustainability Due Diligence Directive (CSDDD) were omitted, as their influence on forest-related policy outcomes is largely captured through their integration into the EU Sustainable Taxonomy, which was included in the assessment.

Certain environmental directives — including the Water Framework Directive, Groundwater Directive, Floods Directive, and the Environmental Quality Standards Directive — were excluded due to their relatively indirect relevance to forest-specific objectives. While these instruments play important roles in ecosystem protection and water management, Task 8.1 experts agreed that their specific implications for forest governance and land-based climate or biodiversity targets were limited compared to more directly targeted instruments.

Finally, the Ecodesign for Sustainable Products Regulation was excluded due to low direct relevance to forest policy objectives, as it primarily focuses on product standards and consumer goods, with limited implications for forest management, land use, or ecosystem outcomes.

These exclusions reflect an effort to balance analytical completeness with practical feasibility and stakeholder engagement, ensuring that the coherence assessment remains focused, robust, and policy-relevant.

Table 2: List of EU-level policy instruments

Included	Excluded
LULUCF Regulation, Renewable Energy Directive (RED III), Nature Restoration Regulation, Carbon Removal and Certification Framework (CRCF), Forest Monitoring Framework, Sustainable Taxonomy, EU Deforestation Regulation (EUDR), Birds and Habitats Directives, Soil Monitoring Directive, Green Claims Directive, 3 Billion Trees Pledge, Guidelines for Defining, Mapping, Monitoring Old Growth Forests, Guidelines on Biodiversity-Friendly Afforestation and Reforestation, Guidelines on Closer-to-Nature Forest Management	Ecodesign for Sustainable Products Regulation, Water Framework Directive, Groundwater Directive, Floods Directive, Corporate Sustainability Reporting Directive, Corporate Sustainability Due Diligence Directive, Environmental Quality Standards Directive Member State measures under the Governance Regulation (National Energy and Climate Plan measures Member State measures under CAP Strategic Plans (CSPs)

A brief synopsis of the EU-level policies included in the horizontal coherence assessment is provided in Appendix I.

2.3.3. Member State-Relevant Instruments Included in the Vertical Coherence Assessment

To assess vertical coherence, which examines the alignment between EU forest-related objectives and national policy instruments, this analysis focuses on four Member States: Czechia, Ireland, Italy, and Sweden. These countries were selected as ForestNavigator case study countries due to their ability to represent diverse ecological, climatic, and socioeconomic conditions across the EU. Together, they reflect varying forest management systems, governance structures, and policy challenges, providing a meaningful basis to explore how EU objectives are interpreted and implemented at the national level.

Czechia

Table 3 below outlines the policy instruments included in the vertical coherence assessment for Czechia. The Hunting Act was excluded from the analysis due to its sector-specific focus on game management and hunting practices, and while relevant to land use, it generally falls outside the primary scope of forest policy and environmental governance. The Principles of the State Forest Policy were excluded largely because its provisions have largely been incorporated into more current legal frameworks and operational programs, and therefore, its inclusion would risk redundancy due to its large degree of overlap with other instruments.

Table 3: List of policy instruments – Czechia

Included	Excluded
Forest Act no 289/1995 Coll.; Czech National Council Act no.114/1992 on the Protection of Nature and the Landscape; Hunting Act; Government ordinance est. conditions for implementation of measures for the afforestation of agricultural land, National Action Plan for Climate Change Adaptation; Concept of the State Forest Policy until 2035; Strategy of the Ministry of Agriculture until 2030; National Biodiversity Strategy; Raw Material Policy for Wood; Implementation Plan of the Strategic Frame of the Czech Republic until 2030	Hunting Act, Principles of State Forest Policy

A brief synopsis of the Czech policies included in the vertical coherence assessment is provided in Appendix II.

Ireland

Table 4 below outlines the policy instruments included in the vertical coherence assessment for Ireland. Ireland's Forestry Programme was excluded for similar reasons as the EU Member State CAP Strategic Plan measures: the Programme primarily consists of a broad set of funding measures and operational schemes whose assessment would be overly onerous and detailed for the scope of this analysis. Evaluating each individual measure (e.g., various afforestation or biodiversity schemes) would require a programme-level review of implementation mechanisms, administrative conditions, and funding eligibility, which falls outside the analytical focus on overarching legal and policy frameworks. The Code of Best Forest Practice was excluded as its operational recommendations are already supported or mandated by existing forestry and environmental law (e.g. Forest Regulations 2017) and including it would risk redundancy in the analysis.

Table 4: List of policy instruments – Ireland

Included	Excluded
Requirements for Afforestation, Land types for Afforestation (Soil & Fertility); Forestry Act 2014; Forestry Regulations 2017; Climate Action Plan 2024; Forest Strategy 2023-2030; Forest Strategy Implementation Plan; National Adaptation Framework: Planning for a Climate Resilient Ireland; Bioeconomy Action Plan 2023-2025; Forest Biodiversity Guidelines; Forest Harvesting and Environmental Guidelines; Forest Regulations 2017;	Forestry Programme 2023-2027; Code of Best Forest Practice

A brief synopsis of the Irish policies included in the vertical coherence assessment is provided in Appendix II.

Italy

Table 5 below outlines the policies included in the vertical coherence assessment for Italy. None of the proposed policies was excluded from the assessment.

Table 5: List of policy instruments – Italy

Included	Excluded
Consolidated Law on Forests and Forestry Supply Chains; Law 394/1991 on Protected Areas; Definition of general criteria for the preparation of territorial plans and forest management plans; National Network of Old-Growth Forests; Guidelines for the identification of old-growth forests; National Forest Strategy; Updated Bioeconomy Strategy and Action Plan; Biodiversity Strategy; National Plan for Adaptation to Climate Change; Bioeconomy Action Plan	n/a

A brief synopsis of the Italian policies included in the vertical coherence assessment is provided in Appendix II.

Sweden

Table 6 below outlines the policies included in the vertical coherence assessment for Sweden. None of the proposed Swedish policy instruments was excluded from the coherence assessment.

Table 6: List of policy instruments – Sweden

Included	Excluded
Forestry Act; Environmental Code; National Forest Programme and Action Plan; National Strategy for Biodiversity and Ecosystem Services; Environmental Quality Objectives	n/a

A brief synopsis of the Swedish policies included in the vertical coherence assessment is provided in Appendix II.

2.4. Results of Coherence Assessment

2.4.1. Horizontal coherence: EU objectives and policy instruments

This section presents the summary results of the EU horizontal coherence assessment, conducted as part of the multi-functional forest policy evaluation. The assessment was carried out through a participatory process involving members of the ForestNavigator stakeholder board with expertise in EU forest, climate, biodiversity, and bioeconomy policy. Stakeholders were provided with an assessment matrix covering 16 forest-related EU policy objectives clustered under five functional areas: climate mitigation, climate adaptation, biodiversity, forest sustainability and health, and the bioeconomy.

Stakeholders were asked to evaluate the degree of synergy or conflict between 19 EU policy instruments and each objective, using a 7-point Likert scale ranging from –3 (strong conflict) to +3 (strong synergy), with 0 indicating a neutral relationship. The scoring reflects stakeholders' expert judgments of whether and how policy instruments contribute to or hinder the achievement of specific forest objectives, based on their design, implementation potential, and interactions with other instruments.

This summary synthesises the combined assessment results, focusing on where stakeholders perceived the strongest synergies, weak or no synergies, or potential conflicts between EU instruments and forest policy objectives. It draws on both the quantitative scores and the qualitative insights drafted on the potential synergies and trade-offs identified for each instrument. The results from the horizontal coherence assessment are provided in *Figure 1* below.

	Contribution of forests to climate mitigation			Climate adaptation of forests		Protect and enhance biodiversity of forests			Enhance sustainability of forests			Ensure sustainable and competitive bioeconomy for forestry sector				
	Restoration of degraded carbon rich ecosystems	Protect primary and old growth forests	Incentivise forest management practices to increase removals	Promote sustainable forest management to reduce climate risks	Promote deployment of nature-based solutions to reduce climate ris	Increase favourable conservation status	Restore degraded ecosystems	Strengthen the protection of forested areas	Improve the MRV of the current state of EU forests	Increase quality of forests through sustainable forest management	Increase quality of forests through re-afforestation	Boost the role of circularity for bio-based products	Ensure sustainable use of wood-based resources from bioenergy	Understand ecological boundaries of the bioeconomy	Unlock bioeconomy investments and markets	Strengthen and scale up bio-based sectors
LULUCF Regulation	17	10	7	11	10	6	8	10	18	5	13	4	7	8	2	6
Renewable Energy Directive	-6	-2	6	-3	-4	-2	-6	-4	5	7	3	5	11	-2	7	6
Nature Restoration Law	21	15	2	12	16	20	22	21	14	10	12	-2	-3	6	-2	-1
Carbon Removal Certification Framework	9	4	9	7	8	3	6	7	13	9	10	9	5	5	11	12
Forest Monitoring Framework	1	9	2	4	1	5	3	8	23	5	4	-1	1	7	1	-1
Deforestation Regulation	6	13	4	9	7	5	3	10	9	7	3	7	9	11	8	7
Habitats Directive	13	15	1	9	9	18	15	18	9	10	5	-3	-5	2	-4	-2
Birds Directive	11	11	-1	7	9	15	12	16	7	7	4	-2	-4	2	-5	0
Soil Monitoring Directive	5	4	3	6	7	8	8	7	13	9	3	1	-2	4	-3	-1
Green Claims Directive	2	2	1	3	3	1	1	2	3	2	2	4	2	4	3	4
Sustainable Taxonomy	1	0	2	2	3	1	4	1	4	3	6	8	2	3	4	9
3 Billion Trees Package	14	2	10	10	12	8	12	5	1	7	13	2	5	2	4	4
Guidelines…Old Growth Forests	12	17	6	4	9	13	7	10	10	7	4	-2	-1	4	0	-1
Guidelines…Biodiversity-Friendly Afforestation	9	4	2	8	6	5	7	5	2	8	12	1	2	2	4	4
Guidelines…Closer-to-Nature Forestry	11	12	10	13	12	12	12	8	6	12	8	1	2	4	2	2

Figure 1: Results of Coherence Assessment for the EU Forest Policy Framework

Climate mitigation

Stakeholders perceived strong synergies between several EU policy instruments and the climate mitigation objectives defined for multi-functional forests. The three core objectives under this cluster, including restoring degraded carbon-rich ecosystems, protecting primary and old-growth forests, and incentivising SFM to increase removals, were consistently recognised as central pillars of the EU's forest-related climate ambition.

The Nature Restoration Regulation (NRR) was viewed as the most strongly aligned instrument under this cluster, with total scores of +21 for restoration of degraded carbon-rich ecosystems, +15 for protection of primary and old-growth forests, and +2 for incentivising SFM to increase removals. Stakeholders highlighted that the NRR's legally binding restoration targets, focus on ecosystem condition, and emphasis on structural and species diversity were key to delivering long-term carbon sequestration. The NRR was also seen as essential to safeguarding irreplaceable carbon stocks in old-growth forests and ensuring climate mitigation co-benefits alongside biodiversity outcomes.

The LULUCF Regulation also scored highly, with +17 for ecosystem restoration, +10 for old-growth forest protection, and +7 for SFM to increase removals. Stakeholders emphasised the Regulation's role in accounting for land-based carbon sinks, including forests, soils, deadwood, and harvested wood products, and recognised it as a foundational instrument for meeting the EU's net-zero target under the Climate Law. Importantly, stakeholders noted that while LULUCF offers strong mitigation potential, its implementation poses risks of trade-offs, as some carbon-focused measures (e.g., fast-growing plantations, carbon-maximised management) may undercut biodiversity or resilience goals if not carefully designed.

The Carbon Removal and Carbon Farming Certification Framework (CRCF) was seen as offering promising synergies (+9, +4, +9 across the three objectives), particularly by mobilising private investment into forest-based removals, incentivising climate-smart management, and embedding permanence, monitoring, and liability safeguards. However, concerns were raised that certification could prioritise easily measured carbon removals over more ecologically complex restoration or inadvertently incentivise monocultures and short-rotation plantations if sustainability safeguards are weak.

The 3 Billion Trees (3BT) pledge and associated biodiversity-friendly afforestation and reforestation guidelines also received positive scores, with stakeholders highlighting their potential to expand forest area (+10 for removals) and improve degraded carbon sinks (+14). However, the scores reflected that success depends heavily on implementation quality, with risks around species selection, site placement, and long-term maintenance if incentives prioritise planting quantity over ecological value.

By contrast, the RED III was seen as a source of tension for mitigation objectives, with negative or neutral scores (-6 for restoration, -2 for old-growth protection, +6 for SFM to increase removals). Stakeholders expressed concerns that rising bioenergy demand under RED III could increase harvest pressures, reduce standing carbon stocks, and undermine long-term sink capacity, especially where safeguards are poorly implemented. While RED III includes sustainability criteria and the cascading use principle, several stakeholders flagged the risk that national energy targets and market signals could override ecological limits.

The Habitats and Birds Directives were perceived as moderately supportive of climate mitigation, especially for old-growth forest protection (+15 and +11) and degraded ecosystem restoration (+15 and +12), even though their primary legal purpose is biodiversity conservation. Their role in maintaining large, intact, carbon-rich ecosystems was consistently flagged as a critical, indirect contribution to the EU's climate goals.

Finally, the Forest Monitoring Framework (FMF) and Soil Monitoring Directive (SMD) were seen as supportive but indirect contributors, offering essential data infrastructure for tracking carbon stocks, disturbances, and mitigation progress (+1 to +5 across objectives). While not delivering mitigation outcomes directly, they were recognised as important enablers for the climate policy architecture.

In summary, stakeholders saw the strongest synergies with mitigation objectives arising from instruments focused on ecosystem restoration, protection, and carbon accounting (NRR, LULUCF, CRCF), with mixed or conflicted effects in energy policy (RED III) and supportive but indirect contributions from monitoring and biodiversity legislation. Across the board, they underscored the importance of balancing carbon-focused measures with ecological integrity to avoid undermining long-term mitigation potential.

Climate adaptation

Stakeholders identified meaningful but variable synergies between EU policy instruments and the two climate adaptation objectives for forests: (1) promoting nature-based solutions (NBS) to reduce climate risks and (2) promoting SFM for resilience.

The Nature Restoration Regulation (NRR) was again highlighted as one of the strongest instruments supporting adaptation, with high scores (+16 for NBS, +12 for SFM resilience). Stakeholders emphasised that the NRR's focus on restoring ecosystem condition, structural complexity, and native species diversity enhances the ability of forest ecosystems to buffer climate risks such as floods, droughts, fires, and pests. In particular, the restoration of riparian forests, wetlands, and degraded uplands was seen as critical for reducing downstream impacts on human settlements, agriculture, and infrastructure. The regulation's attention to ecological connectivity was also flagged as vital for enabling species movement and genetic exchange under changing climate conditions.

The LULUCF Regulation scored moderately well (+10 NBS, +11 SFM resilience), reflecting its potential to incentivise management practices that build resilience, including closer-to-nature forestry and ecosystem restoration. However, stakeholders again noted that without explicit adaptation safeguards, there is a risk that carbon-maximising strategies may ignore or even compromise resilience, for example by favouring monocultures or short-rotation species vulnerable to climate shocks.

The Carbon Removal and Carbon Farming Certification Framework (CRCF) was perceived as offering moderate synergies (+8 NBS, +7 SFM resilience), largely through its emphasis on permanence, liability, and monitoring of land-based removals. Stakeholders appreciated that the CRCF's design could reward management approaches that improve long-term resilience, but they cautioned that the voluntary and market-driven nature of the scheme may lead to uneven adaptation outcomes, depending on the strength of certification methodologies.

The 3BT pledge and biodiversity-friendly afforestation/reforestation guidelines were seen as strongly aligned with adaptation goals (+12 NBS, +8 SFM resilience), particularly where plantings are designed to provide erosion control, water regulation, microclimate moderation, and ecosystem connectivity. Stakeholders noted, however, that the ecological quality and site appropriateness of plantings are critical, as poorly designed afforestation (e.g., non-native species in drylands) can exacerbate rather than reduce climate risks.

The Guidelines on Closer-to-Nature Forest Management were rated as highly supportive (+12 NBS, +13 SFM resilience), as they promote low-impact, biodiversity-enhancing practices that simultaneously improve forest resilience, structural diversity, and adaptive capacity. Stakeholders saw these guidelines as particularly promising for mainstreaming climate-smart practices in working forests.

The Habitats and Birds Directives were seen as moderately supportive for adaptation (+9 NBS and SFM resilience), primarily through their contribution to ecological integrity, connectivity, and the maintenance of resilient natural systems. While not designed as climate adaptation tools, their role in protecting intact ecosystems and habitat networks was viewed as essential for long-term adaptation outcomes.

The FMF and SMD were viewed as indirect but important enablers of adaptation (+1 to +7 across the two objectives). Stakeholders recognised that robust data on forest health, soil condition, and ecosystem stressors is foundational for planning adaptive management and responding to emerging risks, even if these instruments do not deliver on-the-ground interventions themselves.

By contrast, the RED III received negative or neutral scores (-4 NBS, -3 SFM resilience). Stakeholders expressed concern that increased bioenergy demand may lead to more intensive harvesting practices, reducing forest structural diversity and making ecosystems more vulnerable to climate hazards. While RED III includes sustainability criteria, the perceived lack of direct adaptation incentives and the risk of indirect pressures led to generally negative assessments.

In summary, stakeholders identified the strongest adaptation synergies in instruments focused on ecosystem restoration (NRR), biodiversity-friendly management (Closer-to-Nature Guidelines), and resilience-oriented afforestation (3BT pledge), with supportive roles for monitoring frameworks and biodiversity directives. Concerns were raised where climate adaptation was seen as a secondary or under-addressed aspect, particularly in carbon markets (CRCF) and energy policy (RED III).

Protection and enhancement of biodiversity

Stakeholders consistently identified strong synergies between several EU policy instruments and the biodiversity-related objectives: (1) increasing the favourable conservation status of species and habitats, (2) restoring degraded ecosystems, and (3) strengthening the protection of forested areas.

The Nature Restoration Regulation (NRR) was seen as the standout instrument, receiving among the highest scores across all biodiversity objectives (+20 conservation status, +22 restoration, +21 protection). Stakeholders highlighted its legally binding restoration targets, its focus on structural and functional ecosystem recovery, and its prioritisation of areas with high biodiversity value (e.g., Natura 2000 sites, old-growth forests). The regulation was viewed as pivotal for reversing ecosystem degradation, improving habitat quality, and reconnecting fragmented landscapes.

The Habitats Directive and Birds Directive were also rated as critical biodiversity instruments, with particularly high scores for improving conservation status (+18 and +15, respectively), restoring degraded ecosystems (+15 and +12), and strengthening forest protection (+18 and +16). Stakeholders emphasised that these directives provide the legal backbone for species and habitat conservation, with strict protection requirements, ecological connectivity provisions, and assessment obligations (e.g., under Article 6 of the Habitats Directive) that safeguard biodiversity across landscapes.

The Guidelines for defining, mapping, and monitoring old-growth forests were seen as a major contributor (+13 conservation status, +7 restoration, +10 protection), particularly because they help Member States identify irreplaceable biodiversity hotspots and set the basis for strict conservation measures. Stakeholders praised the guidelines for promoting non-intervention management where appropriate, recognising the unique ecological functions of primary and old-growth forests.

The 3BT pledge and the Guidelines on biodiversity-friendly afforestation and reforestation were rated as moderately to strongly supportive (+8 to +12 across objectives), especially where they encourage native species use, habitat creation, ecological connectivity, and improved landscape-level biodiversity. Stakeholders highlighted that if designed and implemented with ecological sensitivity, these afforestation initiatives could contribute to biodiversity gains — but they also cautioned about the risk of poorly designed plantings that prioritise tree numbers over ecological quality.

The Closer-to-Nature Forest Management Guidelines were also seen as strong biodiversity enablers (+12 conservation status, +12 restoration, +8 protection), thanks to their emphasis on structural diversity, native species, deadwood retention, and habitat continuity. Stakeholders noted their potential to enhance biodiversity in managed forests, complementing strict protection measures in natural areas.

The LULUCF Regulation and CRCF scored positively but more moderately (+6–7 conservation status, +6–8 restoration, +7–10 protection), largely through their indirect contributions. While these instruments prioritise carbon outcomes, stakeholders recognised that when aligned with biodiversity safeguards, they can support ecosystem integrity — but there was concern that carbon-focused incentives could sometimes conflict with ecological complexity if not properly regulated.

The FMF and SMD were seen as important enablers (+5–8 across objectives), helping to provide the data and indicators needed to track biodiversity outcomes, identify pressures, and improve the targeting of conservation and restoration actions.

By contrast, the RED III scored negatively (-2 conservation status, -6 restoration, -4 protection). Stakeholders were concerned that rising demand for forest biomass under RED III could put additional pressure on semi-natural forests and sensitive habitats, undermining conservation and restoration gains elsewhere. Despite the inclusion of sustainability criteria, many participants felt that RED III lacks sufficient safeguards to ensure alignment with biodiversity targets.

Overall, stakeholders consistently saw biodiversity legislation (Habitats, Birds, NRR) as foundational to delivering biodiversity outcomes, with complementary roles played by forestry guidelines, afforestation initiatives, and enabling frameworks. Concerns centred primarily on bioenergy policy (RED III) and carbon markets (CRCF), where biodiversity was perceived as under-integrated or potentially at risk from narrowly framed objectives.

Enhancing the Sustainability and Health of Forests

Stakeholders saw strong potential across many EU instruments to improve the sustainability and ecological health of forests, which they recognised as essential for delivering on climate, biodiversity, and rural development goals. This cluster focused on three objectives: (1) improving monitoring, reporting, and verification (MRV) of forest conditions, (2) increasing the quality of forests through SFM, and (3) increasing the quality and quantity of forests through afforestation and reforestation.

The FMF received the highest score for the MRV objective (+23), reflecting its perceived centrality in improving EU-wide forest data systems, harmonising indicators, and enabling more evidence-based policymaking. Stakeholders highlighted that robust MRV is fundamental not only for tracking forest area and condition but also for verifying climate, biodiversity, and socio-economic outcomes. The SMD and the LULUCF Regulation also scored highly on MRV (+13 and +18, respectively), with stakeholders noting their contributions to soil carbon monitoring, ecosystem accounting, and land-use data integration.

For improving forest quality through SFM, stakeholders gave high marks to the Closer-to-Nature Forest Management Guidelines (+12) and the National Forest Programme (NFP) (+2, in the Member State context), recognising their emphasis on ecological integrity, mixed-species stands, structural complexity, and long-term sustainability. The CRCF and LULUCF Regulation were also seen as relevant (+9 and +5), particularly where they incentivise management practices that enhance carbon storage, reduce vulnerability to disturbance, and maintain multiple ecosystem services. Stakeholders praised the Closer-to-Nature guidelines for offering practical frameworks to translate EU ambitions on biodiversity and climate resilience into on-the-ground management.

When it came to increasing the quantity and ecological quality of forests through afforestation and reforestation, the 3BT pledge emerged as a leading instrument (+13), alongside the Guidelines on biodiversity-friendly afforestation and reforestation (+12). Both were seen as providing essential direction on how to expand forest area while maximising ecological and climate benefits, such as using native species, restoring degraded lands, and avoiding ecologically inappropriate plantings. The NRR (+12) and CRCF (+10) were also perceived as supporting this objective through their restoration and carbon farming components, although stakeholders emphasised the importance of balancing carbon goals with ecological quality.

Several enabling instruments, including the EU Taxonomy (+6), the Sustainable Taxonomy (+6), and the Green Claims Directive (+2), were seen as having a supporting role, particularly by setting sustainability criteria and strengthening market signals for sustainable and circular forest-based products.

However, concerns were raised around the RED III, which scored positively for SFM and afforestation (+7 and +3) but negatively or weakly on MRV (+5) and circularity. Stakeholders highlighted the risk that rising biomass demand could drive management practices focused narrowly on supply, without sufficient attention to ecological health, long-term sustainability, or regeneration capacity. Some also flagged that afforestation under RED III-related energy schemes (e.g., biomass plantations) could be ecologically poor if not guided by biodiversity and resilience principles.

In summary, stakeholders viewed the EU's growing emphasis on SFM, MRV, and biodiversity-friendly afforestation as a promising shift toward integrated forest stewardship. They stressed, however, that implementation quality, safeguards, and coherence between policy areas (especially between energy, bioeconomy, and biodiversity goals) would determine whether the EU's sustainability vision for forests is realised on the ground.

Sustainable and competitive bioeconomy

The sustainable and competitive bioeconomy cluster covers five objectives related to forests' role in the circular, low-carbon economy: (1) strengthening and scaling up bio-based sectors, (2) unlocking investments and markets, (3) understanding ecological boundaries, (4) ensuring the sustainable use of wood-based resources, and (5) boosting the circularity of bio-based products. Stakeholders' assessments showed a more mixed and cautious picture here, reflecting both the opportunities and tensions in expanding the forest-based bioeconomy while respecting ecological limits.

The Carbon Removal and Carbon Farming Certification Framework (CRCF) and the RED III emerged as key instruments for unlocking investments and markets (+11 and +7) and scaling up bio-based sectors (+12 and +6). Stakeholders saw the CRCF as an important tool to mobilise private finance into nature-based solutions, including sustainable forest management and afforestation, especially when paired with strong sustainability safeguards. RED III was recognised for boosting demand for bioenergy, but opinions diverged on whether this demand would translate into net sustainability benefits, given concerns over supply chain pressures and potential conflicts with biodiversity goals.

The Sustainable Taxonomy (+9) was seen as central to setting sustainability benchmarks and guiding investment into sustainable forest value chains. Stakeholders highlighted that the taxonomy provides essential market clarity on what qualifies as "sustainable," helping steer capital towards climate- and biodiversity-positive forest products, especially in the construction, textiles, and biochemicals sectors. Similarly, the Green Claims Directive (+4) was seen as supporting the integrity of bio-based markets by reducing greenwashing and ensuring that environmental claims on wood-based products are credible and verifiable.

However, a recurring concern across instruments was whether expansion of the bioeconomy would respect ecological boundaries. Stakeholders gave only moderate to weak scores for this objective, with most instruments falling in the +1 to +5 range, and some even receiving negative scores (e.g., RED III at -2, Habitats Directive at +2, Birds Directive at +2). The NRR (+6) and the Guidelines on Closer-to-Nature Forest Management (+4) were seen as offering partial safeguards, but stakeholders emphasised that understanding and operationalising ecological limits — including sustainable harvest levels, biodiversity thresholds, and landscape resilience — remains an area of weakness in EU bioeconomy governance.

For ensuring the sustainable use of wood-based resources, stakeholders acknowledged the role of the RED III (+11), CRCF (+5), and Sustainable Taxonomy (+2), especially where these instruments reinforce the cascading use principle or embed sustainability requirements into market access. However, concerns were again raised about the capacity of existing rules to prevent over-extraction, maintain carbon sinks, and avoid biodiversity loss. Some stakeholders flagged the need for more explicit safeguards to ensure that increased wood demand does not erode the multifunctional benefits of forests.

Finally, on boosting the circularity of bio-based products, scores were generally low across the board, with only the Sustainable Taxonomy (+8), Green Claims Directive (+4), and EU Taxonomy (+8) scoring moderately. Stakeholders noted that while EU policies increasingly promote eco-design, recyclability, and cascading use, these ambitions are still in early stages for wood-based products, and stronger regulatory and market incentives are needed to close material loops and reduce primary resource pressures.

In summary, stakeholders saw the EU forest-related bioeconomy agenda as an area of both significant opportunity and considerable tension. They highlighted the need for greater policy coherence, improved safeguards, and a stronger evidence base on ecological limits to ensure that bio-based sector expansion genuinely supports — rather than undermines — the climate, biodiversity, and resilience functions of Europe's forests.

Patterns of synergies and conflicts across objectives

The horizontal coherence assessment reveals a clear pattern of perceived synergies between EU policy instruments and several forest-related objectives, but also identifies areas of weak alignment or conflict. Stakeholders consistently saw the strongest synergies with objectives related to climate mitigation, biodiversity, and forest sustainability. In particular, objectives such as the restoration of degraded carbon-rich ecosystems, protection of primary and old-growth forests, and improvement of MRV (monitoring, reporting, verification) systems for EU forests scored among the highest across the instrument set, with combined scores of 127, 116, and 137, respectively (maximum possible score per objective: 192). Instruments like the Nature Restoration Regulation (NRR), LULUCF Regulation, Habitats Directive, Birds Directive, and the Closer-to-Nature Guidelines were seen as key contributors to these outcomes, particularly due to their legally binding restoration targets, strict protection provisions, and focus on ecosystem integrity.

Similarly, climate adaptation objectives, especially the promotion of nature-based solutions to reduce climate risks, attracted consistently positive scores, reflecting stakeholder recognition that restoration, improved management, and ecosystem-based approaches deliver co-benefits for both adaptation and mitigation. Biodiversity objectives also stood out, with strong synergies perceived for increasing the favourable conservation status of species and habitats (118) and restoring degraded ecosystems (114), underscoring the importance of instruments with direct conservation mandates.

In contrast, the assessment revealed more mixed and modest alignment on bioeconomy-related objectives. While some instruments, such as the RED III, and Sustainable Taxonomy, were seen as moderately supportive of unlocking investments and scaling up bio-based sectors, the combined scores for objectives like boosting circularity (32), ensuring sustainable use of wood-based resources (31), and unlocking bioeconomy investments (32) were among the lowest in the matrix. Several conservation-focused instruments (e.g., Birds and Habitats Directives, NRR) were even seen as carrying potential negative synergies with bioeconomy expansion, reflecting stakeholder concerns about limits on resource availability or flexibility.

Finally, afforestation and reforestation objectives showed moderate-to-high synergy scores, especially under the 3 Billion Trees pledge, Biodiversity-Friendly Afforestation Guidelines, and the Closer-to-Nature Guidelines, but received lower alignment under instruments focused on protection or monitoring, reflecting a nuanced understanding among stakeholders that afforestation carries both opportunities and risks depending on its design.

Tensions and trade-offs

The assessment also highlighted tensions or trade-offs between certain objectives, particularly between biodiversity conservation and bioeconomy expansion. Instruments like the NRR, Birds and Habitats Directives, and Guidelines on Old-Growth Forests received negative scores on some bioeconomy objectives, particularly where restoration targets, strict protections, or non-intervention management are seen as constraining productive use or reducing the area available for intensive biomass extraction. Similarly, the RED III Directive, while promoting renewable energy, received negative scores on biodiversity-related objectives, reflecting concerns about the impacts of biomass demand on forest ecosystems, habitat quality, and primary or old-growth forests.

Stakeholders also pointed to potential tensions between carbon-focused mitigation goals and broader ecological or social outcomes. For example, while the LULUCF Regulation and Carbon Removal Certification Framework (CRCF) were seen as highly synergistic with carbon removal objectives, several participants cautioned that carbon maximisation approaches could undermine biodiversity or resilience if pursued through simplified management (e.g., fast-growing monocultures, intensive plantations). Likewise, afforestation efforts were recognised as potentially beneficial or harmful depending on whether they integrate biodiversity and climate resilience principles.

Finally, tensions between flexibility and governance were evident in perceptions of voluntary versus binding instruments. Voluntary initiatives such as the 3BT pledge and biodiversity-friendly afforestation guidelines were praised for offering flexibility and local adaptation, but stakeholders warned that without robust governance and follow-up, these could result in poor outcomes, including inappropriate species selection, low survival rates, or unintended land use change.

2.4.2. Vertical coherence: EU objectives and Member State policy instruments

Czechia

	Contribution of forests to climate mitigation			Climate adaptation of forests		Protect and enhance biodiversity of forests			Enhance sustainability of forests			Ensure sustainable and competitive bioeconomy for forestry sector				
	Restoration of degraded carbon rich ecosystems	Protect primary and old growth forests	Incentivise forest management practices to increase removals	Promote sustainable forest management to reduce climate risks	Promote deployment of nature-based solutions to reduce climate ris	Increase favourable conservation status	Restore degraded ecosystems	Strengthen the protection of forested areas	Improve the MRV of the current state of EU forests	Increase quality of forests through sustainable forest management	Increase quality of forests through re-afforestation	Boost the role of circularity for bio-based products	Ensure sustainable use of wood-based resources for bioenergy	Understand ecological boundaries of the bioeconomy	Unlock bioeconomy investments and markets	Strengthen and scale up bio-based sectors
Forest Act no.289/1995 Coll.	0	0	+1	+1	0	+1	+1	+2	0	+2	0	0	0	0	0	+1
Czech National Council Act no.114 on the Protection of Nature and the Landscape	0	+2	0	0	0	+3	0	+2	+3	0	0	0	0	0	0	0
Concept of the State Forest Policy untill 2035	+1	+2	+1	+2	+1	+1	+1	+1	+1	+2	+2	+2	0	+1	+1	+1
National Action Plan for Climate Change Adaptation	+2	0	+1	+2	0	+1	+1	+1	0	+2	+1	+1	+2	0	0	+1
Strategy of the Ministry of Agriculture until 2030	+1	0	+1	+1	+1	+1	+2	+1	+1	+2	+1	+2	+1	+2	+2	+2
Implementation Plan of the Strategic Frame of the Czech Republic (2022-2025)	0	0	+1	+1	+1	+1	+1	+1	0	+1	+1	0	0	0	0	0
National Biodiversity Strategy 2016-2025	0	0	0	+1	+1	+1	+2	+1	+1	+1	-1	0	0	0	0	0
Raw Material Policy for Wood	0	0	+2	+2	+2	0	0	0	+2	+2	+2	+2	0	+2	+2	+2
Government ordinance establishing conditions for the implementation of measures for the afforestation of agricultural land	0	0	+1	+1	+1	0	+1	0	0	0	+1	+1	+2	0	0	0

Figure 2: Results of Coherence Assessment for Czechia (Source data: WP 8)

Climate mitigation

Czechia's forest-related policy instruments show modest coherence with EU climate mitigation objectives, particularly through strategic and sectoral policies rather than legal frameworks. The State Forest Policy Concept to 2035, the Ministry of Agriculture Strategy to 2030, and the National Action Plan for Climate Change Adaptation demonstrate some synergies with objectives such as restoring degraded carbon-rich ecosystems and incentivising forest management practices to increase removals. However, the overall strength of alignment remains moderate, with few strong synergies. For instance, the Forest Act does not directly target carbon restoration or afforestation, resulting in neutral scores. Likewise, most instruments score neutrally on the protection of primary and old-growth forests, with the exception of the Nature and Landscape Protection Act, which aligns strongly with this objective. Afforestation receives limited emphasis overall, with only the Raw Material Policy for Wood and the Ministry of Agriculture Strategy scoring positively. Across the board, the instruments tend to promote forest productivity and resilience more than they explicitly address carbon sequestration or removals.

Climate adaptation

Several Czech policy instruments show stronger coherence with adaptation objectives. The National Action Plan for Climate Change Adaptation and the State Forest Policy Concept in particular promote sustainable forest management to reduce climate risks, as well as the deployment of nature-based solutions. These instruments also aim to improve forest resilience in the face of climate-related threats, such as drought and pests. The Raw Material Policy for Wood and the Ministry of Agriculture Strategy similarly reflect positive alignment with adaptation goals, by encouraging SFM practices and diversified forest use. While the Forest Act and Nature Protection Act do not directly target adaptation, they provide a baseline framework that can support climate-resilient management in practice. Overall, the adaptation agenda is increasingly reflected in Czech forest and land-use strategies, though practical implementation of nature-based solutions remains limited in scope.

Protection and enhancement of biodiversity

Biodiversity objectives are addressed across multiple instruments, though with varying degrees of coherence. The Nature and Landscape Protection Act scores highly for increasing favourable conservation status, protecting primary and old-growth forests, and strengthening forest protections, and is the most biodiversity-focused instrument in the Czech framework. The Biodiversity Strategy 2016–2025 also shows moderate synergies, especially in restoring degraded ecosystems and supporting SFM. However, it scored negatively on afforestation, indicating potential tensions around tree planting in biodiversity-sensitive areas. The State Forest Policy Concept, Ministry of Agriculture Strategy, and the Climate Adaptation Plan each show moderate alignment with biodiversity objectives, particularly through restoration and integration of biodiversity principles into broader forest management. However, biodiversity goals are less embedded in production-focused instruments like the Raw Material Policy, which primarily addresses economic and structural aspects of forest use.

Sustainability and health of forests

Czechia's instruments show strong coherence with objectives related to forest sustainability and health. The State Forest Policy Concept, Ministry of Agriculture Strategy, and Raw Material Policy for Wood all support improvements to forest quality through SFM, and many include specific goals on ecosystem restoration and forest condition monitoring. While formal MRV systems remain underdeveloped, some instruments, such as the Nature and Landscape Protection Act and Raw Material Policy, contribute to improving monitoring and reporting frameworks. Afforestation and reforestation are supported in principle through several strategies and are specifically targeted by the Government Ordinance on afforestation of agricultural land, although this instrument is narrower in scope. Overall, sustainability and forest health appear as a cross-cutting theme in Czech forest governance, with consistent attention to resilience, regeneration, and ecosystem services.

Sustainable and competitive bioeconomy

Coherence with EU bioeconomy objectives is more variable. The Raw Material Policy for Wood and the Ministry of Agriculture Strategy show the strongest alignment, particularly in relation to circularity, unlocking investment, scaling bio-based sectors, and recognising ecological boundaries. These instruments promote a more integrated vision of the forest-based bioeconomy, balancing resource use with long-term sustainability. In contrast, several other instruments (e.g., the Forest Act, Biodiversity Strategy, and Nature Protection Act) are largely neutral in this area, reflecting limited focus on economic transformation or material innovation. While the State Forest Policy Concept supports circularity and investment in forest value chains, the implementation of bioeconomy strategies appears uneven and still in early stages. There is currently no dedicated instrument addressing the full range of bioeconomy objectives in forests.

Overall assessment

Czechia's forest policy framework demonstrates moderate to positive coherence with EU forest-related objectives. Strengths lie in the emphasis on sustainable forest management, forest health, and biodiversity protection, supported by cross-sectoral strategies such as the State Forest Policy Concept and Ministry of Agriculture Strategy. Climate adaptation is also increasingly addressed. However, coherence is weaker for afforestation, monitoring systems, and the bioeconomy in more traditional or legal instruments. Opportunities exist to better integrate climate mitigation, restoration, and MRV goals into production and conservation policies, and to strengthen cross-cutting implementation.

Ireland

	Contribution of forests to climate mitigation			Climate adaptation of forests		Protect and enhance biodiversity of forests			Enhance sustainability of forests			Ensure sustainable and competitive bioeconomy for forestry sector				
	Restoration of degraded carbon rich ecosystems	Protect primary and old growth forests	Incentivise forest management practices to increase removals	Promote sustainable forest management to reduce climate risks	Promote deployment of nature-based solutions to reduce climate ris	Increase favourable conservation status	Restore degraded ecosystems	Strengthen the protection of forested areas	Improve the MRV of the current state of EU forests	Increase quality of forests through sustainable forest management	Increase quality of forests through re-afforestation	Boost the role of circularity for bio-based products	Ensure sustainable use of wood-based resources for bioenergy	Understand ecological boundaries of the bioeconomy	Unlock bioeconomy investments and markets	Strengthen and scale up bio-based sectors
Forestry Act 2014	0	0	0	0	0	0	0	+2	0	0	0	0	0	0	0	0
Climate Action Plan 2024	+1	0	+3	+1	+1	0	+1	+2	+1	+2	+3	+1	+1	0	0	+1
Forest Strategy 2023-2030	0	+1	0	+1	+1	+1	+1	+1	0	+1	+1	+1	+1	0	+1	+1
Forest Strategy Implementation Plan	0	+1	0	+1	+1	+1	+1	+1	0	+1	+2	+2	+1	0	+1	+1
Forest Biodiversity Guidelines	+1	+1	0	+1	+1	+2	+1	0	0	0	0	0	0	0	0	-2
Forest Harvesting and Environmental Guidelines	0	0	-1	0	0	0	0	+1	0	0	0	0	0	0	0	-1
Forestry Regulations	+1	0	0	0	0	0	0	+1	0	0	+2	0	0	0	-1	-1
Environmental Requirements for Afforestation	+1	0	0	0	0	0	-1	0	0	0	+2	0	0	-1	-1	-2
Bioeconomy Action Plan 2023-2025	0	0	-1	0	0	0	0	0	+1	0	0	+2	+2	+1	+1	+1
Land types for Afforestation: Soil & Fertility	+2	0	0	0	0	0	-1	0	0	0	+2	0	0	0	0	0

Figure 3: Results of Coherence Assessment for Ireland (Source data: WP 8)

Ireland's forest policy framework demonstrates moderate but uneven coherence with EU forest-related objectives. Several recent strategies and plans, notably the Climate Action Plan 2024 and the Forest Strategy 2023–2030 and its Implementation Plan, show positive alignment with climate mitigation, adaptation, and sustainable forest management goals. However, more limited coherence appears in biodiversity protection and bioeconomy development, with some individual instruments even scoring negatively in these areas. While afforestation is a consistent priority, biodiversity and ecological boundary considerations are only partially integrated.

Climate Mitigation

The strongest synergies with climate mitigation objectives appear in the Climate Action Plan 2024, which received high scores for incentivising sustainable forest management practices to increase removals (+3) and promoting afforestation and reforestation (+3). The plan also provides moderate alignment with the restoration of degraded carbon-rich ecosystems and improving forest quality. The Forest Strategy and its Implementation Plan reinforce these objectives, though with slightly lower levels of ambition. In contrast, the Forestry Act 2014, which sets the legal framework for forest management and licensing, is largely neutral with respect to climate mitigation, and offers no explicit support for restoration or enhanced carbon removals.

Several instruments scored negatively on mitigation objectives, including the Bioeconomy Action Plan (−1) and the Forest Harvesting and Environmental Guidelines (−1), due to weak integration of carbon considerations or emphasis on biomass extraction without safeguards for carbon stocks. Nevertheless, Ireland's recent policy direction shows growing awareness of the forest-carbon nexus.

Climate Adaptation

Ireland's policies also show modest but emerging coherence with EU adaptation objectives. The Climate Action Plan, Forest Strategy, and Forest Biodiversity Guidelines promote sustainable forest management for resilience (+1) and nature-based solutions to reduce climate risks (+1), albeit at low to moderate levels. These instruments encourage adaptive practices such as species diversification, climate-resilient afforestation, and flood mitigation via forest cover.

The older Forestry Act does not reflect adaptation priorities, and the Bioeconomy Action Plan makes no reference to adaptation. However, instruments like the Land Types for Afforestation: Soil and Fertility guidance suggest growing attention to site-based resilience. Overall, while adaptation is not yet a central pillar across all forest-related instruments, its integration has improved in more recent strategies.

Protecting and Enhancing Biodiversity

Coherence with biodiversity objectives is variable and generally weaker than for climate or forest health. Only a few instruments demonstrate strong synergies with improving the favourable conservation status of species and habitats, restoring degraded ecosystems, or strengthening protection of forested areas. The Forest Biodiversity Guidelines received the highest scores in this category (+2 for favourable conservation status), while the Forest Strategy Implementation Plan also supports moderate biodiversity-related goals.

However, a number of instruments are neutral or even weakly misaligned with biodiversity enhancement. The Forestry Act, Forestry Regulations, and afforestation-related guidance lack a strong biodiversity orientation, while the Environmental Requirements for Afforestation and Land Types for Afforestation both received negative scores for restoration of degraded ecosystems (−1), indicating possible ecological risks or trade-offs. Concerns about planting on inappropriate sites or biodiversity-poor monocultures were reflected in these lower scores.

Enhancing the Sustainability and Health of Forests

Several Irish policies show meaningful alignment with the EU's sustainability and forest health objectives. The Climate Action Plan, Forest Strategy, and its Implementation Plan all received positive scores for increasing forest quality through sustainable forest management (+2) and promoting afforestation to enhance both forest area and quality. These instruments also include references to forest monitoring, fire prevention, and improved planting techniques.

However, most instruments scored neutral on monitoring, reporting, and verification (MRV) of forest conditions — suggesting that while MRV is acknowledged in strategy documents, it remains underdeveloped in operational policies. The Forestry Regulations and Forest Biodiversity Guidelines offer limited contributions to MRV, despite Ireland's growing reliance on afforestation as a policy lever. This gap points to a need for stronger evidence systems to track the ecological and climate impacts of forest expansion.

Sustainable and Competitive Bioeconomy

Ireland's forest policy framework demonstrates relatively weak coherence with bioeconomy objectives. Only the Bioeconomy Action Plan 2023–2025 received consistently positive scores across several objectives in this cluster, including promoting circularity (+2), sustainable use of wood for bioenergy (+2), and understanding ecological boundaries (+1). However, other instruments – such as the Environmental Requirements for Afforestation, Forestry Regulations, and Forest Harvesting Guidelines – received negative scores due to concerns over bioeconomy expansion without sufficient safeguards or ecological data.

Notably, both the Forest Biodiversity Guidelines and Environmental Requirements for Afforestation scored −2 for scaling up the bio-based sector, reflecting concerns that economic incentives may conflict with biodiversity or sustainability goals if not appropriately managed. Across the policy landscape, bioeconomy considerations remain inconsistently integrated, with a narrow focus on afforestation and timber use rather than a broad vision for sustainable value chains.

Overall assessment

Ireland's forest-related policy framework shows emerging but uneven coherence with EU forest objectives. Strongest synergies are evident in the Climate Action Plan and Forest Strategy, particularly around afforestation, climate mitigation, and sustainable forest management. However, biodiversity protection, MRV, and bioeconomy governance are less consistently integrated. Some afforestation instruments raise concerns about ecological trade-offs, and negative scores for bioeconomy expansion underscore the need for clearer sustainability safeguards. As Ireland ramps up its forestry ambitions, aligning environmental, climate, and economic priorities will be essential for delivering multifunctional forests.

Italy

	Contribution of forests to climate mitigation			Climate adaptation of forests		Protect and enhance biodiversity of forests			Enhance sustainability of forests			Ensure sustainable and competitive bioeconomy for forestry sector				
	Restoration of degraded carbon rich ecosystems	Protect primary and old growth forests	Incentivise forest management practices to increase removals	Promote sustainable forest management to reduce climate risks	Promote deployment of nature-based solutions to reduce climate ris	Increase favourable conservation status	Restore degraded ecosystems	Strengthen the protection of forested areas	Improve the MRV of the current state of EU forests	Increase quality of forests through sustainable forest management	Increase quality of forests through re-afforestation	Boost the role of circularity for bio-based products	Ensure sustainable use of wood-based resources for bioenergy	Understand ecological boundaries of the bioeconomy	Unlock bioeconomy investments and markets	Strengthen and scale up bio-based sectors
National Forest Strategy	+2	+2	+2	+2	+1	+2	+1	+2	+2	+2	+1	+2	+1	0	+1	+1
Consolidated law on forests and forestry supply chains	+2	+2	+2	+2	+1	+2	+2	+3	+2	+2	+1	+2	+1	+1	+1	+1
National network of old growth forests	0	+3	-1	+1	0	+3	+1	+3	+2	+2	0	0	0	0	0	0
Guidelines for the identification of old-growth forests	0	+3	-1	+1	0	+3	+1	+3	+2	+2	0	0	0	0	0	0
National Plan for Adaptation to Climate Change	+1	0	0	+1	+1	+1	+1	+1	0	+1	+2	+1	+1	+1	+1	+1
Definition of general criteria for the preparation of territorial plans and forest management plans	0	+2	+2	+3	+1	+1	+1	+2	+2	+2	+1	0	0	0	0	0
Updated Bioeconomy Strategy and Action Plan	0	0	+2	+2	+2	+1	0	+1	+1	+2	0	+2	+2	+2	+2	+2
Law 394/1991 on Protected Areas	+1	+3	-1	+2	0	+3	+1	+3	+1	+2	0	0	0	0	0	0
Biodiversity Strategy	+2	+3	-1	+2	+1	+3	+3	+3	+1	+2	+2	+2	0	0	0	0

Figure 4: Results of Coherence Assessment for Italy (Source data: WP 8)

Italy's forest-related policy framework demonstrates strong alignment with EU-level objectives across climate, biodiversity, forest health, and bioeconomy domains. Most assessed instruments show moderate to high coherence, with particularly strong synergies identified in national laws and strategies focused on forest protection, sustainable management, and biodiversity. Several policies are also notable for their integrated approach to adaptation and multifunctionality.

Climate Mitigation

Italy’s National Forest Strategy and the Consolidated Law on Forests and Forestry Supply Chains both provide robust support for climate mitigation, particularly through restoration of carbon-rich ecosystems, protection of primary and old-growth forests, and incentivising sustainable forest management to enhance removals. These instruments are notable for their explicit incorporation of climate-related goals, which are framed alongside biodiversity and ecosystem service concerns.

The Biodiversity Strategy and Law 394/1991 on Protected Areas also support mitigation indirectly through forest protection and restoration measures, with the Biodiversity Strategy especially reinforcing synergies with the EU's "no-regrets" approach to old-growth conservation. However, certain instruments like the National Network and Guidelines for Old-Growth Forests received slight negative scores on SFM to increase removals, reflecting a conservation-focused framing that deprioritises timber production.

Climate Adaptation

Adaptation objectives are strongly embedded across the forest governance framework. The National Forest Strategy, Consolidated Law, and Biodiversity Strategy all promote climate-resilient management practices and nature-based solutions. The National Plan for Adaptation to Climate Change provides a complementary, cross-sectoral framework that recognises forests as both vulnerable and vital for landscape-scale risk reduction.

The Definition of General Criteria for Forest Management Plans also scored highly, particularly in promoting SFM for resilience. These plans, intended to guide local and regional planning, emphasise adaptability and ecological function, highlighting Italy's decentralised but coordinated approach to adaptation.

Protection and Enhancement of Forest Biodiversity

Biodiversity objectives are particularly well supported across Italy's forest-related legislation. The National Biodiversity Strategy and Law 394/1991 on Protected Areas both score at the high end of the spectrum, especially on improving conservation status and enhancing protection of forest areas. Similarly, the Guidelines for Old-Growth Forests and the National Network of Old-Growth Forests reflect a strong commitment to identifying and conserving ecologically valuable forest ecosystems.

The Consolidated Law on Forests includes a dedicated section on biodiversity, and the National Forest Strategy echoes these priorities by integrating conservation goals into forest planning and monitoring. Most instruments in this cluster score highly, demonstrating a coherent, multi-instrument approach to halting biodiversity loss.

Sustainability and Health of Forests

Italy shows consistent attention to forest health and monitoring across its forest strategy and planning instruments. The Consolidated Law and the Forest Strategy score highly for objectives related to sustainable forest management and forest quality, as well as for improving monitoring and reporting systems. Forest Management Plans, which set operational standards at the regional and local levels, are a key mechanism to implement SFM and track forest condition, often through digital inventories and long-term ecological indicators.

The inclusion of ecological integrity as a criterion for afforestation (seen in several strategies and laws) helps bridge forest expansion with sustainability objectives. Restoration of degraded forests is also supported under both the Forest Strategy and the Biodiversity Strategy.

Sustainable and Competitive Bioeconomy

Bioeconomy objectives receive moderate support, with the strongest alignment visible in the Updated Bioeconomy Strategy and Action Plan, which explicitly promotes circularity, investment, ecological limits, and sectoral scaling. The National Forest Strategy and Consolidated Law also show positive alignment, supporting forest value chains, long-lived wood products, and sustainable biomass sourcing.

While most conservation- or restoration-focused instruments do not actively engage with bioeconomy scaling, they generally avoid direct conflicts. Exceptions include minor negative coherence scores for certain strictly conservation-focused instruments (such as old-growth forest guidelines), which received slight negative ratings regarding removals or sectoral expansion, reflecting their prioritisation of ecological over economic values.

Overall assessment

Italy's forest governance framework exhibits strong vertical coherence with EU strategic objectives across all five functional areas. The integration of biodiversity, climate adaptation, and sustainability goals is particularly robust, supported by both legal instruments (e.g., Consolidated Law, Protected Areas Law) and strategic frameworks (e.g., Forest and Biodiversity Strategies). The coherence of Italy's bioeconomy approach is comparatively moderate but improving, with the Updated Bioeconomy Strategy providing a clearer orientation toward sustainability and ecological safeguards. Some minor tensions appear between conservation-focused and production-oriented objectives, but they are contextually justified. Overall, Italy's forest-related policies reflect a well-aligned, multifunctional vision consistent with EU priorities.

Sweden

	Contribution of forests to climate mitigation			Climate adaptation of forests		Protect and enhance biodiversity of forests			Enhance sustainability of forests			Ensure sustainable and competitive bioeconomy for forestry sector				
	Restoration of degraded carbon rich ecosystems	Protect primary and old growth forests	Incentivise forest management practices to increase removals	Promote sustainable forest management to reduce climate risks	Promote deployment of nature-based solutions to reduce climate ris	Increase favourable conservation status	Restore degraded ecosystems	Strengthen the protection of forested areas	Improve the MRV of the current state of EU forests	Increase quality of forests through sustainable forest management	Increase quality of forests through re-afforestation	Boost the role of circularity for bio-based products	Ensure sustainable use of wood-based resources from bioenergy	Understand ecological boundaries of the bioeconomy	Unlock bioeconomy investments and markets	Strengthen and scale up bio-based sectors
Forestry Act	-1	-1	+1	0	0	-1	-2	-1	0	+1	0	0	+1	-1	0	0
National Forest Programme and Action Plan	0	+1	+2	+1	+1	+1	0	0	0	+2	0	+1	+1	+1	+2	+2
Environmental Code	+1	+2	-1	+1	+1	+2	+2	+2	0	+1	0	+1	+1	+1	0	0
National Strategy for Biodiversity and Ecosystem Services	+1	+1	0	+1	+1	+1	+1	0	0	+1	0	+1	+1	+1	+1	+1
Environmental Quality Objectives	+2	+2	0	+2	+2	+2	+2	0	0	+2	0	+1	+1	+1	+1	+1

Figure 5: Results of Coherence Assessment for Sweden (Source data: WP8)

Sweden's forest policy framework shows generally positive but uneven alignment with EU climate, biodiversity, adaptation, and bioeconomy objectives, with coherence shaped by a mix of legislative instruments, voluntary programmes, and strategic frameworks. While some instruments show moderate or strong synergies, others show weak or even negative alignment, especially regarding proactive restoration and biodiversity enhancement, as highlighted by the national expert review.

Climate mitigation

Sweden's coherence with EU climate mitigation objectives is mixed. The Forestry Act, Sweden's central legislative framework, provides some positive alignment with sustainable forest management (SFM) to increase removals and the sustainable use of wood, reflecting its focus on reforestation after harvest, production regulations, and forest regeneration. However, it scored negatively on the protection of primary and old-growth forests and on the restoration of degraded carbon-rich ecosystems, since its environmental goal focuses primarily on maintaining local conservation values rather than actively enhancing them. Notably, while the Act regulates clear-cutting and replanting, these activities are not considered afforestation under EU climate definitions, explaining the neutral coherence score there.

The National Forest Programme and Action Plan, particularly active between 2018 and 2022, provided stronger synergies, promoting climate mitigation through SFM, innovation, and voluntary conservation measures, although its impact has waned since funding and activities declined post-2022. The Environmental Code offers moderate synergies for climate mitigation by enabling protection, regulating harmful activities, and reinforcing the sustainable use of resources. The

National Strategy for Biodiversity and the Environmental Quality Objectives (EQOs) also contribute indirectly, especially through restoration and protection of carbon-rich ecosystems, though neither instrument mandates specific mitigation measures.

Climate adaptation

On adaptation, Sweden's framework shows moderately positive coherence. The Forestry Act does not explicitly address climate change adaptation, though it acknowledges climate as an environmental factor to consider in local forestry decisions. This resulted in neutral scores on both nature-based solutions and promoting resilience through SFM. By contrast, the National Forest Programme and Action Plan showed some alignment with these adaptation objectives, particularly through promoting climate-resilient silviculture and ecosystem-based approaches. The Environmental Code also provides a moderate enabling framework by regulating land use and guiding protection, though the expert notes it does not explicitly link protection to reducing climate risk. The Biodiversity Strategy and EQOs reinforce adaptation indirectly by supporting ecosystem integrity, connectivity, and resilience, though not with explicit adaptation mandates.

Protection and enhancement of biodiversity

Biodiversity objectives show stronger alignment across Sweden's policy mix. The Forestry Act, however, scored negatively or neutrally on several biodiversity objectives, reflecting its emphasis on preserving existing conservation values rather than actively restoring degraded ecosystems or improving the favourable conservation status of species and habitats. By contrast, the Environmental Code, Biodiversity Strategy, and EQOs all contribute positively, enabling the protection of forest areas, regulating harmful activities, and setting national goals for biodiversity outcomes. The National Forest Programme contributed during its active phase, supporting voluntary conservation, biotope protection, and the creation of nature reserves, though its influence has diminished post-2022. As the expert highlights, the largely voluntary or strategic nature of many biodiversity measures limits the weight and consistency of these synergies.

Sustainability and health of forests

Sweden's coherence with sustainability and forest health objectives is generally positive but with notable gaps. The Forestry Act's production-oriented regulations contribute to sustainable use and SFM, but without an explicit mandate to improve forest quality or ecological condition beyond ensuring regeneration after harvest. The National Forest Programme showed stronger alignment, promoting continuous cover forestry, mixed-species management, and regional initiatives for nature conservation. The Environmental Code provides a moderate legal foundation for safeguarding ecosystem functions, though its practical impact depends on regional implementation and policy trade-offs. The expert notes that while Sweden has systems in place for monitoring, reporting, and verifying forest conditions, there is no formalised mechanism to improve or scale up MRV practices, contributing to the neutral coherence scores on this objective. The afforestation ambition is also modest, reflected in neutral or low scores across instruments.

Sustainable and competitive bioeconomy

On bioeconomy objectives, Sweden shows mixed but generally positive coherence. The Forestry Act supports the sustainable use of wood-based resources through its production-focused regulations, but shows weaker alignment on understanding ecological boundaries or boosting circularity, leading to neutral or negative scores. The National Forest Programme, during its active years, showed strong synergies with bioeconomy objectives by promoting innovation, investment, and the scaling-up of bio-based sectors, though again its influence has waned. The Environmental Code contributes by ensuring that resource use does not cause significant environmental harm, while the Biodiversity Strategy and EQOs provide important sustainability guardrails but are not designed to actively stimulate bioeconomy growth.

Overall assessment

Overall, Sweden's forest governance aligns broadly with EU-level objectives, particularly on biodiversity, ecosystem services, and sustainable use. However, this coherence is often shaped by non-binding or voluntary mechanisms, and there are important gaps in how climate change, afforestation ambition, MRV improvement, and ecological boundaries are integrated into practice. The national expert emphasises that while Sweden has progressive frameworks and high environmental ambitions, the real-world impact is constrained by variability in regional implementation, reliance on voluntary measures, and the limited integration of proactive restoration, adaptation, and climate mitigation across key instruments.

2.5. Discussion of the coherence assessment results

2.5.1. Role of governance, monitoring, implementation

The coherence of the EU's forest policy framework ultimately hinges not only on the design of policy instruments but on their effective implementation at the Member State level. Many key instruments assessed, such as RED III, EUDR, and NRR, rely heavily on national authorities for enforcement, target-setting, permitting, and compliance monitoring. As the vertical coherence assessments in Czechia and Ireland illustrated, even where overarching EU objectives are well-articulated, policy outcomes may diverge significantly depending on the administrative capacity, legal interpretation, and political will at the national level. Italy demonstrated high alignment across EU objectives, supported by an integrated forest governance system that includes dedicated strategies and binding legal frameworks. By contrast, Sweden, despite having progressive environmental goals, relies more heavily on voluntary measures, and coherence is sometimes weakened by inconsistent regional implementation and the absence of binding restoration or monitoring mandates.

This reliance on Member States' implementation introduces a critical governance variable into the coherence equation. Instruments with legally binding provisions (e.g. the NRR and EUDR) require national systems for compliance checks, restoration planning, or traceability. Where governance capacity is uneven, either due to limited technical expertise, underfunded agencies, or fragmented competencies, the policy mix risks under-delivery, regardless of its formal coherence.

The central role of Monitoring, Reporting, and Verification (MRV) systems is also evident. Instruments such as the proposed FMF, the Soil Monitoring Directive, and the Sustainable Taxonomy are crucial enablers of coherence, not because they directly achieve outcomes, but because they provide the data and transparency necessary to track interactions, evaluate trade-offs, and inform adaptive management. The FMF, in particular, was consistently rated as a linchpin for improving forest health monitoring, verifying afforestation outcomes, and supporting biodiversity indicators across the EU. However, MRV systems remain underdeveloped in many Member States. For instance, Ireland received largely neutral scores on MRV, indicating that while it promotes forest expansion, mechanisms to track and evaluate forest condition and ecosystem outcomes are still limited.

In contrast, voluntary frameworks such as the 3BT pledge, the Guidelines on Biodiversity-Friendly Afforestation, and the Closer-to-Nature Forest Management Guidelines rely almost entirely on uptake and implementation at the subnational level. Their potential for delivering synergies is high, as stakeholder assessments showed, but only if sufficient governance infrastructure, technical capacity, and long-term funding mechanisms are in place to guide and monitor implementation. In Czechia, for example, afforestation and restoration are acknowledged in national strategies but are not consistently integrated into legal instruments, limiting their influence. This reinforces the broader conclusion that governance in terms of capability and coordination is a foundational determinant of policy coherence and effectiveness of the forest policy framework.

2.5.2. Need for integrated approaches

A clear message emerging from the coherence assessment is that no single policy instrument (however well-designed) can deliver the full suite of forest-related objectives across climate mitigation, climate adaptation, biodiversity, forest health, and the bioeconomy. Coherence is a function not of individual instruments but of how the policy mix operates as a system.

The results showed strong synergies between objectives and certain instruments, notably the Nature Restoration Regulation, LULUCF Regulation, and the Habitats and Birds Directives. However, these synergies were often clustered around particular functions (e.g. biodiversity and mitigation), while other areas (notably the bioeconomy) demonstrated more fragmented or even conflicting interactions. Some instruments, such as RED III, were seen as potentially in tension with biodiversity or resilience goals if implemented without adequate safeguards.

Ireland demonstrates a fragmented policy mix, with strong emphasis on afforestation and climate mitigation in its Climate Action Plan, but weaker integration of biodiversity safeguards, leading to negative scores for some afforestation-related instruments. Czechia has cross-sectoral strategies that promote sustainability and resilience, but these are not always consistently aligned with operational forestry instruments. Meanwhile, Sweden's relatively strong biodiversity strategies and environmental objectives are not fully embedded in forest-specific legislation, and climate adaptation is not explicitly addressed in its Forestry Act, revealing a lack of vertical integration.

This underscores the importance of cross-sectoral coordination in forest governance. Climate, biodiversity, and bioeconomy policies often originate from different EU Commission DGs, are led by different ministries at the Member State level, and are implemented by different agencies. Without formal mechanisms to align these policies horizontally, for example, through joint strategies, shared monitoring frameworks, or integrated planning requirements, trade-offs are more likely to go unaddressed.

In particular, the mainstreaming of biodiversity safeguards into climate and bioeconomy instruments was seen as essential. Stakeholders consistently raised concerns about instruments that prioritise carbon or biomass outcomes at the expense of ecological complexity. Instruments such as the Green Claims Directive were recognised for helping to create more coherent market signals, but they remain nascent. Future policy development must embed biodiversity safeguards not as optional add-ons but as integral to climate and bioeconomy decision-making. Stakeholders emphasised the necessity of integrated approaches for ensuring the multifunctionality and long-term sustainability of Europe's forests.

2.5.3. Gaps and areas for policy development

Despite many promising areas of alignment, the assessment highlighted specific gaps and areas where further policy development or adjustment is warranted.

Stakeholders flagged the lack of attention to circularity in the forest-based bioeconomy. Objectives related to reuse, recycling, and material efficiency received consistently low coherence scores, and few instruments were seen as addressing circularity in a meaningful way. While the Sustainable Taxonomy shows potential in this regard, more targeted policy support is needed to advance circular wood-based product systems and reduce pressure on primary forest resources. Member States like Ireland and Czechia showed limited policy articulation on how to operationalise circularity in the forest-based economy. Sweden's Forestry Act focuses on wood production but shows limited alignment with objectives around ecological boundaries and circular material use.

There is a perception among stakeholders of insufficient operationalisation of ecological boundaries within the bioeconomy and carbon market instruments. While many strategies now reference planetary boundaries or ecosystem resilience, few offer concrete criteria, thresholds, or monitoring frameworks to ensure forest use remains within sustainable limits. The Bioeconomy Strategy, the CRCF, and RED III were all noted as areas where improved safeguards, ecological indicators, or additional sustainability conditions could help close this gap. While Italy's updated Bioeconomy Strategy integrates sustainability criteria, other countries (e.g., Ireland, Czechia) lack dedicated instruments that clearly define limits to resource use in expanding forest-based sectors.

Third, several stakeholders noted a lack of integration between climate adaptation, mitigation, and biodiversity objectives. Instruments often address these areas separately, despite the well-documented co-benefits of nature-based solutions and resilience-oriented management. While the Nature Restoration Regulation and Closer-to-Nature Guidelines exemplify integrative thinking, many instruments, particularly in the energy and carbon sectors, treat adaptation and biodiversity as secondary concerns. While Sweden has strong biodiversity frameworks, adaptation is not explicitly addressed in forest law. Ireland's adaptation measures are emerging but remain underdeveloped compared to afforestation and mitigation priorities.

Finally, stakeholders emphasised that future efforts may benefit from revised or new instruments and policy innovations that can enhance the coherence of the forest policy mix. Such efforts could include: strengthening circular economy principles and cascading use of wood; establishing ecological thresholds and sustainability ceilings for biomass extraction; providing financing and technical assistance for integrated forest restoration and management; and expanding MRV coverage to include biodiversity and resilience indicators alongside carbon metrics.

2.5.4. Methodological and process reflections

The policy coherence assessment conducted through the PolCA approach offered valuable insights into how stakeholders perceive synergies, conflicts, and trade-offs within the EU's forest policy mix. The structured matrix approach enabled a qualitative analysis of interactions, supporting a nuanced understanding of where policies reinforce or undermine one another. It also allowed for the incorporation of expert knowledge, including national and EU-level perspectives, in a participatory and relatively efficient process.

However, some methodological limitations must be acknowledged. First, as a perception-based method, the assessment captures informed judgments rather than direct empirical measurement. Stakeholder scores may reflect expectations, interpretations of policy language, or concerns about future impacts, rather than current, observable outcomes. This is particularly relevant for newer or evolving instruments such as the CRCF, the Forest Monitoring Framework, the Sustainable Taxonomy, and the EUDR, where implementation details are still under development.

In addition, scores can vary by stakeholder background, institutional affiliation, or sectoral priorities. While the workshop format encouraged deliberation and convergence, subjectivity remains a feature of such assessments. While the scoring system proves useful for simplifying complex relationships, it may risk oversimplifying the full spectrum of policy interactions, especially where effects are context-dependent or contingent on implementation quality.

The scope of the vertical assessment was constrained by the need to maintain feasibility and comparability. Only four countries were assessed, and within each, only a subset of forest-relevant instruments were reviewed. In countries with decentralised forest governance, such as Italy or Sweden, this may omit regional variations or informal instruments that shape implementation.

Despite these limitations, this coherence assessment provides a valuable lens through which to examine forest policy coherence for multifunctionality. It complements legal or technical analyses by foregrounding how policies are experienced and interpreted by those involved in their design and implementation. As such, it offers a useful input for reflection, dialogue, and forward-looking policy development.

3. Part II: EU Reference Policy Scenario

3.1. Methodological approach and data

3.1.1. Selection of policy measures

The selection of policy instruments for the Reference Policy Scenario was carried out in conjunction with the selection of policy instruments for the coherence assessment (see section 2.3), utilising the same initial steps, including:

- **Stakeholder workshop and long list creation**: An initial workshop was conducted with ForestNavigator stakeholders to collaboratively generate a comprehensive long list of forest-relevant EU policy instruments.
- **Literature review of strategic documents**: A detailed review of EU strategic documents, including the EU Climate Law, Forest Strategy, Biodiversity Strategy, Bioeconomy Strategy, Circular Economy Action Plan, and the Action Plan for Nature, People and the Economy, was carried out to identify key forest-related instruments. Secondary literature was also consulted to ensure completeness.
- **Expert helicopter interviews**: Targeted interviews were conducted with high-level policy experts identified through the literature review. These discussions helped validate the initial long list and identify any additional, overlooked instruments. The experts provided a strategic perspective on relevant EU forest policy frameworks.
- **Expert shortlisting**: The validated long list was compiled into the ForestNavigator Policy Tracker, a database shared with partners and stakeholders. Policy experts from Task 8.1 then reviewed each instrument to determine whether it should be included in the reference scenario, resulting in a refined shortlist of the most relevant instruments.
- **Member State Validation**: National policy instruments were identified and validated by ForestNavigator country experts in Czechia, Ireland, Italy, and Sweden. Validation was further supported by reviews from at least one additional external policy expert in each MS.

To ensure that the reference scenario remained realistic, policy-relevant, and implementable within the ForestNavigator modelling framework, several additional steps were undertaken beyond those used in the coherence assessment, including:

- **Consultation with Modelling Experts:** During the ForestNavigator Annual Consortium Meeting, modelling teams reviewed policies where inclusion remained uncertain. Using structured discussion and voting, consensus was built on policies sufficiently mature and implementable for inclusion in the reference scenario. This step helped balance ambition with modelling feasibility, leading to an operationally grounded policy package.
- **Review by the Steering Committee Review:** The resulting list of reference scenario policies was reviewed by the ForestNavigator Steering Committee. This step ensured that the selection aligned with the project's overall strategic vision and objectives, and enabled final refinement based on cross-WP feedback.
- **Final validation by the European Commission:** The final review by the European Commission ensured that the selected reference scenario reflects ongoing EU policy priorities and has institutional legitimacy for use in the ForestNavigator modelling and policy pathway development.

The coherence assessment covers a broad set of EU and Member State instruments to understand intended interactions, synergies, and trade-offs in the forest policy mix. The Policy Reference Scenario uses a narrower subset: only measures that are implemented/adopted and sufficiently specified to be translated into modelling inputs (e.g., NECP WEM/WAM and selected CAP measures, plus a small number of EU-level safeguards). Measures that are relevant for coherence but not readily operationalised in the modelling (either due to their recent adoption, limited implementation track record, or because they represent more transformative measures) are discussed in the coherence assessment above. Policies which were included in the coherence assessment, but are excluded from the reference Policy scenario will potentially be considered for exploration under Task 8.2. These instruments will help explore alternative futures that aim to achieve deeper climate, biodiversity, and bioeconomy goals. *Table 7* provides an overview of the differences in policy coverage between the policy coherence assessment, the reference scenario, and the ambitious scenario.

Table 7: Policies in the coherence assessment, reference scenario and ambitious policy scenario

	Coherence Assessment	Reference Scenario	Ambitious Scenario
EU	LULUCF Regulation; RED III; NRR; CRCF; FMF; EUDR; Habitats Directive; Birds Directive; Soil Monitoring Directive; Green Claims Directive; Sustainable Taxonomy; 3 Billion Trees Package; Guidelines for Defining, Mapping, Monitoring Old Growth Forests; Guidelines on Biodiversity-Friendly Afforestation and Reforestation; Guidelines on Closer-to-Nature Forest Management	European Climate Law; RED III; Habitats Directive; Birds Directive; NECP Measures (WEM/WAM)	LULUCF Regulation; CAP Strategic Plan measures; NRR; FMF; Soil Monitoring Directive; CRCF; Sustainable Taxonomy; CSRD; Guidelines for Defining, Mapping, Monitoring Old Growth Forests; Guidelines on Biodiversity-Friendly Afforestation and Reforestation; Guidelines on Closer-to-Nature Forest Management; Forest Strategy for 2030/3 Billion Trees Pledge; Biodiversity Strategy for 2030; Bioeconomy Strategy; Adaptation Strategy; New Circular Economy Action Plan; Action Plan for Nature, People, and the Economy
Czechia	Forest Act no.289/1995 Coll.; Czech National Council Act no.114/1992 on the Protection of Nature and the Landscape; Government ordinance establishing the conditions for the implementation of measures for the afforestation of agricultural land; Concept of the State Forest Policy until 2035; National Action Plan for Climate Change Adaptation; Strategy of the Ministry of Agriculture until 2030; Implementation Plan of the Strategic Frame of the Czech Republic; National Biodiversity Strategy; Raw Material Policy for Woo	Forest Act no.289/1995 Coll.; Czech National Council Act no.114/1992 on the Protection of Nature and the Landscape; Government ordinance establishing the conditions for the implementation of measures for the afforestation of agricultural land	Concept of the State Forest Policy until 2035; National Action Plan for Climate Change Adaptation; Strategy of the Ministry of Agriculture until 2030; Implementation Plan of the Strategic Frame of the Czech Republic; National Biodiversity Strategy; Raw Material Policy for Wood;
Ireland	Forestry Act; Forestry Regulations 2017; Environmental Requirements for Afforestation; Climate Action Plan; Forest Strategy 2023-2030; Forest Biodiversity Guidelines; Forest Harvesting and Environmental Guidelines; Bioeconomy Action Plan 2023-2025; Land Types for Afforestation: Soil and Fertility	Forestry Act; Forestry Regulations 2017; Environmental Requirements for Afforestation	Forestry Programme 2023-2027; Climate Action Plan; Forest Strategy 2023-2030; Forest Biodiversity Guidelines; Forest Harvesting and Environmental Guidelines; Bioeconomy Action Plan 2023-2025; Land Types for Afforestation: Soil and Fertility
Italy	Consolidated Law on Forests and Forestry Supply Chains; Law 394/1991 on Protected Areas; Definition of general criteria for the preparation of territorial plans and forest management plans;	Consolidated Law on Forests and Forestry Supply Chains; Law 394/1991 on Protected Areas; Definition of	National Forest Strategy; Guidelines for the identification of Old-Growth Forests; National Plan for Adaptation to Climate Change; Updated Bioeconomy Strategy and Action Plan; Biodiversity Strategy

	Coherence Assessment	Reference Scenario	Ambitious Scenario
	National Network of Old-Growth Forests; National Forest Strategy; Guidelines for the identification of Old-Growth Forests; National Plan for Adaptation to Climate Change; Updated Bioeconomy Strategy and Action Plan; Biodiversity Strategy	general criteria for the preparation of territorial plans and forest management plans; National Network of Old-Growth Forests	
Sweden	Forestry Act; Environmental Code; National Forest Programme and Action Plan; National Strategy for Biodiversity and Ecosystem Services; Environmental Quality Objectives	Forestry Act; Environmental Code	National Forest Programme and Action Plan; National Strategy for Biodiversity and Ecosystem Services; Environmental Quality Objectives

Moreover, additional national policy measures related to afforestation, deforestation, forest management, woodland conversion and wood use with specified quantitative targets within three of the case study countries (Ireland, Czechia, Italy) were identified as relevant to the reference scenario, and feasible to implement in the models (*Table 8*). These additional measures were extracted from national strategies and programme documents (Ireland), legislation amendments (Czechia), and energy policy documents (Italy). These additional policy measures are provided in the table below.

Table 8: Case study country national forest policy measures

Member State	Type of measure	Description	Target
Ireland	Afforestation	Afforestation to meet overall forest strategy target of 18% forest cover	Afforestation of 4500 ha per year (2023-2025) increasing to 8000 ha per year 2026-2030, then sustained at 4000 per year 2031-2050
Ireland	Deforestation	Limit deforestation to half of the current national rate	Deforestation of 495 ha per year until 2030, primarily for bog restoration, which has no short-term abatement potential
Ireland	Forest management	Extend rotation of 31% of all spruce forests	Extend rotation age at MMAI (by 10-15 years) for 31% of Sitka spruce forests from 2023 onwards
Czechia	Forest management	Amended Forest Law lowers minimum age requirement for final felling operations in high forest stands from 80 to 60 years, enabling earlier stand conversion	
Italy	Wood use	Increase forest residues and agricultural residues for biofuels	

3.1.2. Modelling of the EU Reference Policy Scenario

This chapter is organised as follows: The modelling of the EU Reference Policy Scenario was conducted by aligning the EU model (GLOBIOM-G4M-X) and four national models (CBM-Czechia, CBM-Ireland, CBM-Italy, Heureka-Sweden). To this aim, selected policy measures were used for modifying the parametrisation of both the EU and national models (see Section 3.1.2.1). The GLOBIOM-G4M-X model projected future wood harvest levels and afforestation/deforestation according to the policy measures, and the model output was used as input both in the EU and national modelling for a consistent modelling of future forest land CO_2 emissions and removals (see Sections 3.1.2.2 and 3.1.2.3). Next, we describe the modelling methods for EU and National Toolbox alignment (see Section 3.1.2.4), after which the individual National Toolbox implementation details are described (Section 3.1.2.5). Finally, sensitivity of the Reference Policy Scenario CO_2 emissions/removals under changing climate and increasing natural disturbances was obtained by driving both the EU and National models with an EU-scale biophysical modelling framework providing climate change modifiers and future natural disturbance events (see Section 3.1.2.6).

3.1.2.1. Inclusion of Policies in the EU Policy Modelling toolbox

In this subchapter, we describe first what EU-level policies are captured, followed by national policy measures, and finally, the representation of national plans that cover EU-level policies.

Inclusion of EU-level policy measures
Apart from representing the selected NECP LULUCF policy targets and CAP Strategic Plan targets, GLOBIOM-G4M also represents the following additional EU-level policies.

1. Sustainable bioenergy uses under the Renewable Energy Directive (RED) III

The REDIII sustainability requirements for bioenergy are represented by restricting biomass sourcing from feedstocks that may conflict with biodiversity conservation objectives. In particular, “high biodiverse natural land in Natura 2000 protection areas” and other areas assumed to be under strict protection are safeguarded in GLOBIOM and G4M by prohibiting their conversion to bioenergy plantation or afforested land. The definition and spatial representation of “high biodiverse natural land in Natura 2000 protection areas” in the GLOBIOM-G4M modelling is specified below.

2. Protection of high biodiverse natural land in Natura 2000 areas

We assume strict protection for high biodiverse natural land in Natura 2000 areas. The spatial dataset of “high biodiverse Natura 2000 protection areas” is based on Chapman et al. (2025), which was developed by intersecting rasterised Natura 2000 protected area with the species distribution map. Initial land cover information was derived by intersecting the spatial layers with the Corine Landcover Accounting Layer 2018 and subsequently remapped to ETL2 land-cover classes.

The resulting dataset was projected to a 5-arcmin resolution before being aggregated to the NUTS2 level to match the spatial resolution of GLOBIOM-G4M.

Using this dataset, we identified “high biodiverse natural land in Natura 2000 protection areas” for each Member State. Among the ETL2 land-cover classes, the following categories were classified as natural land types: “ETL2_Grassland”, “ETL2_HeathlandShrub”, “ETL2_WoodlandForest”, “ETL2_Wetlands”, “ETL2_MarineTransitional”, “ETL2_RiversLakes”, and “ETL2_SparseVeg”. For each NUTS2 region, the total natural land area in 2020 was calculated as the sum of these land-cover categories.

A set-aside protection scheme was then applied in GLOBIOM-G4M to preserve these natural land areas, assuming no conversion of protected natural lands to other land-use categories.

3. Maintenance of grassland area under CAP conditionality

The model also represents the GAEC1 CAP target to “maintain a certain share of permanent grassland of the total agricultural area”[i]. This target is modelled by constraining managed pasture area in each Member State to remain at or above its 2000 level, which serves as the modelling base year.

Inclusion of national policy measures

Overall, GLOBIOM-G4M-X captures 20 selected policies from NECPs and CAP strategic plans spanning 17 countries in Europe. These policies modified the land use configuration in the model. Specifically, the measures presented in *8. Appendix* III: Selected NECP have been included in the model.

The GLOBIOM-G4M-X model was calibrated to achieve at least the afforestation targets set in the CAP strategic Plans for 2024-2030 in each country, while remaining within the limits of land available for afforestation and avoiding excessive deviations from historically observed maximum afforestation rates. However, in Greece, Portugal, and the Netherlands, the CAP targets could not be reached. *Table 9* presents the CAP targets reported by each Member State, alongside afforestation values included in G4M.

Table 9: CAP Strategic Plan targets included in GLOBIOM-G4M-X

Member State	CSP Target 2024-2030	G4M afforestation projection 2024-2030	Comment
Austria	200	38,424	G4M exceeds the CAP target
Belgium	359	5,005	G4M exceeds the CAP target
Bulgaria	2,873	19,577	G4M exceeds the CAP target
Croatia	1,178	8,003	G4M exceeds the CAP target
Cyprus	50	555	G4M exceeds the CAP target
Czechia	2,060	15,586	G4M exceeds the CAP target
Denmark	8,253	19,005	G4M exceeds the CAP target
Germany	340	95,660	G4M exceeds the CAP target
Greece	160,169	37,754	G4M cannot reach the CAP target: The average historical afforestation rate is about 4 kha/year, while it should be about 23 kha/year for afforesting 160 kha in 2024-2030. The target includes non-productive investments for the establishment of forestry plantations, the prevention and restoration of damage to forests due to forest fires, natural disasters, among others, and afforestation and creation of woodland.
Hungary	16,174	49,693	G4M exceeds the CAP target
Italy	40,752	513,545	G4M exceeds the CAP target
Latvia	10,281	27,887	G4M exceeds the CAP target
Lithuania	3,500	24,566	G4M exceeds the CAP target
Netherlands	40,377	45,484	G4M cannot reach the CAP target: The historical afforestation rate is below 3 kha/year, while it should be about 6 kha/year to reach the target
Poland	20,660	86,209	G4M exceeds the CAP target
Portugal	212,287	42,228	G4M cannot reach the CAP target: The target area includes not only afforestation but also improvement of forest stands, improvement of forest management, and restoration of high-value nature habitats. Portugal has a strong declining afforestation rate in 1996-2023.

[i] Conditionality. European Commission. https://agriculture.ec.europa.eu/common-agricultural-policy/income-support/conditionality_en

Member State	CSP Target 2024-2030	G4M afforestation projection 2024-2030	Comment
Romania	8,903	42,986	G4M exceeds the CAP target
Slovakia	5,497	11,843	G4M exceeds the CAP target
Slovenia	240	2,613	G4M exceeds the CAP target
Spain	35,765	93,454	G4M exceeds the CAP target

Other relevant policy measures

In addition to the NECP policy targets explicitly represented in the model, several national policy instruments incorporated through country-specific assumptions are aligned with broader EU-level regulations. These include measures included in the CAP strategic plans, national forest strategies, and biodiversity-related conservation policies. Although implemented through country-specific assumptions, many of these measures contribute directly or indirectly to overarching EU strategies related to land use, biodiversity protection, and forest management.

One example of such policies integrated into GLOBIOM-G4M is the implementation of a "10% strict protection" scheme for forests, including primary and old-growth forests under strict conservation. For this target, a set-aside management scheme is applied to primary and old-growth forests in the EU, starting in 2025. The model also represents reduced forest management intensity in protected areas, both within and outside Natura 2000 zones.

These measures correspond to, or support, the following EU-level regulatory frameworks:

EU Forest Strategy for 2030 and 3 Billion Trees pledge

The EU Forests Strategy for 2030 emphasises afforestation, reforestation, resilience, and improvements in forest quality. Adopted as part of the European Green Deal, the strategy contributes to the EU objective of reducing GHG emissions by 55% by 2030 and achieving climate neutrality by 2050.

The strategy also includes the pledge to plant 3 billion additional trees across the EU by 2030. Although this specific tree-planting target is not modelled as a standalone policy instrument in GLOBIOM-G4M, its effects are implicitly captured through afforestation targets reported in national NECPs and modelled accordingly. These afforestation activities cannot be exclusively attributed to a single policy measure, as they result from the combined influence of multiple EU and national initiatives.

EU Biodiversity Strategy for 2030

This strategy includes several binding targets that are reflected in the model, such as the extension of strict protection to 10% of EU terrestrial and marine areas. Elements of these commitments, particularly those related to land conservation, are reflected in the model through land-use restrictions and protection assumptions, although they are not uniquely attributable to the Biodiversity Strategy.

3.1.2.2. GLOBIOM-G4M-X projected wood demand and harvest level

Using the policy measures described in the previous chapter, the GLOBIOM-G4M-X model projected future wood demands, harvest levels and afforestation/deforestation according to the included policy measures. This model output was used in both the EU and national modelling for a consistent modelling of future forest land CO_2 emissions and removals.

For the inclusion in the model of the Reference Policy Scenario (REF) wood demands, the EU bioenergy demand was updated by aligning it to PRIMES under a scenario compatible with the Member States' NECP national ambitions, considering national pathways aligned to both WEM (With Existing Measures) and WAM (With Additional Measures) scenarios. Traditional residential wood fuel demand (firewood) was endogenously assumed to diminish over time in the model, as an effect of moving from residential to industrial bioenergy production. Wood material demands were aligned to the Baseline's (BASE) GDP and population growth.

The main differences between the REF scenario and the BASE scenario are the lower bioenergy demand allocated to forests (i.e. a relatively higher share of biomass demand is allocated to energy crops outside forest land), and the decrease over time of traditional fuelwood demand.

The resulting harvest volumes were obtained by combining the different demands in GLOBIOM. The harvest levels were also reconciled to MS targets explicitly defined in the NECPs. The resulting harvest levels for the REF scenario are presented in *Figure 6* and compared to the ones of the BASE scenario.

Under the REF scenario, the projection of roundwood harvest at the EU27 level is rather stable and varies between 530 and 545 Mm^3 $year^{-1}$, that is between 6-90 Mm^3 $year^{-1}$ less than under the Baseline scenario (average diff. 59 Mm^3 $year^{-1}$). The total harvest volume (i.e. including roundwood and extracted logging residues) is stable in the short-term period (up to 2030) but increases from 589 to 643 Mm^3 $year^{-1}$ by 2050, before returning to the present levels by 2070 (*Figure 6*). The increase is caused by the demand for logging residues for energy use. However, in the case of the total harvest, the REF scenario remains under the BASE scenario by 11 to 113 Mm^3 $year^{-1}$ (average diff. 68 Mm^3 $year^{-1}$).

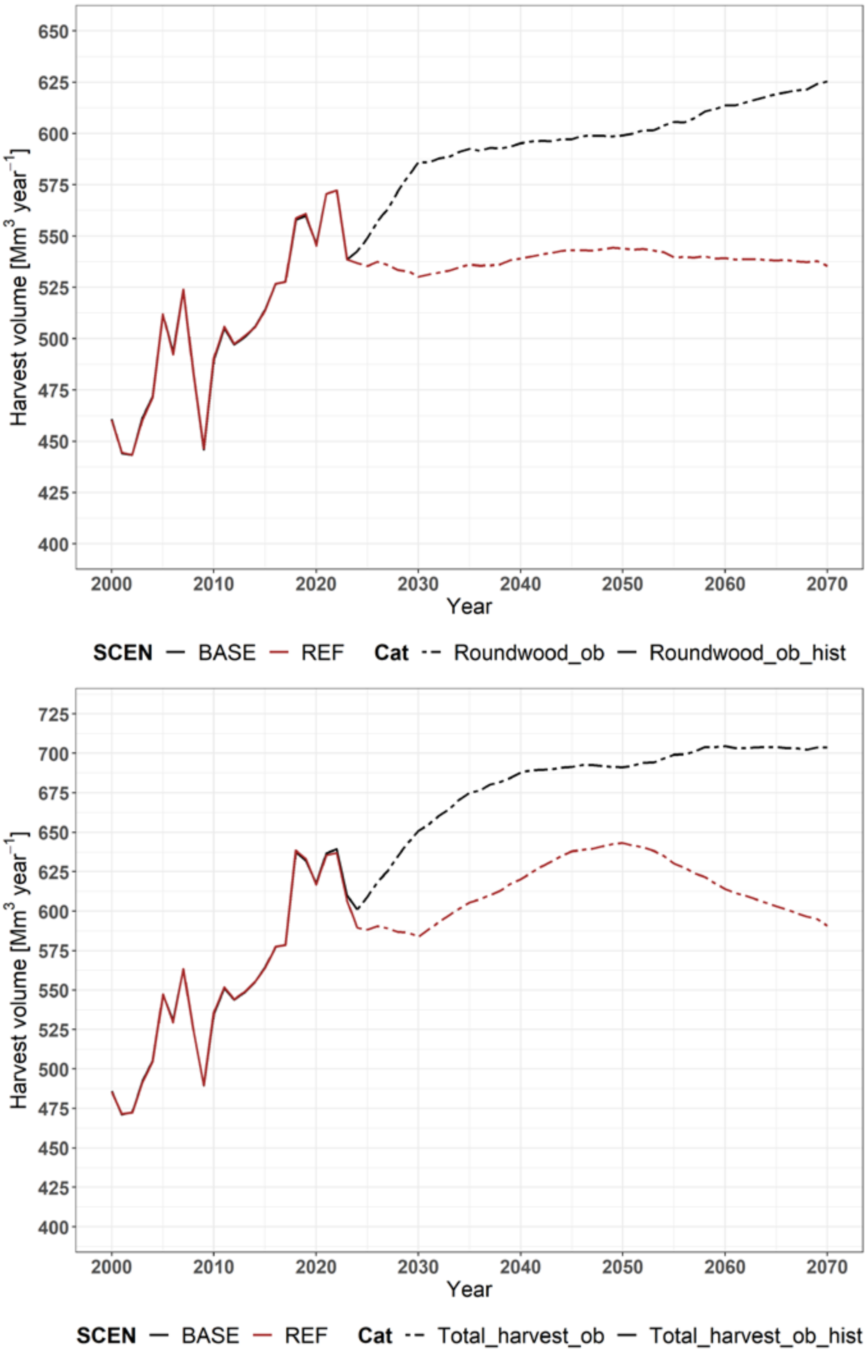


Figure 6: EU27 roundwood harvest volume developments (over bark) and total harvest (roundwood over bark and extracted logging residues) in the REF and BASE scenarios.

Generally, at the level of single Member States, we observe an alignment to the EU27 projections with a relative reduction of harvest volumes under the REF compared to the BASE scenario (*Figure 7*). However, there are also cases where we observe increases in harvest volumes relative to BASE, like in France, due to the inclusion of specific national harvest targets from NECPs. In some Member States, there is a significant impact on harvest levels due to the increasing volume of extracted logging residues (e.g. Finland, Germany, Poland, Sweden) (*Figure 8*).

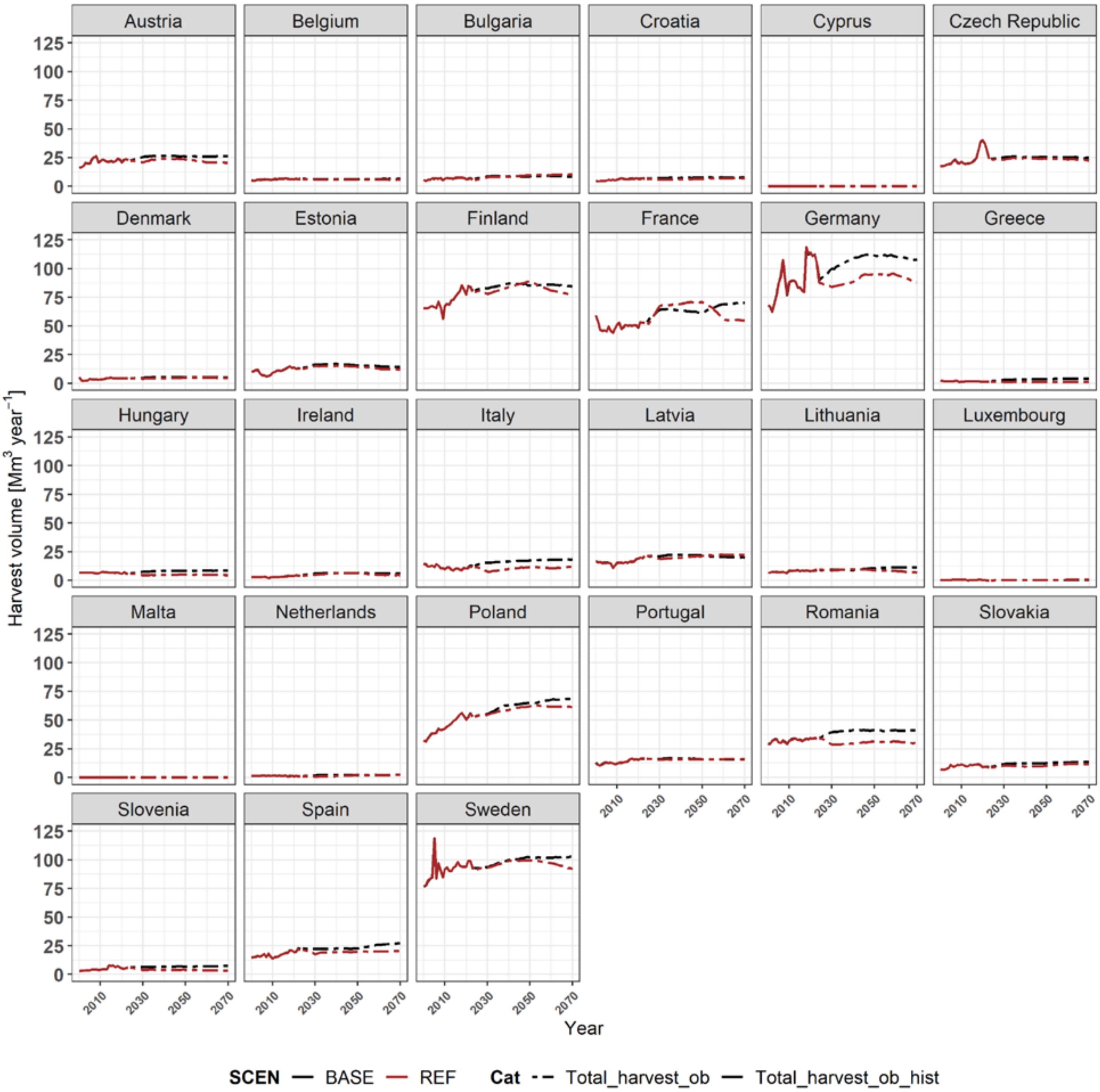


Figure 7: Total harvest volume by Member State in the REF and BASE scenarios.

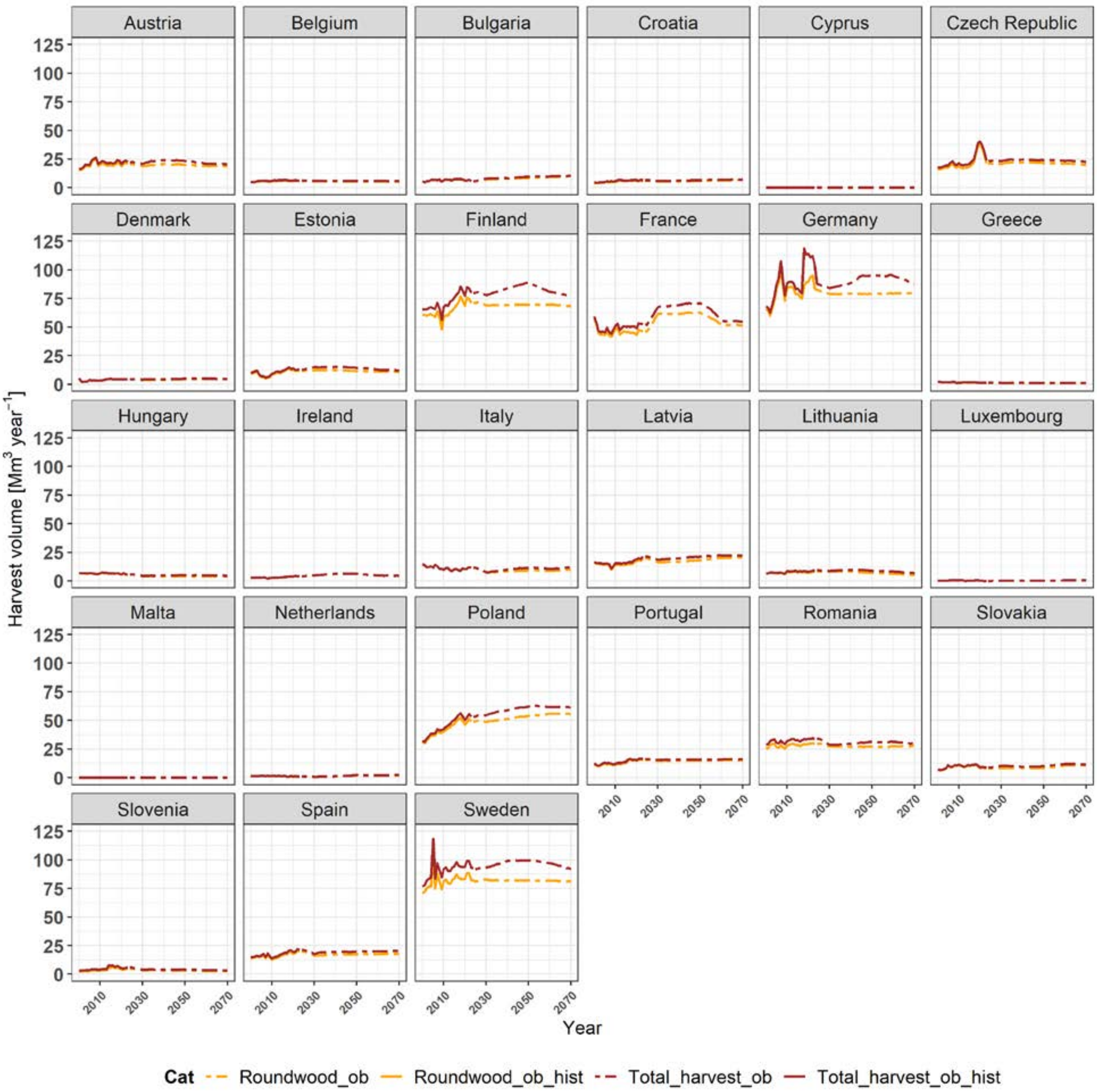
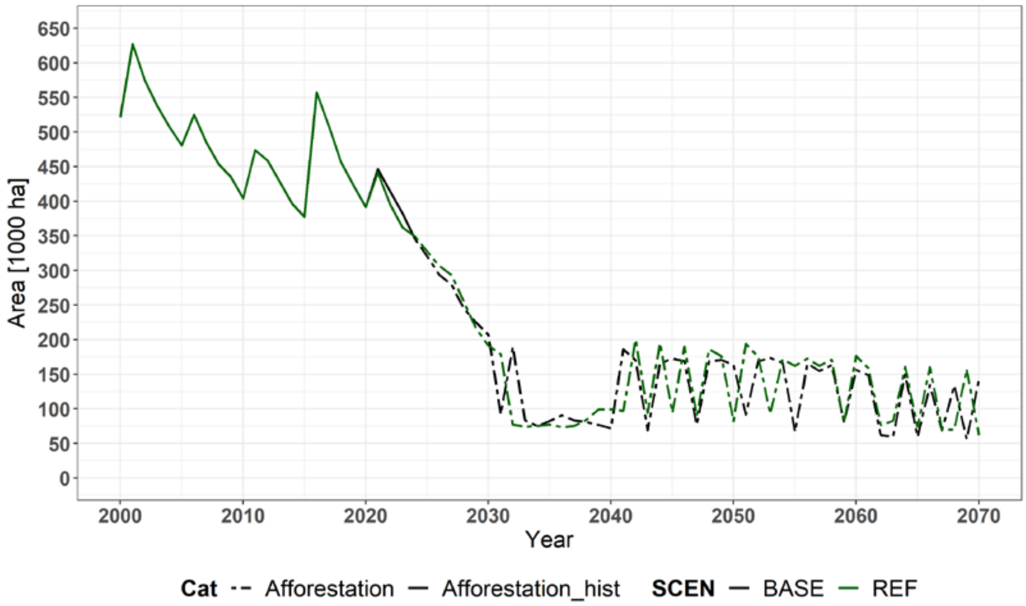


Figure 8: Development of roundwood harvest and total harvest volume by Member State in the REF scenario

3.1.2.3. GLOBIOM-G4M-X projected afforestation and deforestation

The overall EU27 afforestation and deforestation areas are projected to be similar than in the BASE scenario (*Figure 9*), leading to a total increase of afforested area of 132 kha under REF relative to BASE in the period 2024-2070. However, at the MS level, the inclusion of the NECP and CAP strategic plans measures influences the afforested area for some individual countries (*Figure 10*). By zooming into a single MS, it is possible to observe more significant differences, like in the case of Ireland and the Czech Republic (*Figure 11*). Differences in terms of deforestation are marginal between BAU and REF (<500 ha).



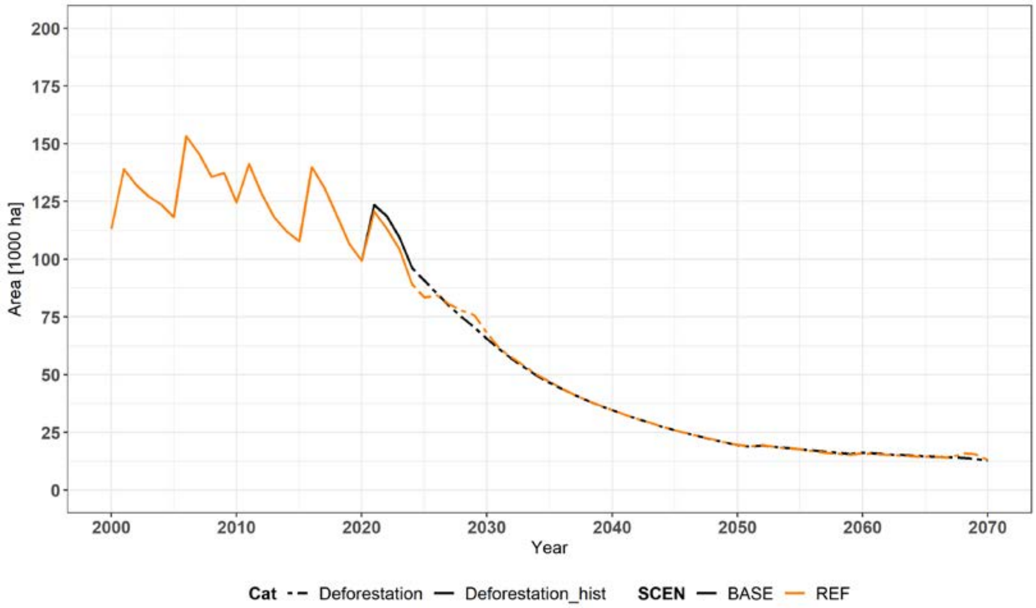


Figure 9: EU27 afforestation and deforestation rate developments

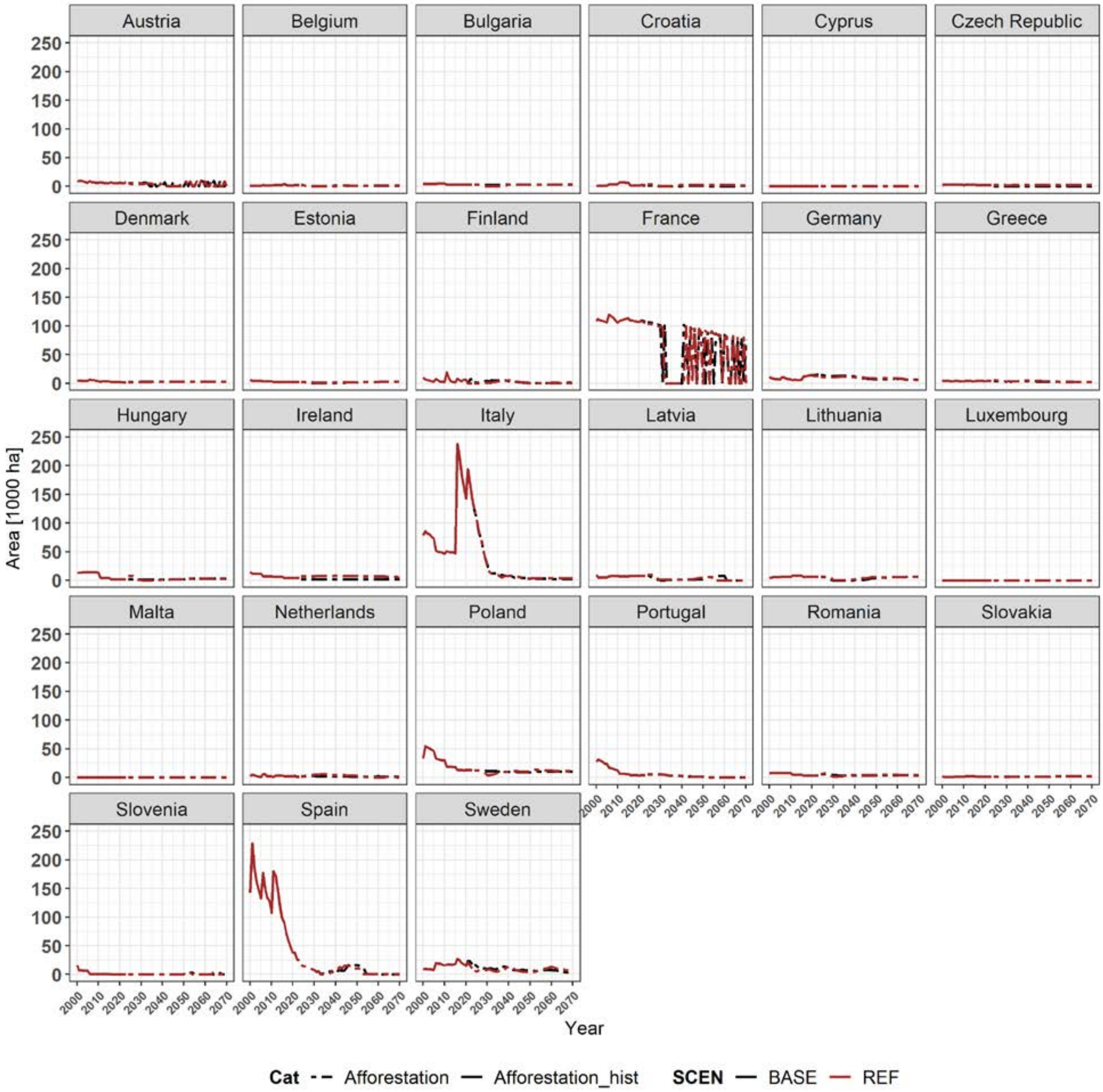


Figure 10: Comparison of afforestation rate by Member State under the REF and BASE scenarios

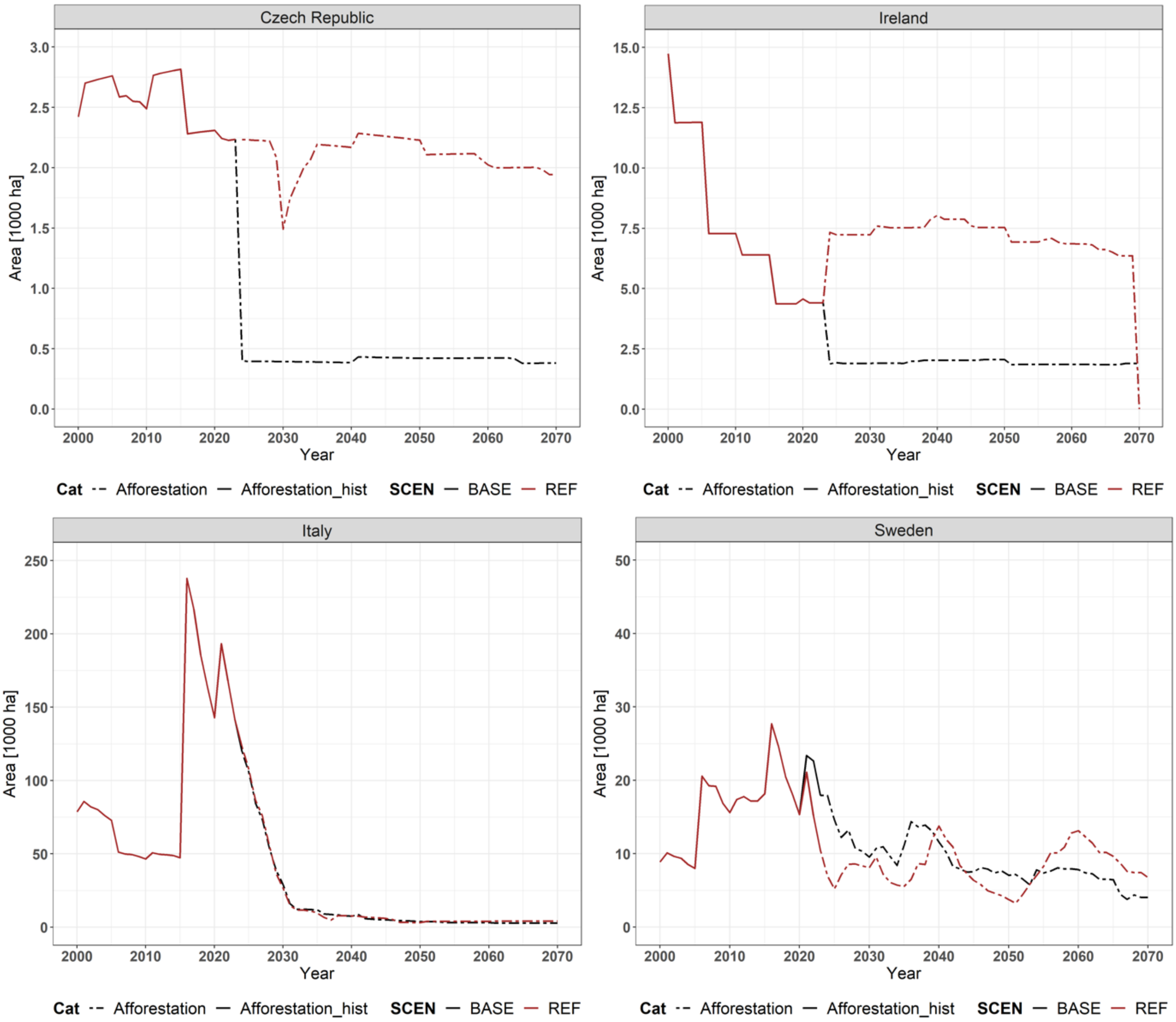


Figure 11: Comparison of afforestation rate in the four case study countries under the REF and BASE scenarios

3.1.2.4. Alignment of the EU and National Policy Modelling Toolbox

The alignment of the EU model and the national models is obtained by first simulating the EU demands in the GLOBIOM-G4M-X model and transferring the output to the national models. The annual G4M projections are then transferred to the national models (CBMs and Heureka), which reproduce the same annual harvest volumes (CBMs and Heureka) and afforestation/deforestation areas (CBMs) specified by GLOBIOM-G4M-X. GLOBIOM-G4M-X and the national models are run in parallel to assess CO_2 emissions and removals from forest land under the aligned harvest and afforestation/deforestation assumptions.

Finally, GLOBIOM-G4M-X estimates yearly CO_2 emissions and removals from the HWP pool using its post-hoc HWP module, which applies the production approach. The annual HWP emissions and removals are derived through linear interpolation of GLOBIOM's 10-year output periods.
To enable a consistent comparison of forest emissions and removals across different models, we use a reporting protocol based on standardised modelling input/output variable definitions tested among modelling partners participating in the ForestNavigator Forest Policy Modelling Forum.

Accordingly, the outputs from each model simulation are reported as annual projections of carbon stocks and emissions/removals from 2024 (the first projection year) to 2070, following each model's calibration to historical data for preceding periods.

3.1.2.5. National Policy Modelling toolbox

Three national versions of the CBM model were applied for the simulation of national CO_2 emissions/removals pathways in the Czech Republic, Ireland, and Italy. For Sweden, the Heureka model was used.

CBM-CZ

The Czech-specific CBM-CFS application follows the pilot model calibration described in ForestNavigator deliverable D6.2 (Augustynczik et al., 2025) and the baseline pathway projection described in D6.3 (Di Fulvio et al., 2025). The present deliverable introduces several additional model refinements — minor adjustments to dead organic matter (DOM) parameters and a modified treatment of temperature for the projection period (held constant at the 2024 level). The observation and projection periods have also been updated relative to previous work stages: year 2024 is now included in the observation period, as the corresponding data became available, and consequently excluded from the projection period.

Application of EU model inputs for CBM-CZ

Timber harvest demand and harvest residue extraction rates for the BASE and REF scenarios (2025–2070) were taken from the GLOBIOM-G4M-X model output and used as harvest targets in CBM-CZ. For the observed period 2011–2024, harvest demand was based on reported data from the Czech Statistical Office (CzSO), disaggregated by seven tree species groups and 14 NUTS3 units using scaling factors derived from NFI observations (NFI2–NFI3; Máslo et al., 2023). Harvest residue extraction was set in accordance with the GLOBIOM-G4M-X prescription, representing an intensity of 55–60% of the available amount. *Figure 12* shows the harvest and harvest residues extraction data as used for the BASE and REF scenarios by CBM-CZ relative to the request of G4M.

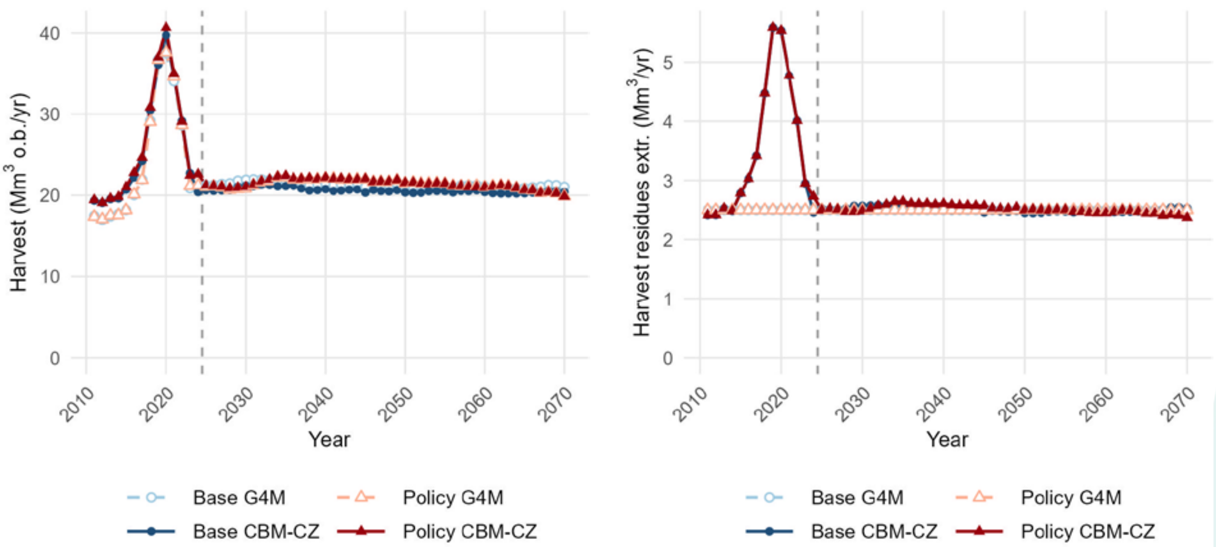


Figure 12: Harvest level (left) and extraction of harvest residues (right) for Base and Policy scenarios in the Czech Republic, showing requests by G4M and CBM-CZ. Note: the projection period 2025-2070 is aligned; original source data is retained for the observation period 2011-2024.

Projected afforestation and deforestation demand was taken from GLOBIOM-G4M-X model outputs. As these are only available at the country scale, they were disaggregated into 14 NUTS3 regions and tree species using a probability matrix defining the share of area assigned to each target species per region and land-use category. To reduce model complexity for afforestation while preserving the dominant species composition, only the three most frequent target species were retained for each region × land-use combination, with their probabilities rescaled proportionally to sum to 100%. The resulting species-specific transition probabilities were used to construct the afforestation disturbance event files for CBM-CFS3. Deforestation amounts for the projection period (2025–2070) were likewise derived from GLOBIOM-G4M-X country-level output. The original input matrix, comprising four deforestation types across seven tree species groups per NUTS3 region, was first reduced to the three dominant deforestation type–species combinations per region, with amounts rescaled proportionally to preserve the regional totals. The resulting simplified regional structure was then propagated across the full projection horizon, with annual totals scaled to match the GLOBIOM-G4M-X country-level trajectory while the relative distribution across regions and deforestation types was held constant. *Figure 13* shows afforestation and deforestation areas as used for the base and policy scenarios by CBM-CZ relative to the request of G4M.

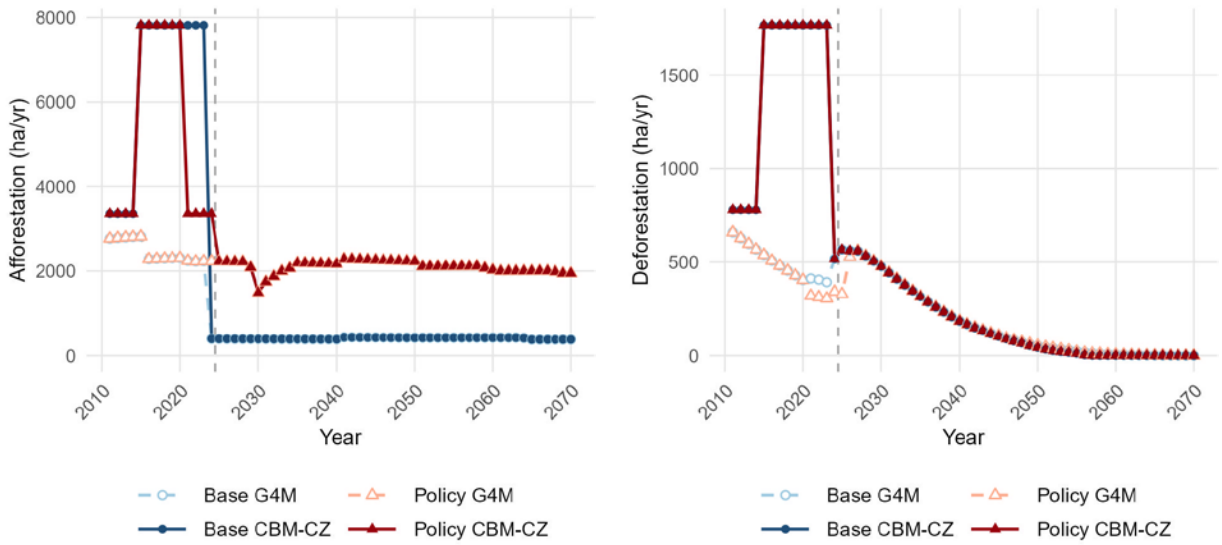


Figure 13: Afforestation (left) and Deforestation (right) for Base and Policy scenarios, showing the request by G4M and model execution by CBM-CZ. Note: during the alignment of the projection period 2025-2070, the two models practically overlap.

Additional national measures represented in CBM-CZ

The BASE and REF scenarios broadly correspond to the WEM and WAM framework, with afforestation, deforestation, harvest demand, and harvest residue extraction intensity following the general country-scale assumptions from GLOBIOM-G4M-X. It should be noted that the quantitative difference between the WEM and WAM scenarios is limited, as both share similar afforestation and deforestation assumptions and harvest parameters. This reflects the overriding role of the national forest adaptation strategy, whose imperatives largely determine the assumed forest management actions under both scenarios. A key element is the prescribed post-salvage species change, applied exclusively to Norway spruce: salvage-logged areas are implicitly treated as sites unsuitable or climatically risky for continued spruce management, and are therefore partially redirected toward broadleaves and mixed species, with spruce regeneration limited to a reduced region-specific fraction of 5–35% of the originally stocked area.

Key assumptions/constraints preserved/ deviations from EU inputs
Wildfire disturbances were not included in the current CBM-CZ simulations. Although wildfire risk in the Czech Republic is projected to increase under climate change (Trnka et al., 2021; Možný et al., 2021), with recent events such as the 2022 Bohemian Switzerland fire illustrating the potential scale of such disturbances (Kudláčková et al., 2023), the current contribution of wildfires to the national forest carbon budget and GHG emissions remains limited. Incorporating wildfires in a meaningful way would require dedicated model calibration, additional data, and methodological development that was beyond the scope of the present country-specific modelling work, where other disturbance processes and scenario components were prioritised.

CBM-IE

Application of EU model inputs for CBM-IE
Timber and fuelwood harvest demands from the GLOBIOM-G4M-X model for the BASE and REF scenarios, for the period 2024-2070, were used as harvest targets in CBM-IE. Harvest demand was allocated between coniferous and broadleaf stands, available for wood supply (AWS), based on the historical proportion of harvest originating from broadleaf stands during 2006-2023 (10%). It was further assumed that 20% of the total harvest was derived from thinnings, with the remaining 80% coming from clear-felling. Fuelwood supply was assumed to be sourced entirely from thinnings.

Projected afforestation and deforestation rates were also derived from GLOBIOM-G4M-X outputs. In line with the 2024 Forestry Programme, all afforestation was assumed to occur on mineral soils and was allocated equally between coniferous and broadleaved species (50% each). Projected deforestation areas were randomly distributed across all species and age-class strata.

Emissions from organic soils were included in the CBM-IE projections using the same methodologies implemented in the national GHG inventory (see Black et al., 2025). This is particularly important because G4M-X does not explicitly model emissions from organic soils, despite forests on organic soils accounting for around 60% of Ireland's forest area.

Additional national measures represented in CBM-IE
The BASE and REF scenarios closely resemble the WEM and WAM measures, respectively, as outlined in the Irish CAP 2024 (Black et al., 2025). Shortened rotation ages for conifer stands by 20-30% less than the rotation age at maximum mean annual increment (MMAI) reflect current management practice under the WEM policy measure in CAP 2024. For the WAM policy measure, extension of rotation age to MMAI for 31% of spruce stands is a key forest management policy represented in the Irish CAP 2024. Although this is not implicitly implemented under the REF scenario, extension of rotation is indirectly implemented because the total clearfell harvest is lower than the BASE scenario (*Figure 14*), which results in an extension of the rotation age.

Key assumptions/constraints preserved/ deviations from EU inputs

Projected target harvest, afforestation and deforestation rates set by GLOBIOM-G4M-X align well with the output rates observed for CBM-IE BASE and REF scenarios (*Figure 14*). The GLOBIOM-G4M-X target harvest is constrained by silvicultural rules applied in CBM-IE as areas become available for wood supply with an evolution of the age class structure (Black et al., 2025). In most cases, however, the total target harvest is met (*Figure 14*) because the potential AWS, set by silvicultural rules only, is higher than the GLOBIOM-G4M-X target. CBM-IE, in essence, is a bottom-up silvicultural forecast, in contrast to GLOBIOM-G4M-X, which is a supply-demand forecast. Future afforestation rates for the BASE (ca. 2000 ha per year) and REF scenarios (ca. 8000 ha per year) are broadly consistent with the CAP 2024 WEM and WAM policy measures. Deforestation rates are consistently lower than those applied in the CAP 2024 (Black et al., 2025).

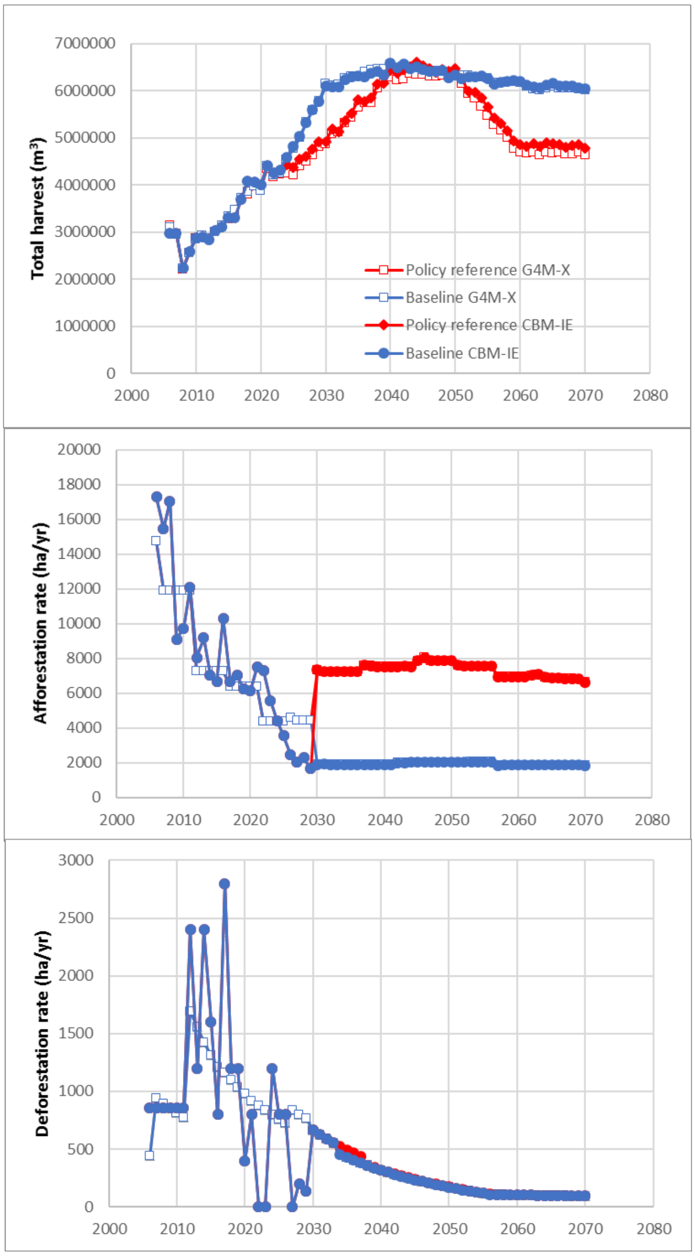


Figure 14: Comparison of GLOBIOM-G4M-X target harvest, afforestation and deforestation rates and rates achieved using the CBM-IE models.

Only one forestry CAP 2024 policy measure, conversion of 16,000 ha of low-productivity conifer stands located on fen peats to native birch woodland, was not included in the REF scenario because the potential location of these sites and conifer/productivity classes being replaced are not well defined. CBM-IE is not a spatially explicit model. The spatial scale for CBM-IE is the total national level and not NUTS 2 or 3.

CBM-IT

From 2024 to 2070, the CBM model was aligned with the key inputs used by GLOBIOM-G4M-X. Annual harvest volumes predicted by G4M were allocated across regions, forest types, and management practices based on available biomass and historical roundwood production data from FAOSTAT (2005–2018) for coniferous and broadleaved species. The period 2019–2023 was excluded from this allocation because extensive salvage logging following the autumn 2018 windstorm temporarily modified the species composition of harvest removals, increasing the share of coniferous timber. Based on these assumptions, about 75% of harvest demand was allocated to broadleaf species and 25% to coniferous species.

All other management parameters remained unchanged, including minimum rotation lengths for even-aged high forests and coppices, as well as thinning frequency and intensity. Together with the exclusion of management activities in forest areas not available for wood supply, these assumptions ensure the continuation of historical management practices at both national and regional scales.

However, in light of additional national measures promoting increased biomass utilisation for energy production (NECP measure for Italy), the proportion of non-merchantable biomass residues removed during routine silvicultural practices—such as final cuts, thinnings, and partial cuts—was gradually increased over time. Their share of total biomass removals increased from approximately 6% until 2030 to around 18% from 2045 onward.

Annual afforestation and deforestation rates, as defined by GLOBIOM-G4M-X from 2024 onward, were distributed across regions and forest types following the same distribution patterns applied during the calibration period (2005-2023).

From 2024 onwards, the annual area affected by wildfires was held constant at the 2005-2023 average of 13.8 kha yr^{-1} and distributed across regions and forest types according to the prior calibration criteria. No additional natural disturbances, such as windstorms or bark beetle outbreaks, were included in the projections after 2024.

HEUREKA

The HEUREKA model for representing the REF scenario was forced to the harvest volumes for Sweden according to the GLOBIOM-G4M-X model. Under this scenario, the roundwood harvest for Sweden stabilises at 80-90 Mm^3/year, and HEUREKA was able to match the projection from GLOBIOM-G4M-X (*Figure 15*).

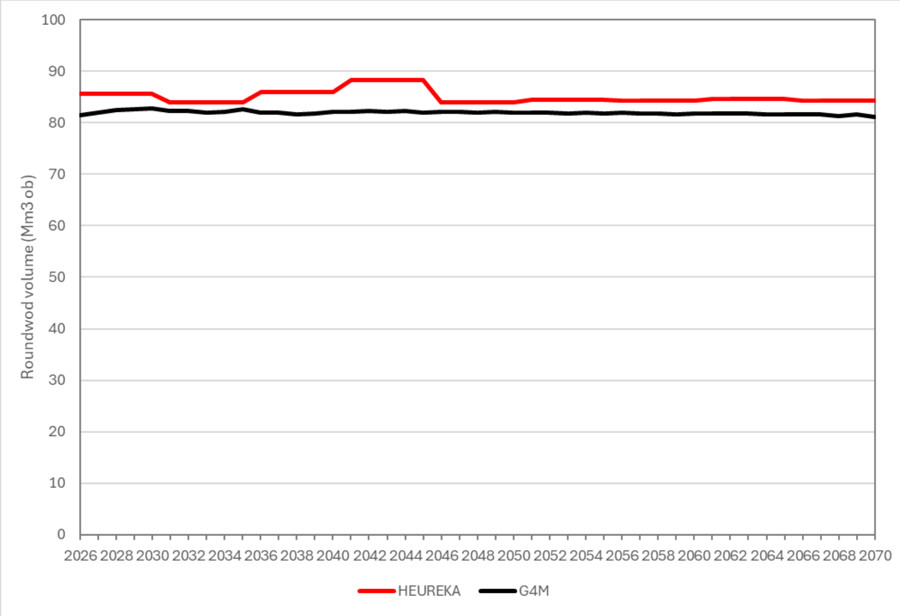


Figure 15: Roundwood harvest volume over bark as projected by HEUREKA and GLOBIOM-G4M.

3.1.2.6. Climate change and natural disturbance scenarios

For inclusion of the climate change and natural disturbance impacts in the national models, we rely on the framework described in D6.2, simulating changes in forest dynamics and disturbance activity based on the process-based biophysical model i3PGmiX (see Deliverable 3.2 for details) and computing growth shifters and disturbances that were subsequently used in the EU and national models to modify growth and disturbance patterns due to climate change impacts (Figure 16).

Figure 16. Climate change shifters computation.

To drive the biophysical model, we have used the climate forcing data from ISIMIP3b (https://data.isimip.org/search/tree/ISIMIP3b/InputData/climate/), considering RCP4.5. To represent uncertainty induced by the climate models, we have considered two Global Climate Models (GCMs) set as priority in ISIMIP3b and that represent an upper and lower bound of climate impacts in EU forests, namely UKESM1-0-LL and GFDL-ESM4. Furthermore, we have used two sets of simulations to account for uncertainty in CO_2 fertilisation effects by simulating forest growth with transient atmospheric CO_2 concentration from RCP4.5 and a second set with fixed atmospheric CO_2 concentration at 2020 levels. This resulted in the four combinations of climate change scenarios described in *Table 10*.

Table 10: Scenarios for assessing climate change and natural disturbances impacts.

Short label	Interpretation	Climate model	CO_2 fertilisation
NoCC	Reference Policy Scenario without explicit climate-change and disturbance impacts	Not applied	Not applied
GFDL_CO2	Climate-impact sensitivity case under RCP4.5	GFDL-ESM4	Included
GFDL_noCO2	Climate-impact sensitivity case under RCP4.5	GFDL-ESM4	Excluded
UKESM_CO2	Climate-impact sensitivity case under RCP4.5	UKESM1-0-LL	Included
UKESM_noCO2	Climate-impact sensitivity case under RCP4.5	UKESM1-0-LL	Excluded

Forest growth shifters were derived by assessing biomass, mean annual increment and mortality development compared to a baseline scenario with historical (1990-2010) climate conditions:

$$growth\_shifter_{CC,year} = \frac{mai_{CC,p}}{mai_{historical,year}}$$

$$mortality\_shifter_{CC,year} = \frac{mortality_{CC,year}}{mortality_{baseline,year}}$$

In addition to transient climate impacts on forest growth, changes in natural disturbances were also assessed, including windstorms, bark beetle outbreaks, and wildfires.

The effects of these disturbances were simulated using three climate modules: windstorm damage was estimated using ForestGALES, bark beetle outbreaks using LandClim, and wildfire impacts using the FLAM model.

For windstorms and bark beetle outbreaks, total damaged timber volume was extracted from the same simulations used to derive the forest growth shifters. For the national models, disturbance impacts were aggregated to the appropriate spatial resolution. For countries with enough historical data to characterise typical disturbance regimes, such as Czechia, disturbance shifters were developed using the same approach applied for the growth shifters. These disturbance shifters were then incorporated into the national models to increase salvage logging during years affected by disturbance events.

For countries-disturbance combinations lacking historical time series to characterise disturbance regimes, the absolute damage volumes were used instead of disturbance shifters. This approach was applied, for example, to windstorm and bark beetle damage in Italy and Czechia. In the EU-scale model, disturbance impacts were implemented directly using grid cell-specific damage estimates.

Wildfires were implemented using burned area projections generated by the FLAM model (see Deliverable 3.4) under the same climate change scenarios. Unlike windstorms and bark beetle outbreaks, wildfire impacts were based on burned area rather than damaged timber volume. Region-specific mortality and emission coefficients were applied to the affected areas to estimate the resulting forest losses and emissions.

CBM-CZ

Climate inputs

The direct climate change impacts are mediated to the model in two ways: A) by growth shifters affecting forest growth (NAI/GAI), and B) by temperature input affecting respiratory processes of dead organic matter components (litter, deadwood and soil carbon pools) in CBM.

Growth shifters (relative ratios) were provided for two GCM scenarios (GDFL-ESM4 and UKESM1), two variants of CO_2 effect (included/excluded), for species groups (conifers/broadleaves), and CZ NUTS2 regions. For CBM-CZ use, were aggregated to five distinct climate units (CLUs), affecting three coniferous and four broadleaved tree species groups. The implemented effect on growth is shown in *Figure 17.*

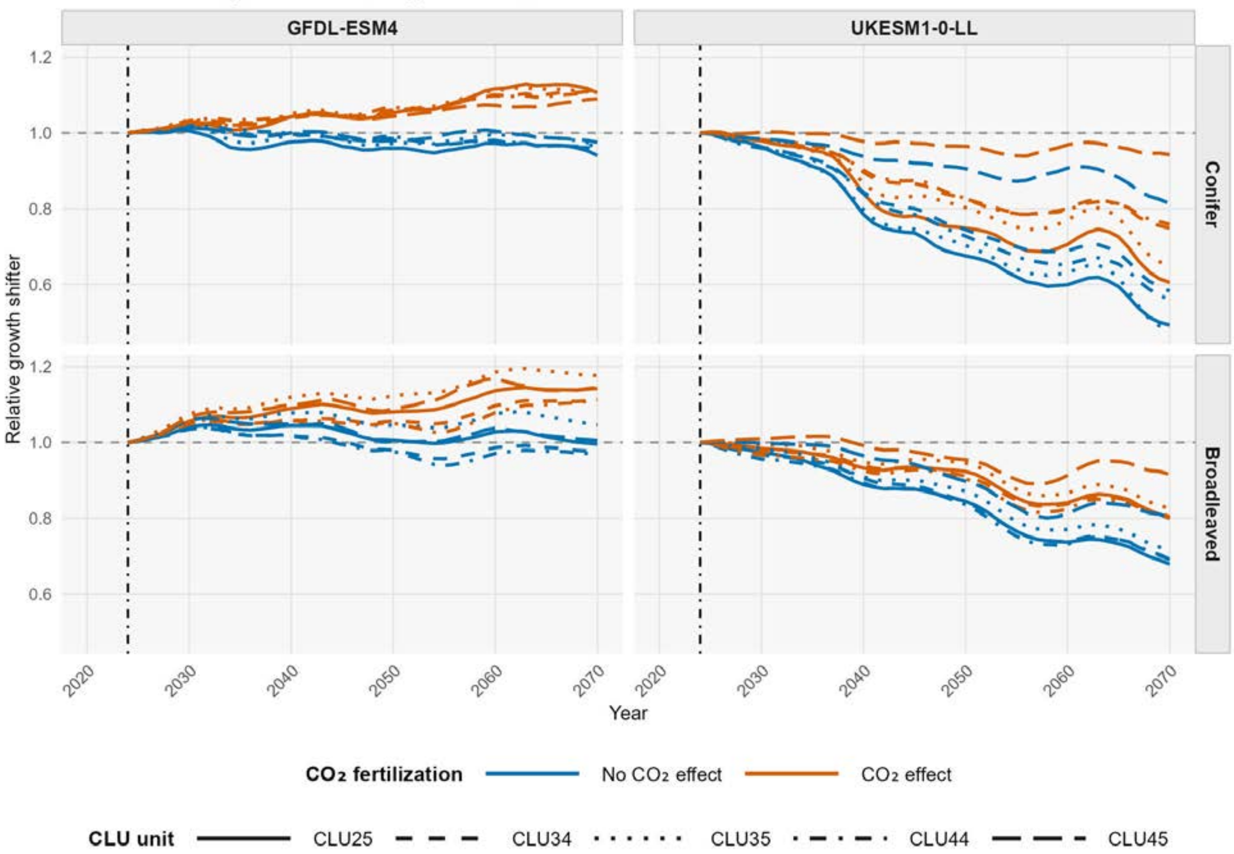


Figure 17: Relative growth shifter input for the Czech Republic from 2024 – 2070, after redistribution to five climatic units (CLUs) shown by Global Climate Model and tree species groups, with highlighted CO_2 effect – included/excluded by blue/orange colours. Mean over NUTS2 regions within CLU.

Annual mean air temperature for the 14 Czech NUTS3 regions was constructed as a continuous bias-corrected series covering 2010–2070, combining observed station-based data from the Czech Hydrometeorological Institute (2010–2024) with climate model projections from two GCMs (GFDL-ESM4 and UKESM1-0-LL, SSP2-4.5) provided by the ForestNavigator project. Since projections are available only at the coarser NUTS2 level, a bias correction was applied to each NUTS3 × GCM combination by independently extrapolating linear temperature trends from both the observed and projected series to their junction point at 2024.5, thereby avoiding contamination by the warming trend or by the anomalously warm year 2024. Both smoothed (5-year centred moving average) and unsmoothed (raw annual) forms were produced, with the smoothed series used as climate input for CBM-CFS3, providing region- and scenario-specific temperature forcing for each of the two GCM pathways throughout the projection period.

Baseline normalization

The bias-corrected smoothed temperature series described above was used as the default climate input for CBM-CZ and for all scenarios presented in this deliverable (D8.1). Additionally, comparative runs using the bias-corrected unsmoothed annual series were performed to assess the sensitivity of modelled emissions to the choice of temperature input resolution.

Implementation of natural disturbance inputs

Biotic disturbance intensity for the projection period (2025–2070) was represented by a combined wind and bark beetle disturbance index (wind_bb) derived from the ForestNavigator mortality output, available for four scenario combinations covering two GCMs (GFDL-ESM4, UKESM1-0-LL) and two CO_2 fertilisation options (*Figure 18*). The index serves as a national-level annual multiplier that shifts the composition of harvest between salvage logging and planned silvicultural operations (thinning and final cut). The reference harvest composition was established from the pre-calamity period 2011–2014, from which a national salvage logging share was derived per species group. For each projection year, the new salvage harvest was computed by scaling the total harvest capacity at each NUTS3 × species level by this reference share and the annual disturbance index, with the result capped at the original total harvest capacity of that cell. When salvage demand reached this cap, thinning and final cut were set to zero, reflecting extreme disturbance conditions where salvage fully displaces planned silvicultural operations. Additionally, an extreme scenario extension was applied to the UKESM scenarios, introducing a national-level harvest capacity threshold of 3 Mt C/yr for spruce salvage; amounts exceeding this threshold were redistributed to standing dead and lagged salvage disturbance types rather than counted as immediate timber removal. To avoid an abrupt compositional shift at the start of the projection, species shares within each NUTS3 × harvest type group were linearly interpolated across a ten-year transition window (2025–2034), blending the 2024 observed composition with the stable projected composition emerging from year 2035 onward.

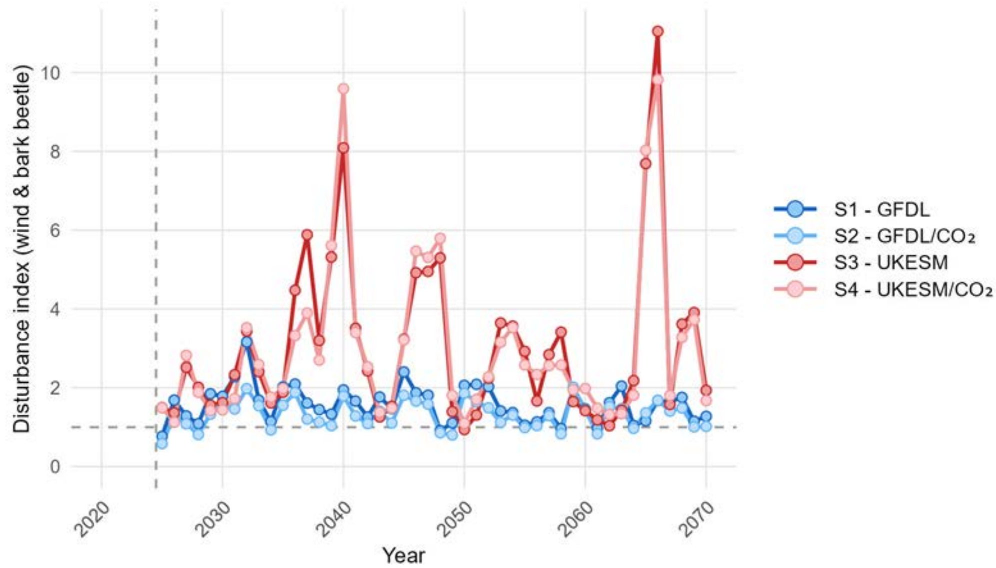


Figure 18: Biotic disturbance index for GCM scenarios and CO_2 variants (included/excluded) implemented to CBM-CZ projections.

Deviations/limitations

Apart from the implemented harvest capacity limit for extreme disturbance events as described above and related details on harvest type (salvage/planned) distribution, no other specific deviations and limitations were used.

CBM-IE

Climate inputs

The impacts of climate change on forest growth (GAI) under the GDFL-ESM4 and UKESM1 scenarios were modelled using species-specific growth shifters for conifers and broadleaves provided by G4M-X. These growth shifters, expressed as relative ratios, were applied in CBM-IE as growth multipliers and triggered through a disturbance event in 2024.

The influence of climate change on the DOM pool was modelled by using annual temperature projections from the respective climate change scenarios. For the historical period prior to 2024, annual temperature was fixed at 10 ºC, consistent with the CBM-IE configuration used in the Irish GHG inventory (Black et al., 2025). In addition, CBM-IE employs modified DOM base decay and transfer rate parameters for DOM pools that differ from the default values used in CBM-CFS3 (see Black et al., 2025). These modified parameters were retained throughout the simulations.

There was no attempt to normalise or smooth the projected annual temperature inputs before CBM-IE model runs.

Implementation of natural disturbance inputs

Ireland experienced a low occurrence of wildfires, varying from 22 to 1,980 ha per year. Interannual variation of wildfire areas under different climate change scenarios was implemented using a fire shifter ratio provided by climate change model outputs, which was applied to the mean historical wildfire area for 2006-2023. Wildfire disturbances were based on the fire shifter-adjusted areas, targets implemented randomly across all species types and age classes in CBM-IE.

Windthrow is the only significant natural disturbance affecting Irish forestry. The climate change impacts of extreme windthrow events, on an annual basis, are not provided by the G4M-X climate inputs because of large uncertainties in windspeed projections from the climate change models. Therefore, we implemented one extreme windthrow event in 2046 based on a climate change scenario-specific target windthrow area provided by G4M-X. The windthrow areas were converted to a target merchantable volume for windthrow using historical windthrow data from Storm Darwin in 2018. Windthrow events were then applied in the model using a windthrow disturbance matrix, where all biomass pools are transferred to the DOM pool (D6.3). The windthrow disturbance was only applied to conifer stands between 20 and 50-years old, which are more prone to windthrow events, and 1/3 of the windblown merchantable timber was salvage logged in the year the windthrow event was triggered. The remaining 2/3 of salvage logging volume was removed in the following 3 years after the windthrow event. All salvage logging was assumed to occur in addition to the scheduled target harvest set by G4M-X. Salvage logged areas were replanted with the same species after harvest.

Deviations/limitations

The growth multiplier approach in CBM-IE applies a different shifter value each year after the disturbance event is triggered in 2024. However, there was an implementation conflict for the application of the annual growth shifter to newly afforested land after 2024. Therefore, a 10-year mean growth shifter ratio was applied to newly afforested lands at 10-year intervals after 2024.

The impact of climate change in natural mortality, assumed to be represented by a deviation in the ratio (mortality shifter) of salvage logging, relative to a historical mean salvage logging value, could not be implemented because there is no detailed information on annual salvage logging in Ireland, besides storm Darwin windthrow events in 2018.

The climate change impacts on emissions from organic soils has not been considered because there is no information on the climate change impact on water table depth. This is a major limitation because emissions from organic soils are significantly affected by water table depth (Hökkä et al., 2016).

CBM-IT

Ancillary input data made available by climate models, spanning the interval 2024 - 2070, were implemented with two specific model runs based on GFDL-ESM4 and UKESM1-0-LL, excluding additional effects due to CO2 fertilisation. Both case studies applied the same amount of harvest, silvicultural parameters, and afforestation/deforestation rates defined within the previous scenario (Policy Reference).

To simulate the expected effects of climate on mean annual temperature (MAT) and total annual precipitation (P), MAT and P are considered constant until 2024. Starting from 2025, their values change in proportion to the relative variations indicated by each climatic data series, already scaled at the regional (NUTS 2) level and spanned between original climatic units, as defined within the CBM modelling framework applied to the Italian case study.

Growth multipliers data series provided by each climate model, already scaled at NUTS 2 level and distinguished between broadleaves and coniferous group of species, were preliminarily distributed between the various Spatial Units[ii], as defined within the CBM modelling framework, and directly applied to each model run.

The area affected by wildfires within the simulation period 2024 - 2070 was modified according to the following assumptions:

1. The area was preliminarily extracted from the latest data available at the national level[iii], the distribution of area affected by wildfires in Italy in the year 2024, distinguished by regions and species composition (broadleaves/conifers). This proportion was applied for the entire time series 2024 - 2070.
2. Assuming the year 2024 as the reference year for each climatic scenario, the area affected by wildfires, for each region and species group, varies within the period 2025 - 2070, according to the relative variation reported from each climatic model.

[ii] Spatial Units are defined by the intersection of administrative (i.e., NUTS2 regions) and climatic units.

[iii] AA.VV., (2025). Ecosistemi terrestri ed incendi boschivi in Italia: Anno 2024. ISPRA, 1, pg. 1-48.

3. The area affected by wildfires was further distributed between crown fires and underwood fires according to the proportion inferred from previous model assumptions, within the calibration period 2014-2023.
4. A minimum share of salvage logging was associated, within the entire model run (2005 – 2070), with crown fire disturbance events.

For modelling the expected impact of windstorms and bark beetle outbreaks, and consequent salvage logging, the following assumptions were applied:

1. The impact was extracted from the historical time series, referring to the area and merchantable volume affected by the 2018 windstorm (the only event in Italy within the calibration period) and bark beetle disturbance events within the following years.
2. The intensity of future disturbance events expected by each climate model was scaled against the merchantable volume affected by the corresponding disturbance event that occurred within the calibration period and proportionally converted to a corresponding amount of area affected by the same event. Both the windstorm and consequent insect outbreaks were assumed to affect the same regions and forest types as the 2018 windstorm, due to the lack of representative case studies within the calibration period.
3. As for these disturbance events, salvage logging was defined through the variable "area", starting from the first year following the windstorm event (which occurs in 2049, meaning salvage logging is applied from 2050 to 2056) while applying the same criteria defined for the calibration period.

3.2. Results

3.2.1. EU model projections

EU Policy Reference Scenario projection

The forest land emission profile (including biomass, litter and deadwood from forest land, afforestation and deforestation) from GLOBIOM-G4M-X shows that the implementation of the REF scenario can increase the forest removals of CO_2 both in the short and long terms. The main driver leading to this increase in removals is the reduction of harvest levels in the REF scenario compared to BASE. In the REF scenario, the EU27 removals reach -258 $MtCO_2$/year by 2030, -236 $MtCO_2$/year by 2040, -214 $MtCO_2$/year by 2050 and -190 $MtCO_2$/year by 2070 (*Figure 19*). During the projection period 2024-2070, the REF CO_2 removals increase by an average of -69 $MtCO_2$/year compared to BASE, for an average harvest reduction of 68 Mm^3/year. Overall, we can observe that the forest land removals remain relatively stable at over -200 $MtCO_2$/year under the REF, while they decline to -100 $MtCO_2$/year under the BASE.

Accordingly, the EU27 forest land stock will continue to increase also in the REF scenario but with a steeper pathway compared to that of the BASE scenario (*Figure 20*).

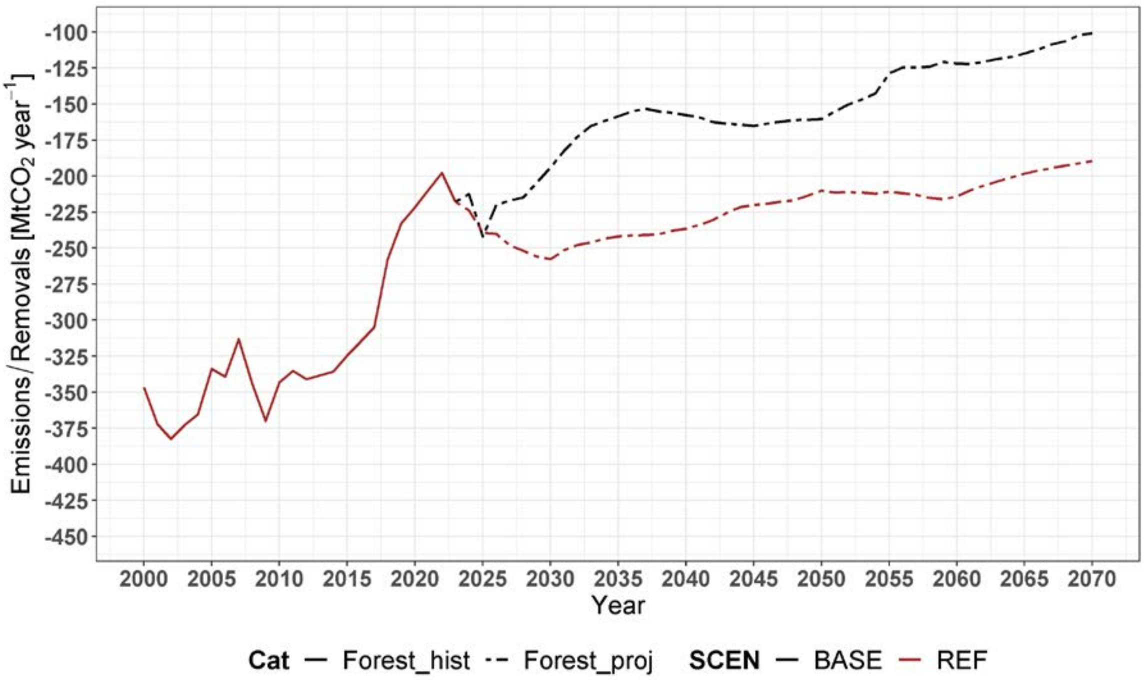


Figure 19: GLOBIOM-G4M-X projection of forest land emissions/removals according to the REF scenario compared to the BASE for the EU.

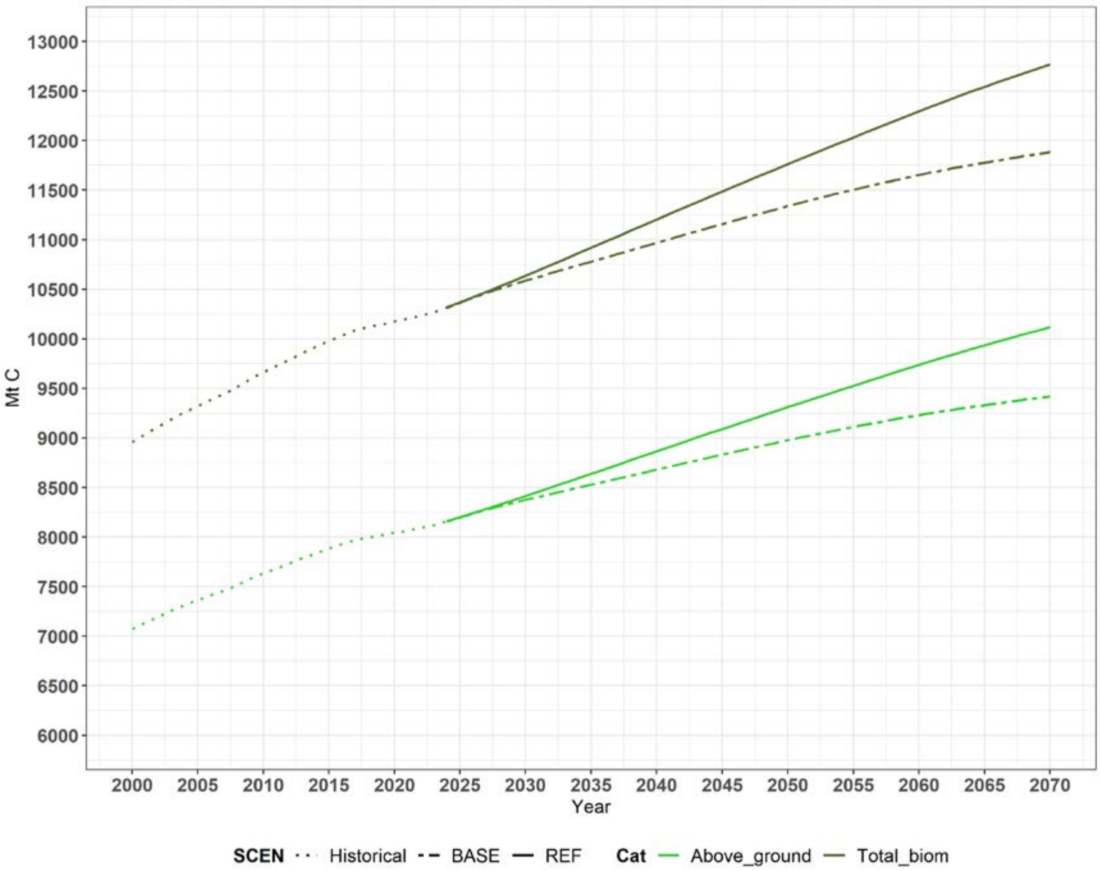


Figure 20: GLOBIOM-G4M-X projection of forest land carbon stock according to the REF scenario compared to the BASE for the EU (Above_ground = above ground biomass, Total_biom= total forest biomass).

The inclusion of the HWP pool in the removals provides an additional -26 to -31 $MtCO_2$/year on top of the forest land removals, with a rather stable contribution over time. The total removals from forest land and HWP amount to -286 $MtCO_2$/year by 2030, -267 $MtCO_2$/year by 2040, -240 $MtCO_2$/year by 2050 and -216 $MtCO_2$/year by 2070 (*Figure 21*).

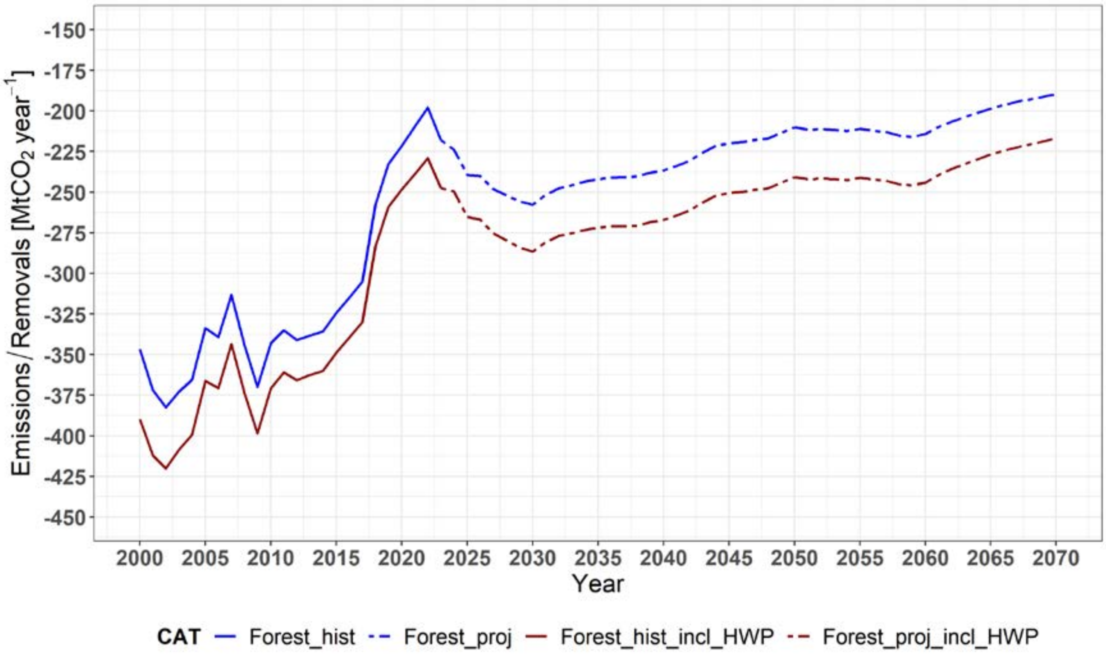


Figure 21: GLOBIOM-G4M-X projection of forest land and HWP emissions/removals according to the REF scenario for the EU.

After including the CO_2 emissions not covered by GLOBIOM-G4M-X (i.e. soil carbon) by shifting the output of the model to the UNFCCC GHGI levels[iv] (see detailed methodology in D6.3), the forest land total removals amount to -282 $MtCO_2$/year by 2030, -260 $MtCO_2$/year by 2040, -233 $MtCO_2$/year by 2050, and -213 $MtCO_2$/year by 2070 (*Figure 22*). The corresponding figures when summing the HWP pool to the forest land removals are -310 $MtCO_2$/year by 2030, -291 $MtCO_2$/year by 2040, -264 $MtCO_2$/year by 2050, and -241 $MtCO_2$/year by 2070 (*Figure 23*).

[iv] Revised shifting factors by MS were computed, summing up to 23.6 $MtCO_2 year^{-1}$ for forest land emissions.

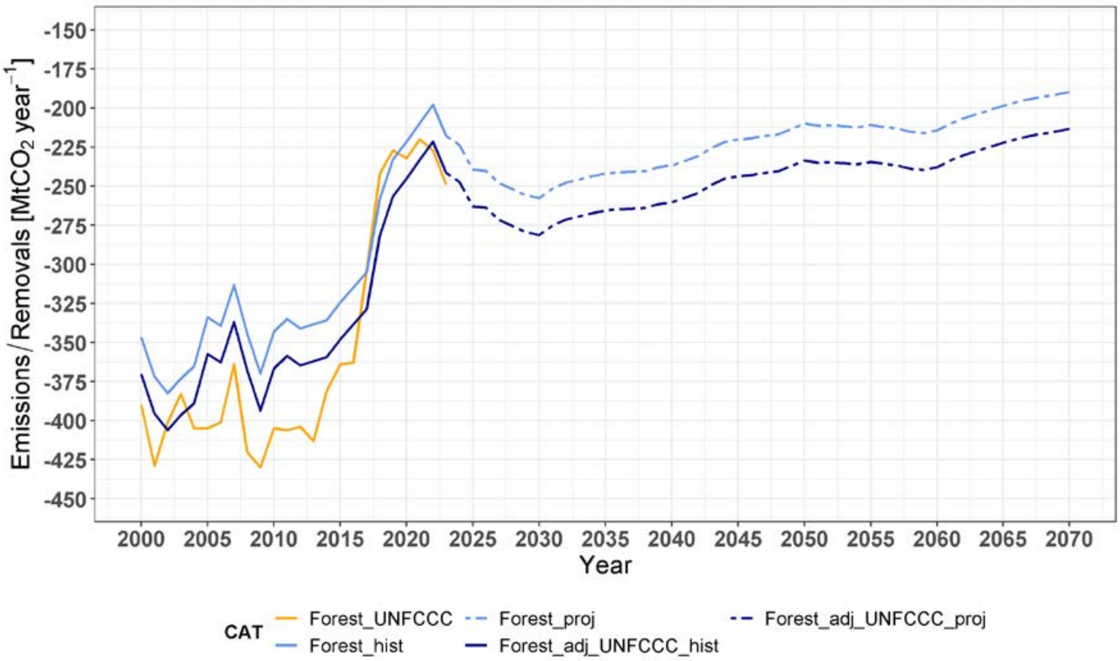


Figure 22: GLOBIOM-G4M-X projection of forest land emissions/removals according to the REF scenario before and after calibration to the UNFCCC GHGI inventories for the EU.

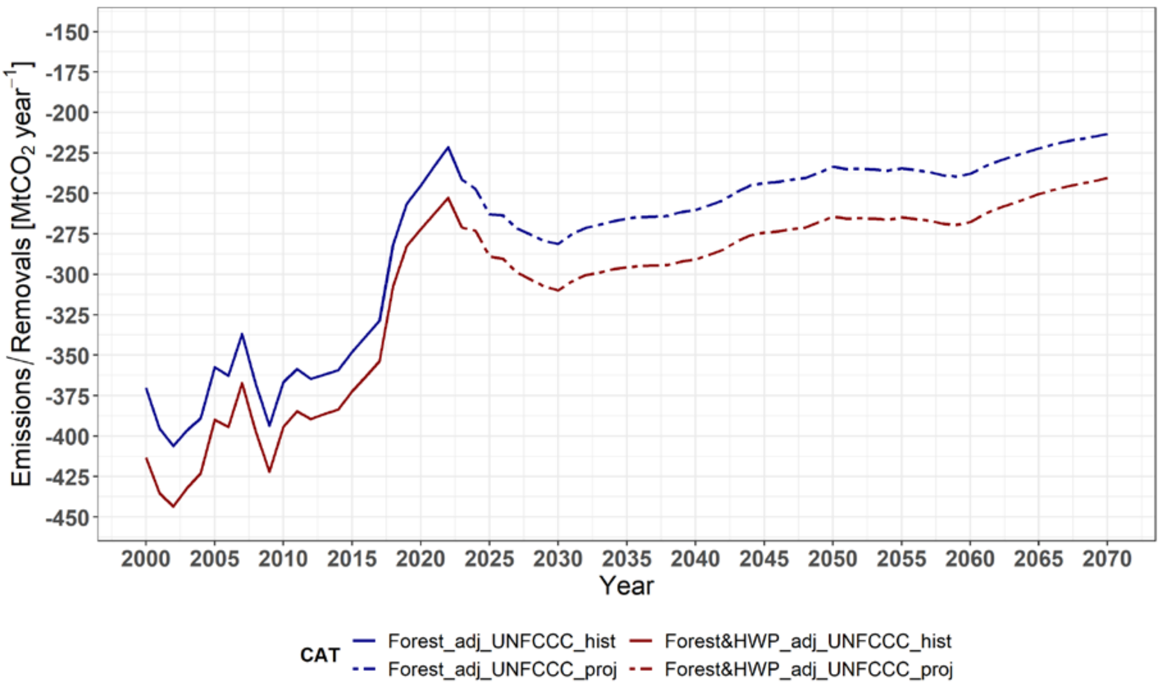


Figure 23: GLOBIOM-G4M-X model output, including forest land (top) and forest land and HWP (bottom) calibrated to the UNFCCC GHGI.

The difference between the REF and BASE scenario is maintained after including the HWP pool and aligning to the UNFCCC GHGI. Overall, the removals under the REF stabilize at ≈ -250 $MtCO_2$/year, compared to a decline to ≈ -160 $MtCO_2$/year under the BASE (*Figure 24*).

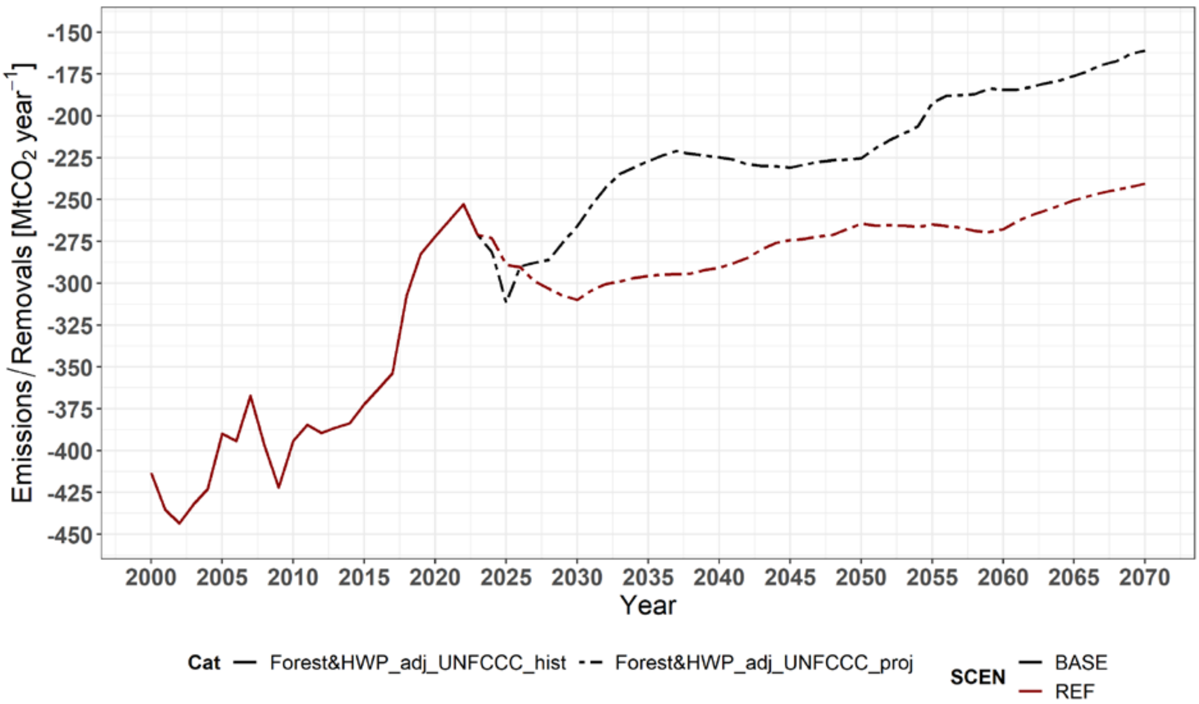


Figure 24: GLOBIOM-G4M-X model output, including forest land and HWP (bottom) calibrated to the UNFCCC GHGI comparison between the REF and BASE scenarios.

Member States Reference Policy Scenario projections

In this section, we present the projections for emissions and removals from GLOBIOM-G4M-X for each of the EU27 MS when implementing the REF scenario as a breakdown of the figures in the above section.

Generally, at the MS level, we also observe that the REF scenario allows for stabilising CO_2 removals; however, future trends at the MS level are also influenced by the country-specific forest age structures shaped by historical harvest and natural disturbances (*Figure 25-Figure 26*). Significant long-term improvements compared to the BASE can be observed in France and Germany, where the additional removals could exceed -20 $MtCO_2$/year by 2070. Large differences in the long term can also be observed in Romania, Poland, Sweden and Finland; however, the increases in removals are not sufficient to reverse the historical declines of the forest land sink.

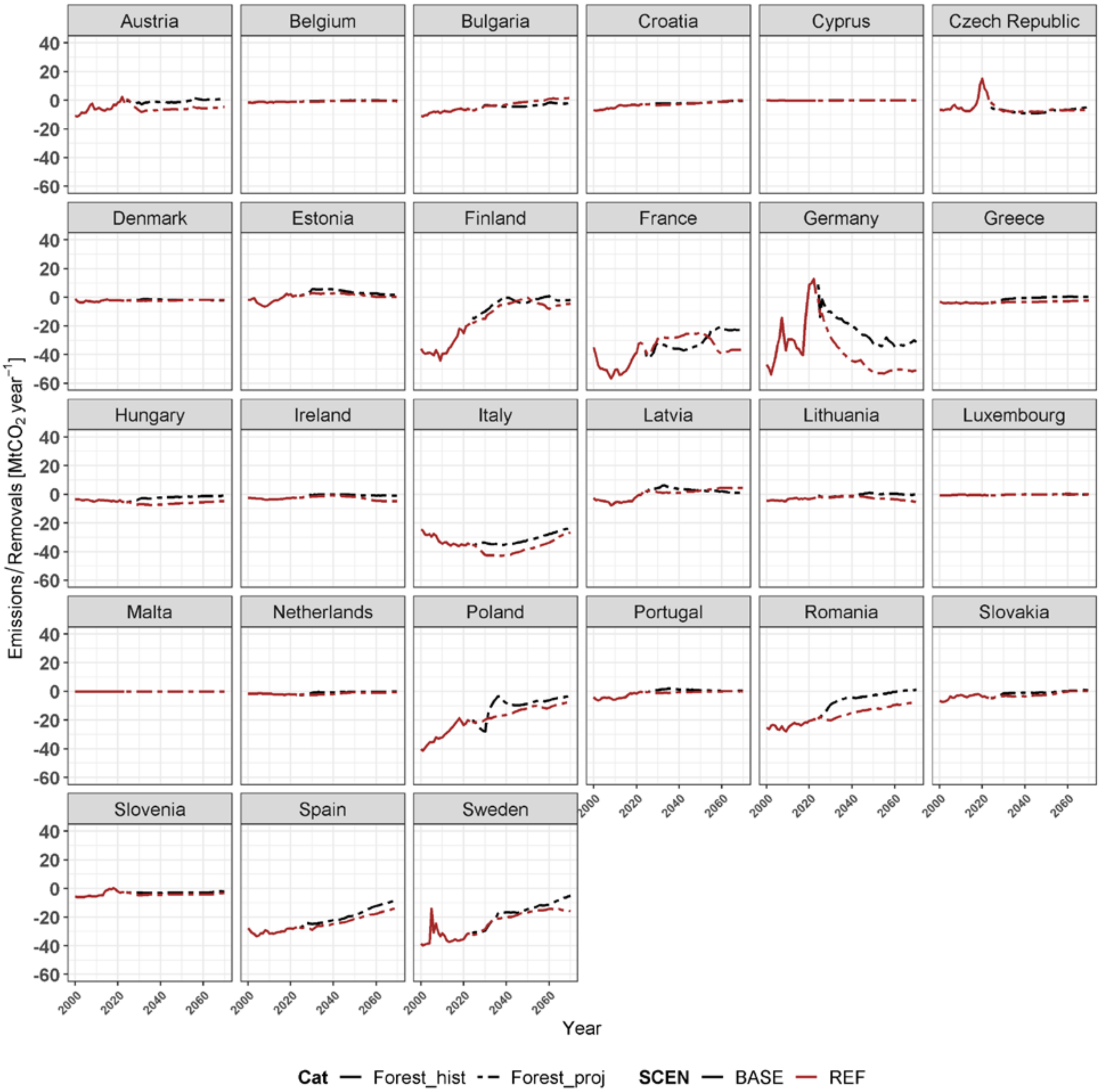


Figure 25: Forest land emissions and removals by Member State according to GLOBIOM-G4M-X.

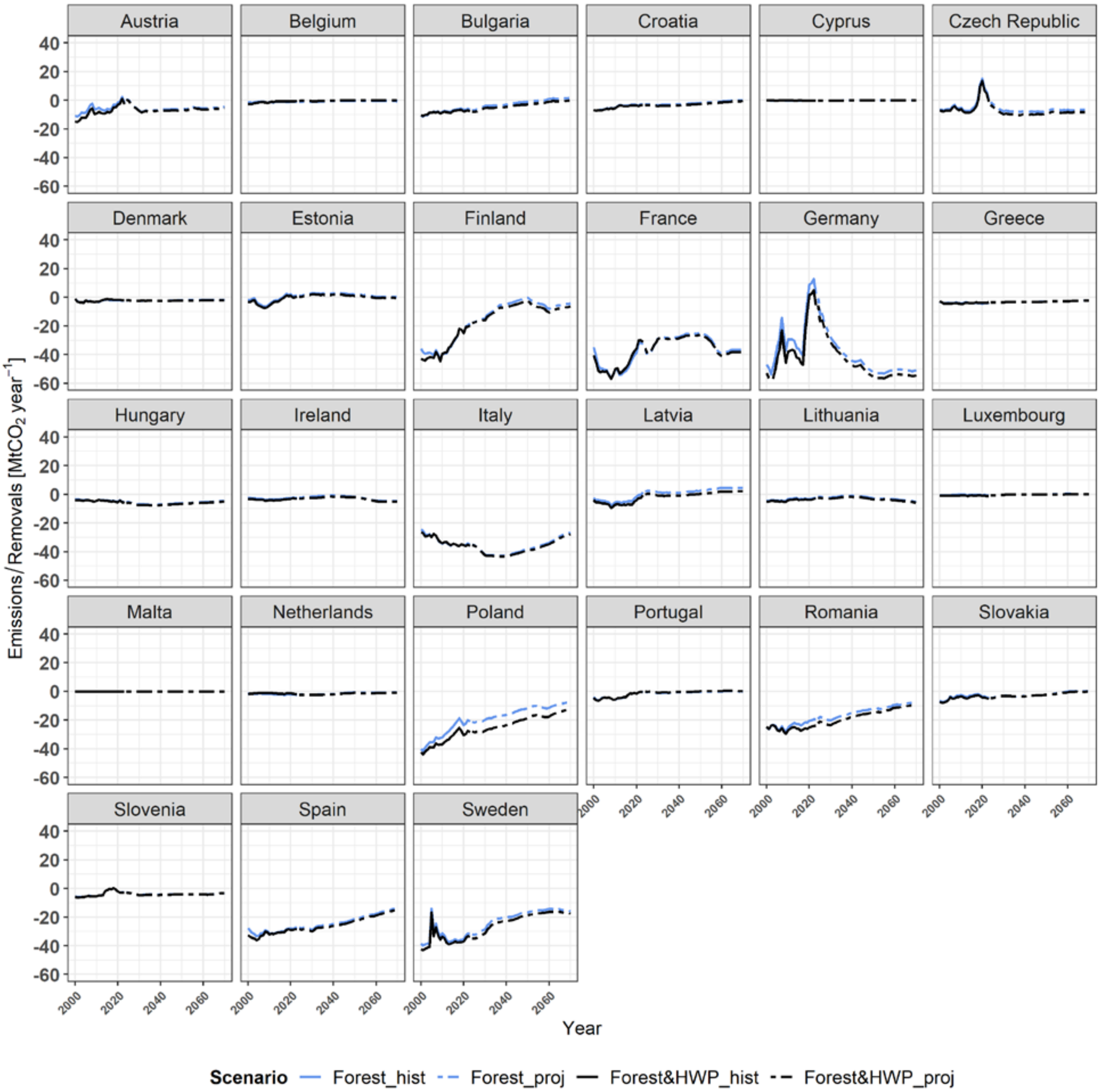


Figure 26: Forest land and HWP pool emissions and removals by Member State according to GLOBIOM-G4M-X.

After alignment of emissions and removals to the UNFCCC GHGI, we can observe that in the long term, the largest contributions to the EU removals can be expected in Germany, France, Italy and Spain. Contributions exceeding -20 $MtCO_2$/year can also be observed in Sweden, Poland and Romania. In these countries, the HWP pool also has a significant contribution (*Figure 27-Figure 28-*10).

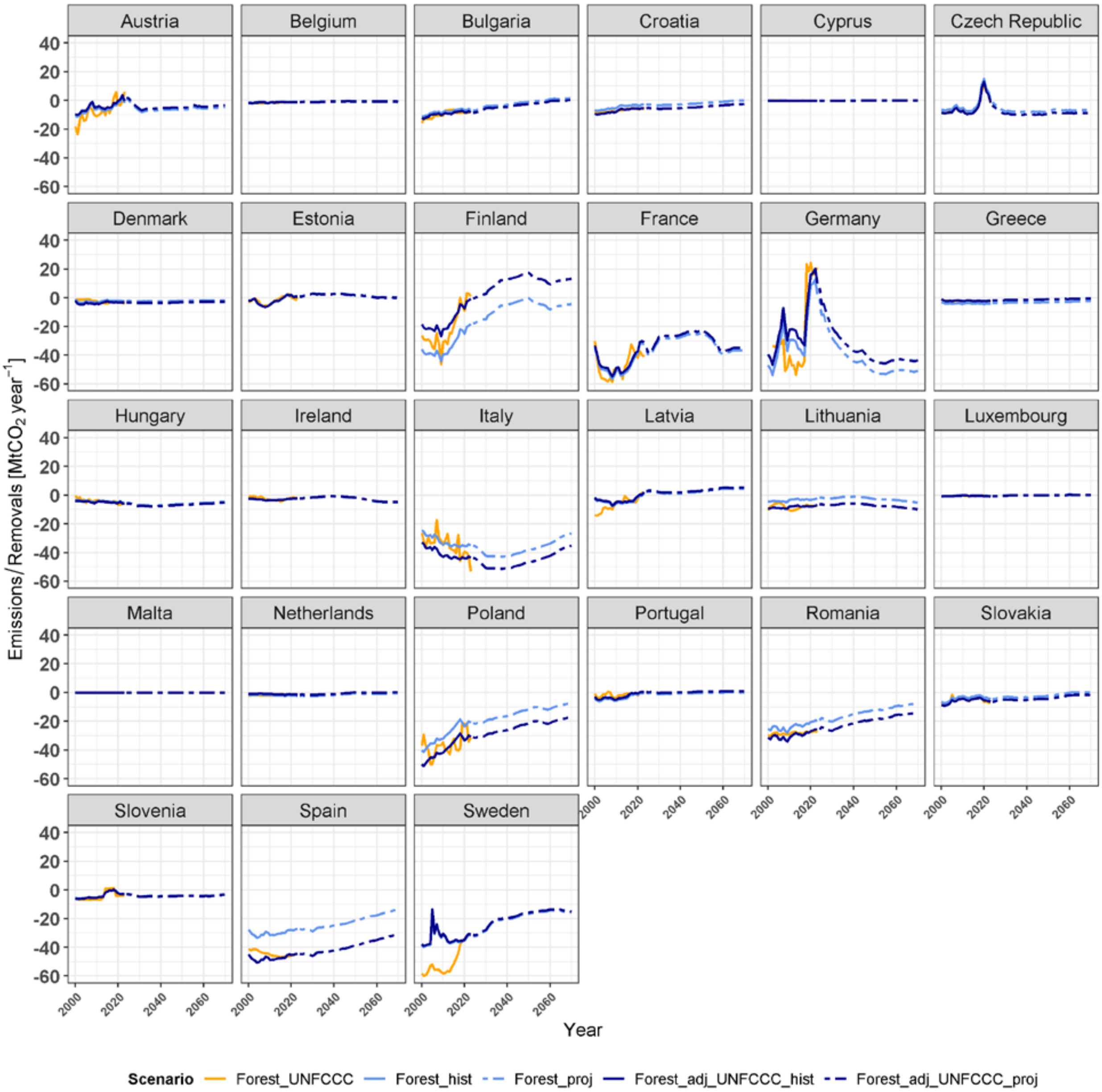


Figure 27: Forest land emissions and removals by MS calibrated to the UNFCCC GHGI.

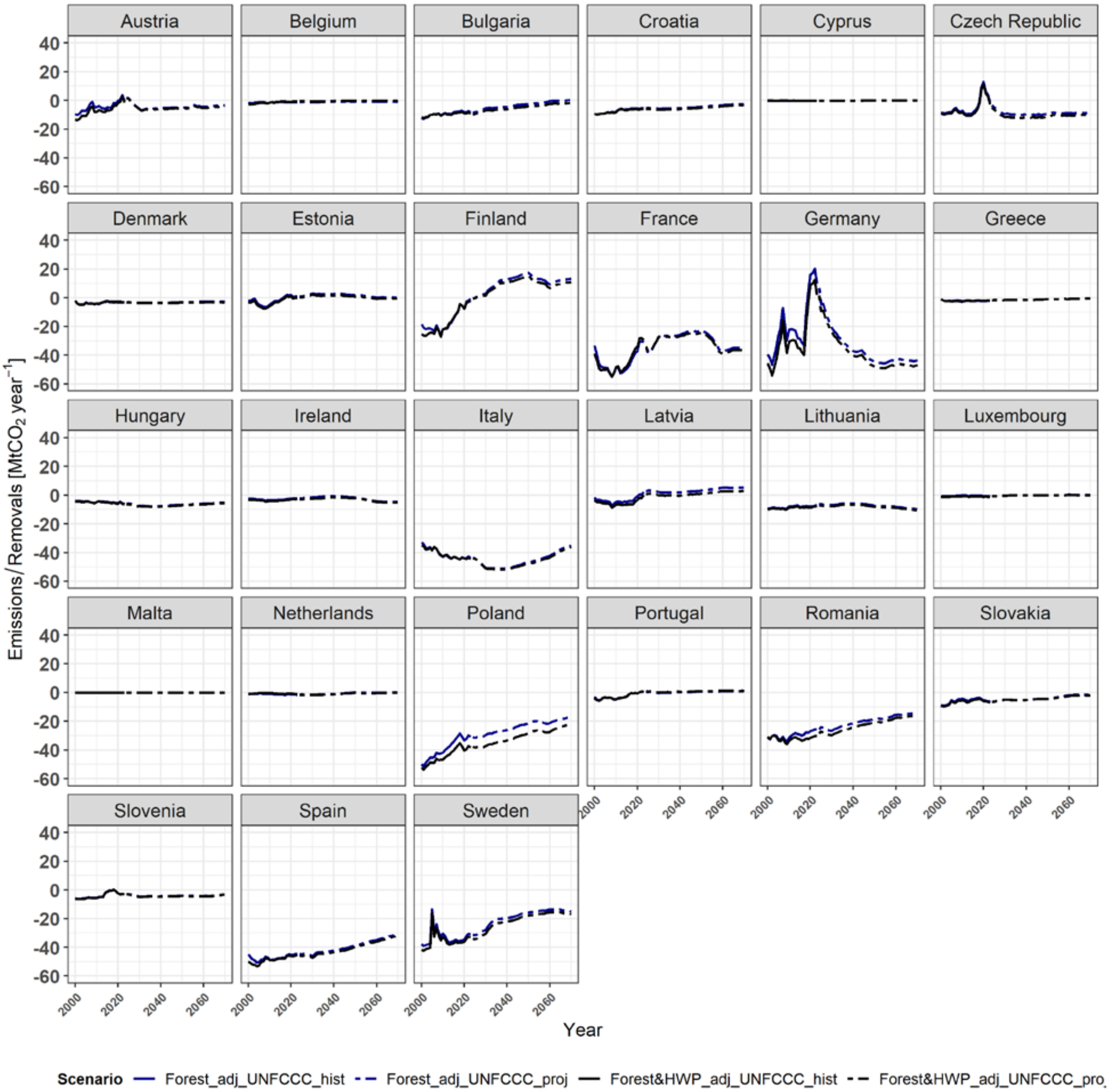


Figure 28: Forest land and HWP emissions and removals by Member State calibrated to the UNFCCC GHGI.

Climate change and natural disturbances' impact on the EU and Member States Reference Policy scenario

The inclusion of climate change and natural disturbance impacts in the GLOBIOM-G4M-X model reveals a very large range of uncertainty for the removals under the REF Scenario (*Figure 29*, *Table 11*). Stable or increasing removals can be achieved when considering the GFDL-GCM. In particular, when considering the GFDL and the potential CO_2 fertilisation effects, the forest land removals could exceed -350 $MtCO_2$/year in the long term (after 2050). However, when considering the UKESM climate model, we observe a potentially strong reduction of EU27 forest land removals, suggesting that forest land could potentially become a net source of emissions by 2050, particularly when excluding CO_2 fertilisation effects.

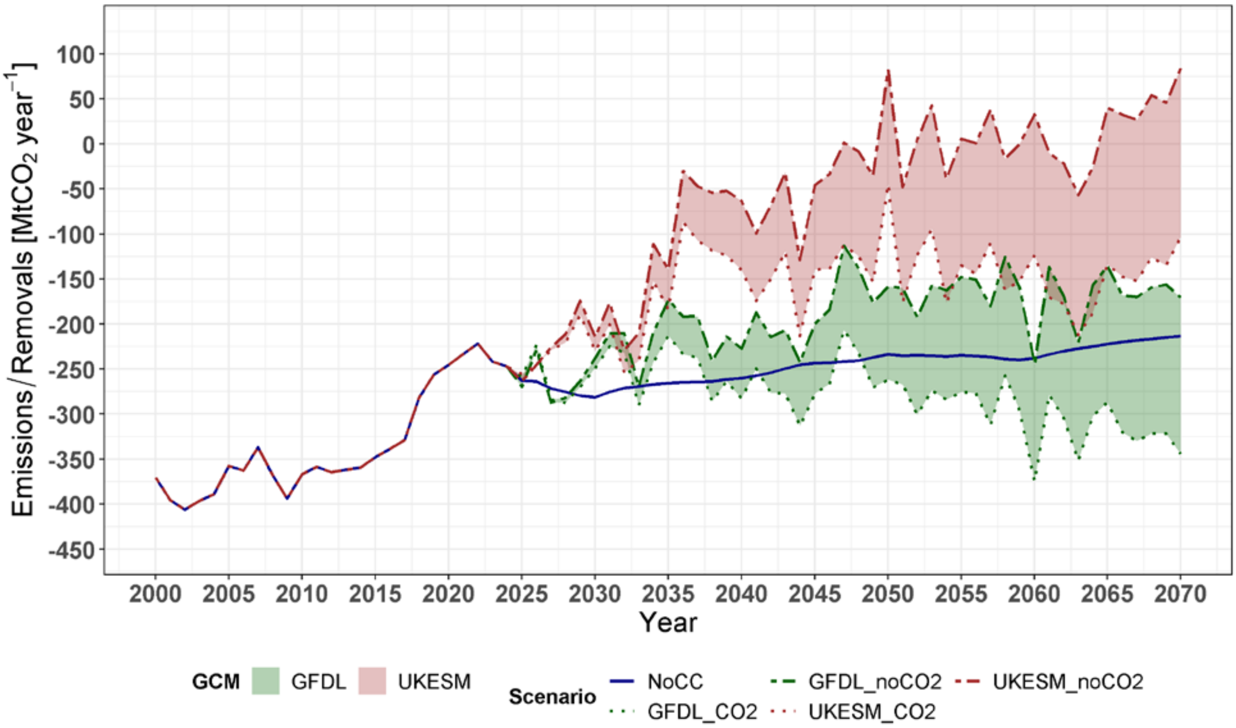


Figure 29: EU27 forest land emission profile (calibrated to UNFCCC GHGI) after the inclusion of climate change and natural disturbances according to RCP4.5 and under two alternative climate models (GFDL, UEKSM) and two different assumptions on CO_2 fertilisation effects (CO_2= CO_2 fertilisation effect included, $noCO_2$= CO_2 fertilisation effect excluded).

Table 11: Summary of total EU27 CO_2 emissions/removals (Mt CO_2 yr^{-1}) including forest land and HWP under the climate scenarios over the period 2025-2070.

Scenario	**2025**	**2050**	**2070**	**Mean 2025-2070**	**Range 2025-2070**
NoCC	-293.1	-268.4	-244.7	-279.8	-314.2 to -244.7
GFDL_CO2	-288.2	-296.8	-375.7	-311.5	-408.6 to -241.4
GFDL_noCO2	-300.1	-193.1	-201.8	-225.9	-318.7 to -147.9
UKESM_CO2	-285.8	-79.4	-134.8	-192.1	-287.7 to -79.4
UKESM_noCO2	-293.5	48.1	52.8	-90.6	-293.5 to 52.8

Unit: Mt CO_2 yr^{-1}. Total calculated emissions/removals. The total forest balance includes living biomass, deadwood, litter, harvested wood products and a statistical correction term. The statistical correction is fixed term across scenarios and years, as fixed statistical alignment to UNFCC GHGI (-23.6 $MtCO_2$ $year^{-1}$) for including emissions not directly

The development of single carbon pools underscores the differences between long-lived and short-lived carbon pools, with smoother reactions to disturbances for living biomass compared to the more rapid fluctuations leading to larger interannual variability for deadwood and litter pools (*Figure 30*).

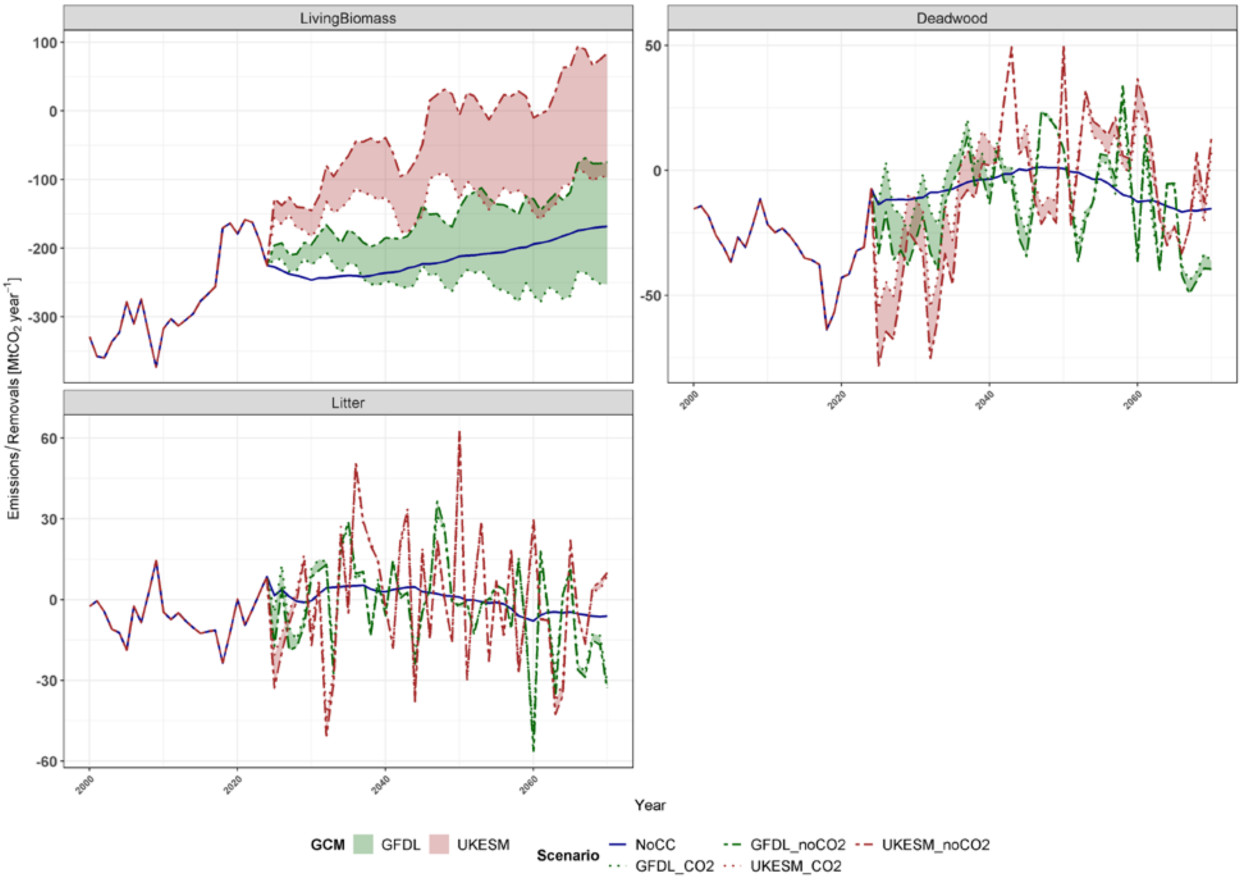


Figure 30: Development of EU forest living biomass, deadwood and litter carbon pools emissions and removals under of climate change and natural disturbances according to RCP4.5 and under two alternative climate models (GFDL, UEKSM) and two different assumptions on CO_2 fertilisation effects (CO_2= CO2 fertilisation effect included, noCO_2= CO_2 fertilisation effect excluded).

In the central and southern areas of the EU, the inclusion of climate change and disturbances (e.g. France, Germany, Italy) generally leads to relatively lower CO_2 removals compared to the original REF scenario (i.e. which does not account for climate change impacts), as a more unidirectional impact (i.e. only increases in CO_2 emissions relative to NoCC scenario without additional removals) (*Figure 31*). On the other hand, in the north of the EU (e.g. Finland, Sweden) we observe that the impacts of climate change and disturbances are dependent on the specific GCM and CO_2 fertilisation assumptions, with removals being higher/lower than the original REF scenario (*Figure 31*).

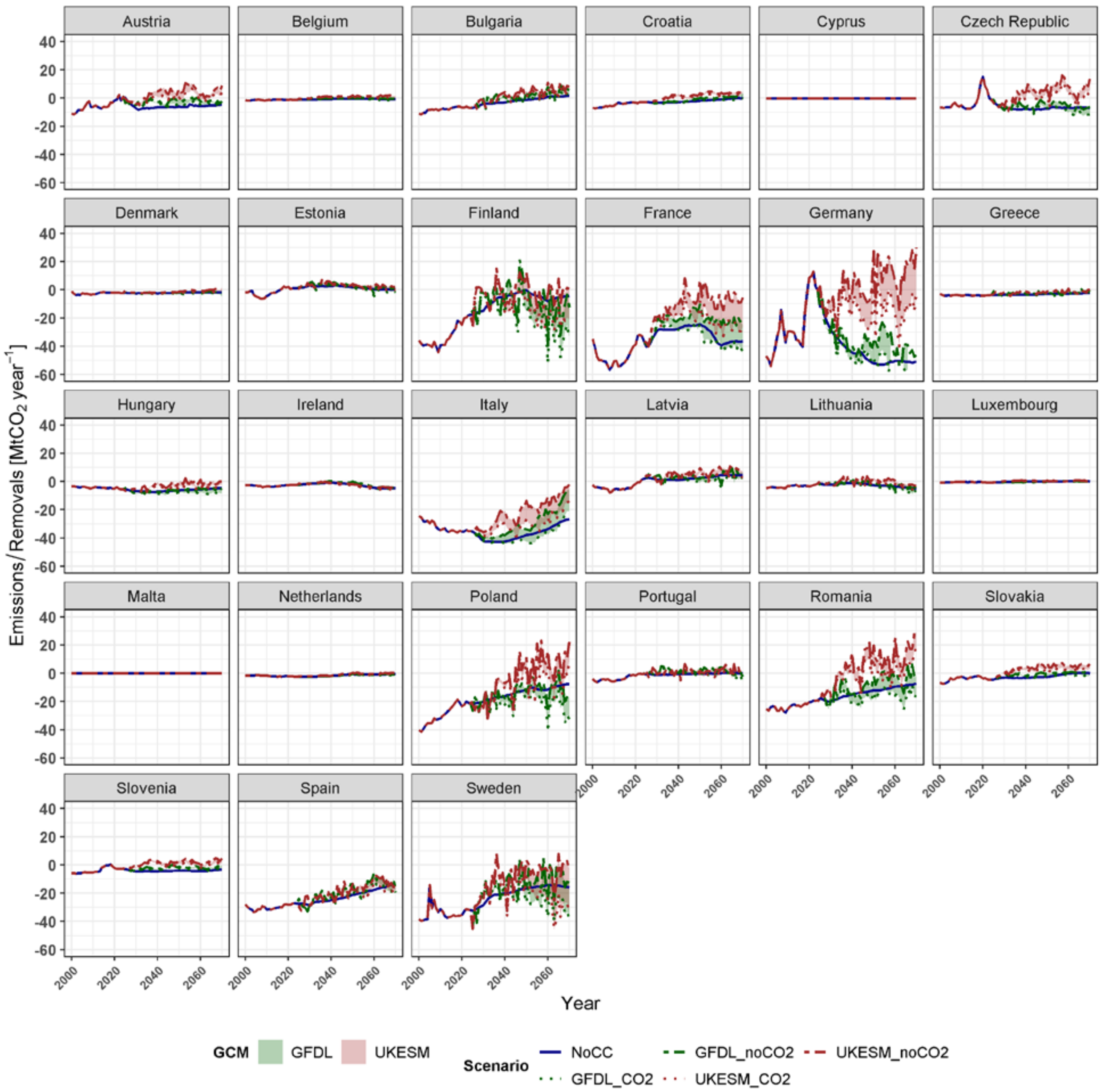


Figure 31: Member State forest land emission profile (calibrated to UNFCCC GHGI) after the inclusion of climate change and natural disturbances according to RCP4.5 and under two alternative climate models (GFDL, UEKSM) and two different assumptions on CO_2 fertilisation effects (CO_2= CO_2 fertilisation effect included, noCO_2= CO2 fertilisation effect excluded).

The G4M-X model was forced to the same level of wood demand and harvest under each scenario. However, in the most extreme disturbance scenarios, the total EU27 harvested wood volume exceeded by 5-7% the original demand (*Table 12*). The harvest volume created by additional disturbances was mostly buffered by the internally modelled reprioritisation of harvest areas, aiming to keep the total country harvest as close as possible to the original wood demand.

Table 12: Total EU27 projected harvested biomass volume (sum of roundwood over bark and logging residues) according to the climate change and disturbances scenarios.

Scenario	2025	2050	2070	Change 2025-2070
NoCC	594.0	642.6	593.5	-0.5
GFDL_CO2	596.7	669.7	620.1	23.4
GFDL_noCO2	599.2	673.8	617.0	17.8
UKESM_CO2	607.8	669.7	632.5	24.7
UKESM_noCO2	610.3	671.6	625.1	14.8

Unit: $Mm^3\ yr^{-1}$.

3.2.2. National models projections

CBM-CZ

Comparison of the baseline and policy reference scenario

Both the BASE and REF scenarios follow the recovery path of Czech forests after the historic drought-induced bark beetle calamity, which peaked in 2020 and temporarily brought the ecosystem CO_2 balance to source conditions. As harvests normalise from 2025 onward and afforested areas begin contributing to biomass accumulation, both the BASE and REF scenarios project a progressive strengthening of the forest carbon sink, reaching substantial net removals by 2070 (*Figure 32*). The REF scenario achieves a larger total removal (approximately −15 Mt CO_2 eq./yr for AR+FL combined) compared to the BASE scenario (approximately −14 Mt CO_2 eq./yr), with the difference mainly attributable to the additional afforested area under the REF scenario.

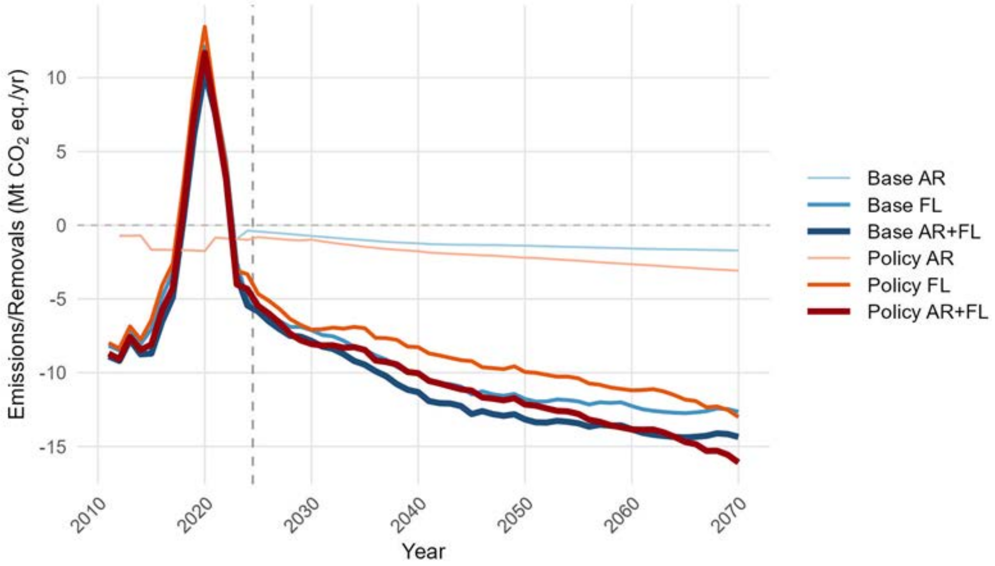


Figure 32: Total ecosystem CO_2 emissions and removals for Base (blue lines) and Policy Reference (red lines) scenarios. The specific contribution of Afforestation (AR) and forest land remaining forest land (FL) is discerned by different line thickness.

The two scenarios share a quantitatively similar — though not identical — total harvest demand trajectory, as visible in the harvest figure presented in the methodological section (*Figure 12*), with harvest residue extraction intensity remaining quantitatively similar between the two scenarios. The principal difference lies in the rate of afforestation: the REF scenario prescribes a substantially stronger afforestation programme, reaching approximately 175,000 ha of accumulated afforested area by 2070 compared to around 90,000 ha under the BASE scenario, while deforestation rates remain virtually identical between the two (*Figure 33*). Both scenarios implement the same adaptive forest management logic, whereby post-salvage regeneration on Norway spruce sites shifts progressively toward broadleaved species and fir, reflecting the national adaptation strategy. This results in a steady decline in the spruce area share from approximately 43% in 2011 to around 31% by 2070, with the REF scenario showing a marginally steeper decline driven by its larger afforestation component (*Figure 34*).

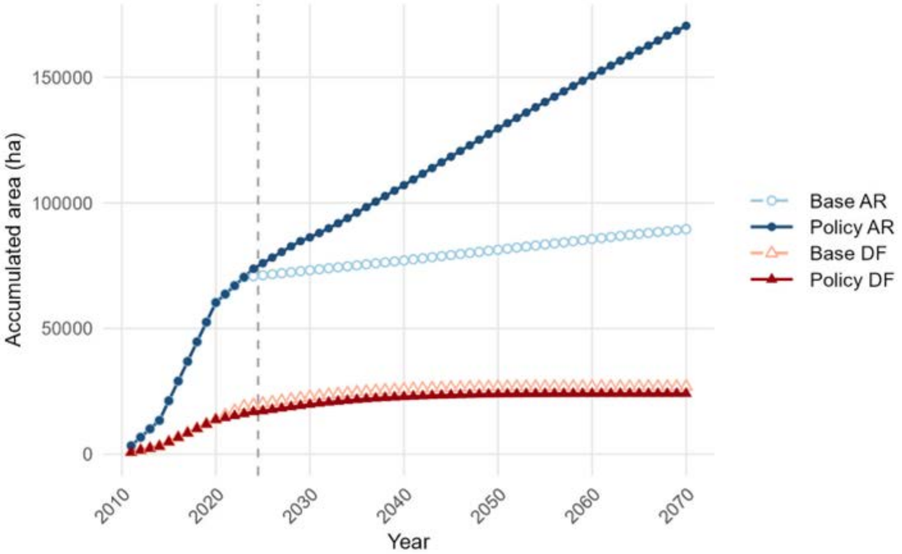


Figure 33: Afforestation (AR, blue colors) and deforestation (DF, red colors) areas under Base and Policy scenarios. The scenarios differ in the adopted AR rates, while DF remains roughly identical.

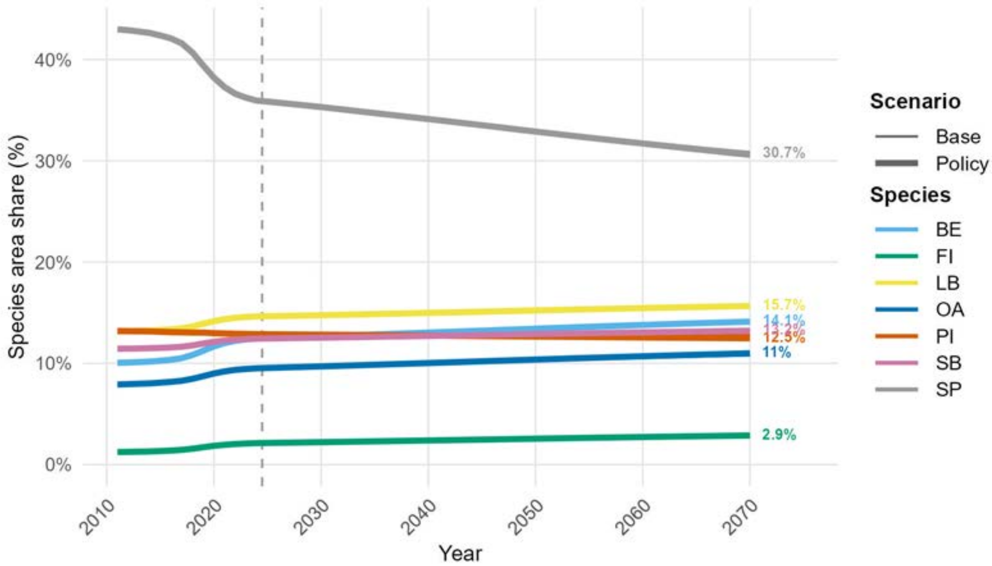


Figure 34: Changing species composition is implemented identically following the same adaptive strategy under both Base and Policy scenarios, and therefore the lines basically overlap and differences between them remain marginal. Most significant change is the anticipated reduction of spruce (SP) and proportionally increased share of broadleaved species (BE – Beech, OA – oaks, LB – long-lived broadleaved, SB – short-lived broadleaved) and firs (FI).

It is important to highlight that both scenarios represent an optimistic upper bound on sink potential rather than a realistic forecast. The projection period assumes flat mean air temperature (no further warming) from 2024 onward, no CO_2 fertilisation effect on growth, no changes in baseline growth rates, and no future disturbance events beyond the prescribed harvest. These conditions represent an optimistic development that would allow the forest sector to operate in a mostly undisturbed way. In light of this, these scenarios are not intended as stand-alone predictions, but rather as controlled reference trajectories against which the impact of climate change, CO_2 effects, and biotic disturbance — introduced in the subsequent climate scenario analyses — can be clearly isolated and quantified.

Policy and climate change projections

The four climate scenarios (S1–S4) diverge markedly from the REF scenario and from each other, reflecting the contrasting climate trajectories of the two GCMs (*Figure 35*). Under the GFDL-ESM4 model (S1, S2), the ecosystem CO_2 balance follows a trajectory broadly similar to the REF scenario, with a progressive strengthening of net removals through the projection period. The warmer and drier UKESM1-0-LL model (S3, S4), in contrast, drives repeated and severe disturbance peaks — particularly around 2040, 2050, and 2065 — that temporarily reverse the sink to a strong source, with peak emissions exceeding +20 Mt CO_2 eq./yr. These episodes reflect climate-driven increases in biotic disturbance intensity that the harvest capacity cannot fully absorb within a single year, directly mirroring the dynamics observed during the recent bark beetle calamity. The CO_2 fertilisation effect (S2 vs. S1; S4 vs. S3) provides a modest but consistent improvement in the carbon balance, slightly enhancing net removals under both GCM families, yet this benefit is small relative to the dominant contrast between the two climate models.

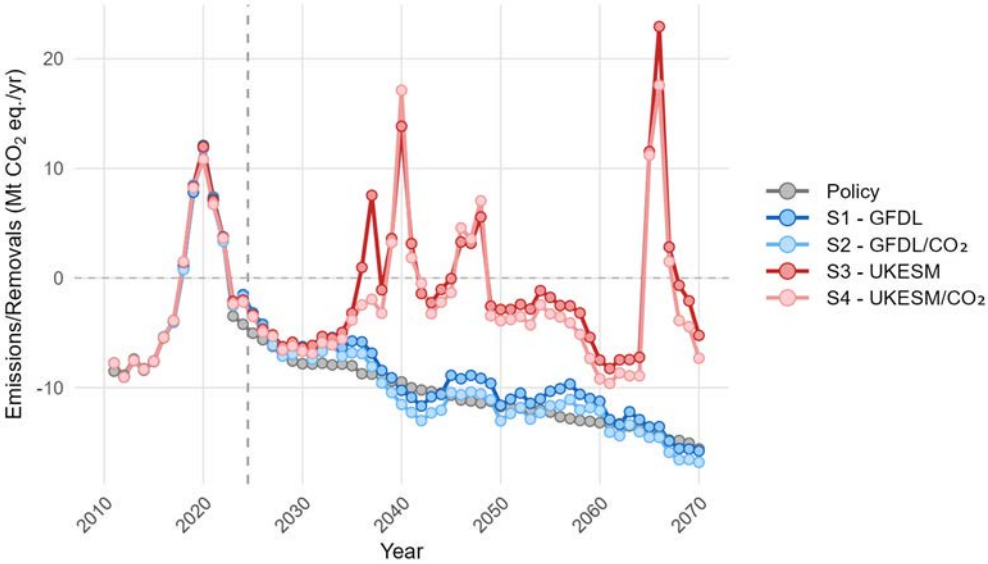


Figure 35: Emissions and removals for four climate scenarios relative to Policy reference (no climate change for projection period included in this reference). The scenarios include two GCMs (GFDL and UKESM), without or with CO_2 effect included.

The breakdown of the ecosystem balance by carbon pool (*Figure 36*) shows that during UKESM disturbance peaks, the loss of living biomass is accompanied by a corresponding increase in the deadwood pool — a direct model representation of tree dieback, where dying trees are transferred from living biomass to dead organic matter rather than being harvested. The total net balance (black line) therefore appears less extreme than the living biomass component alone, because carbon is redistributed within the ecosystem rather than lost from it. This pattern closely resembles the observed calamity period, where salvage logging could not keep pace with tree mortality. The GFDL scenarios show far more stable pool dynamics, with living biomass dominating a gradually increasing sink and dead organic matter (DOM) pools remaining close to equilibrium.

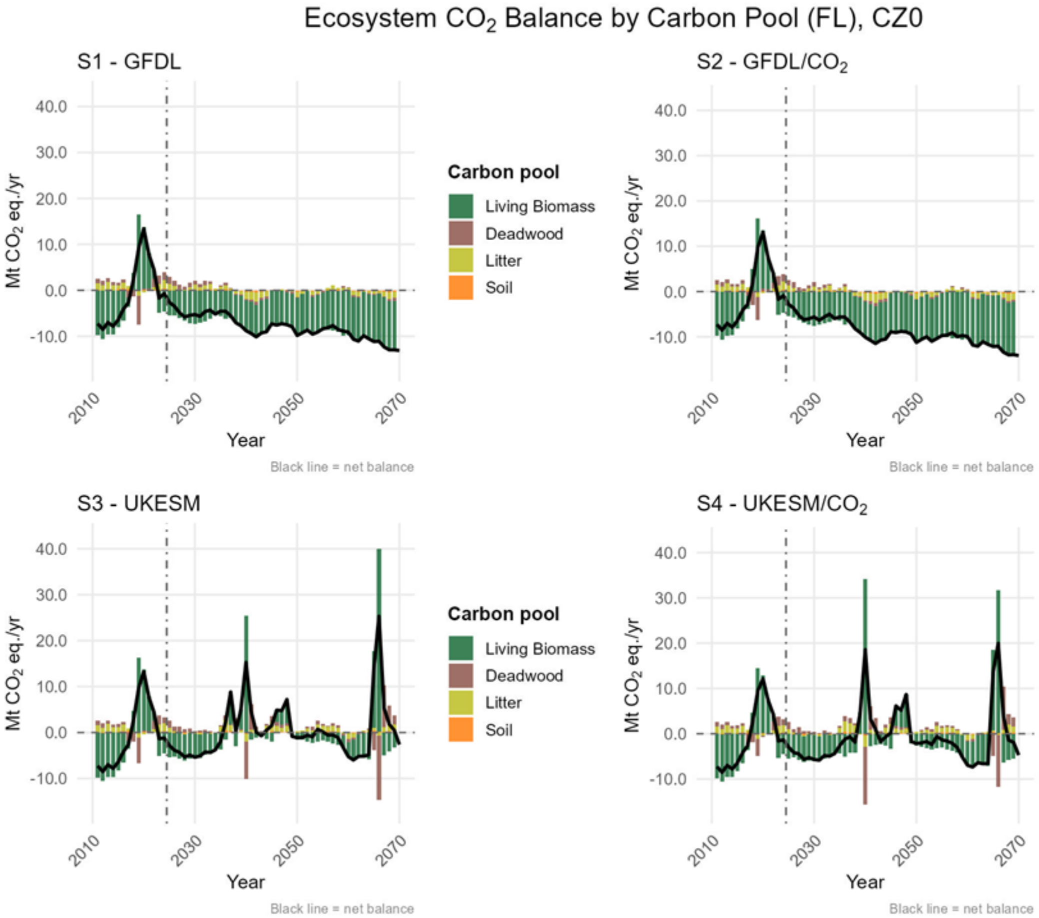


Figure 36: Ecosystem CO_2 balance by carbon pool at the country level for four climate scenarios (see *Figure 35* for scenario details).

The harvest composition figure (*Figure 37*) reinforces this interpretation. Under GFDL scenarios, salvage logging accounts for a moderate and stable share of total harvest through the projection period. Under UKESM, salvage logging repeatedly exceeds 50% of total harvest, and during disturbance peaks approaches or dominates the entire harvest volume — effectively displacing planned silvicultural operations (thinning and final cut) and converting forest management from a structured long-term programme into reactive crisis management. The figure also captures the role of snag cutting (dead standing trees logged with a one-year lag), which is visible as a sizeable component in the UKESM scenarios during extreme events, representing the portion of previous-year mortality that is recovered in subsequent years when salvage capacity becomes available.

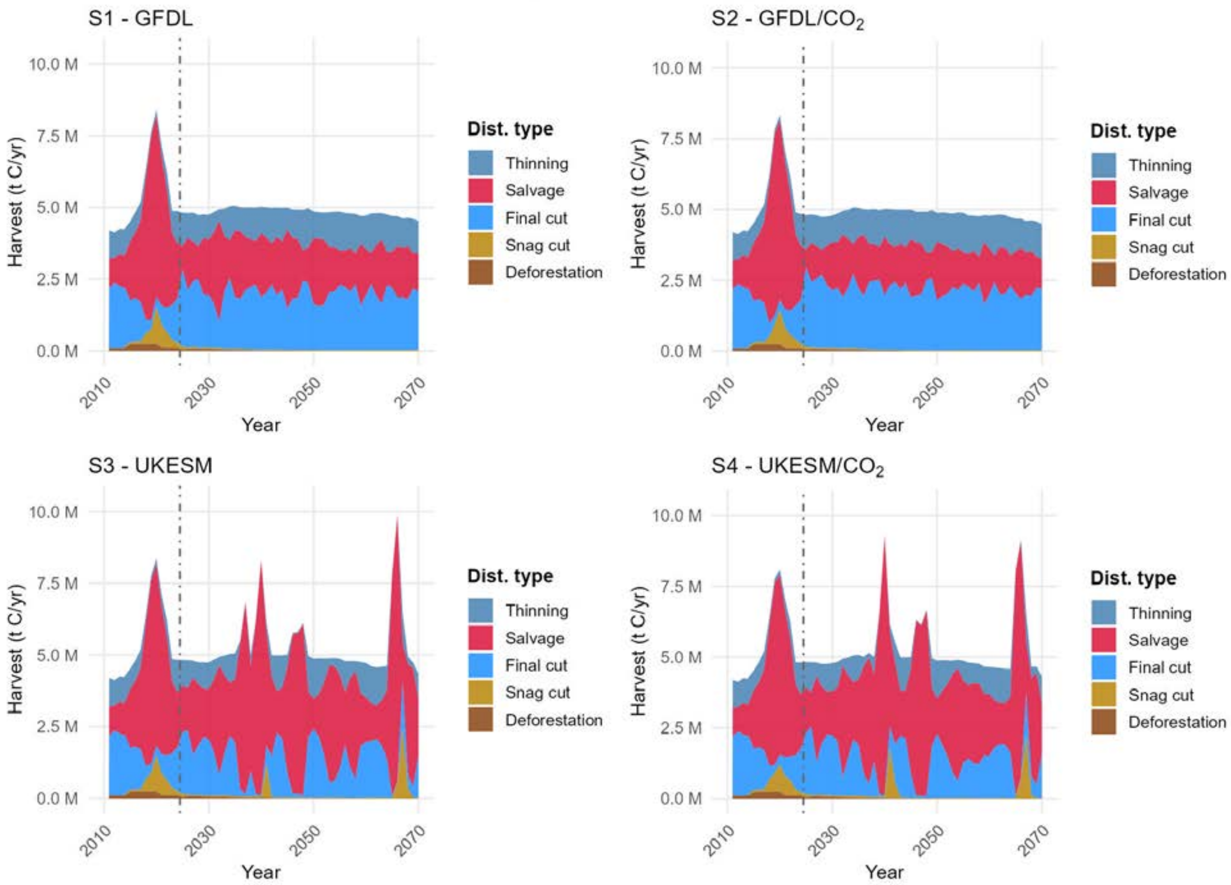


Figure 37: Harvest by disturbance types at the country level for four climate scenarios (see *Figure 35* for details)

Finally, a methodological note on the mean annual temperature (MAT) sensitivity (*Figure 38*). Using raw annual mean air temperature as direct forcing for soil and deadwood respiration — as in the S4/MAT variant — produces substantially higher interannual variability in DOM pool fluxes (including deadwood, litter and soil) compared to the smoothed temperature input, and shifts the long-term DOM balance toward greater emissions in warmer years. However, this likely overestimates the temperature sensitivity of decomposition in practice. Heterotrophic respiration in forest soils and deadwood is subject to thermal damping with depth: the surface litter layer responds rapidly to air temperature, but decomposition in deeper litter horizons, coarse woody debris, and mineral soil integrates temperature signals over longer time windows. Some form of temporal averaging of the temperature input is therefore both ecologically justified and necessary to retain realism in the modelled carbon fluxes — a centred moving average, as used in the standard runs, likely better represents the effective thermal environment experienced by the decomposer community across the full depth profile of the DOM system.

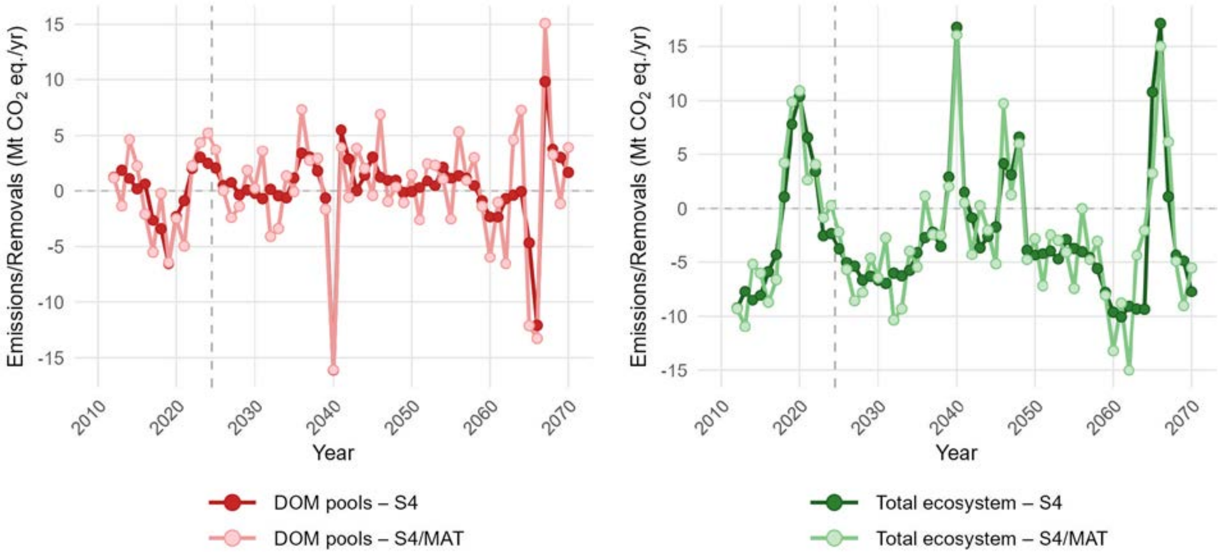


Figure 38: Effect of using 5-yr center smoothed vs. annual (MAT-labelled variant) air temperature input to CBM-CFS3 exemplified on the modelled fluxes for DOM (deadwood, litter, soil) polls (left) and as expressed in the total ecosystem exchange (right). Both example figures use the S4 – UKESM/CO_2 scenario.

CBM-IE

Comparison of the baseline and policy reference scenario

The GHG profiles from both the BASE and REF scenarios (*Figure 39*) are dominated by emissions from organic soils (ca. 2.8MtCO_2 per year) and changes in biomass removals driven by the level of harvest and future afforestation rates (*Figure 14*). The BASE scenario shows a transition from a net sink in 2024 to a net emission source by 2028, and the forest remains a net emission source until 2070. The REF scenario shows a slower transition to a small net emission source by 2039, followed by a recovery to a net sink, which is higher than the 2024 levels by 2070. Differences between the BASE and REF scenarios can be attributed to higher harvest and lower afforestation rates in the BASE, than in the REF scenario (*Figure 14*), which impacts the biomass sink (*Figure 39*).

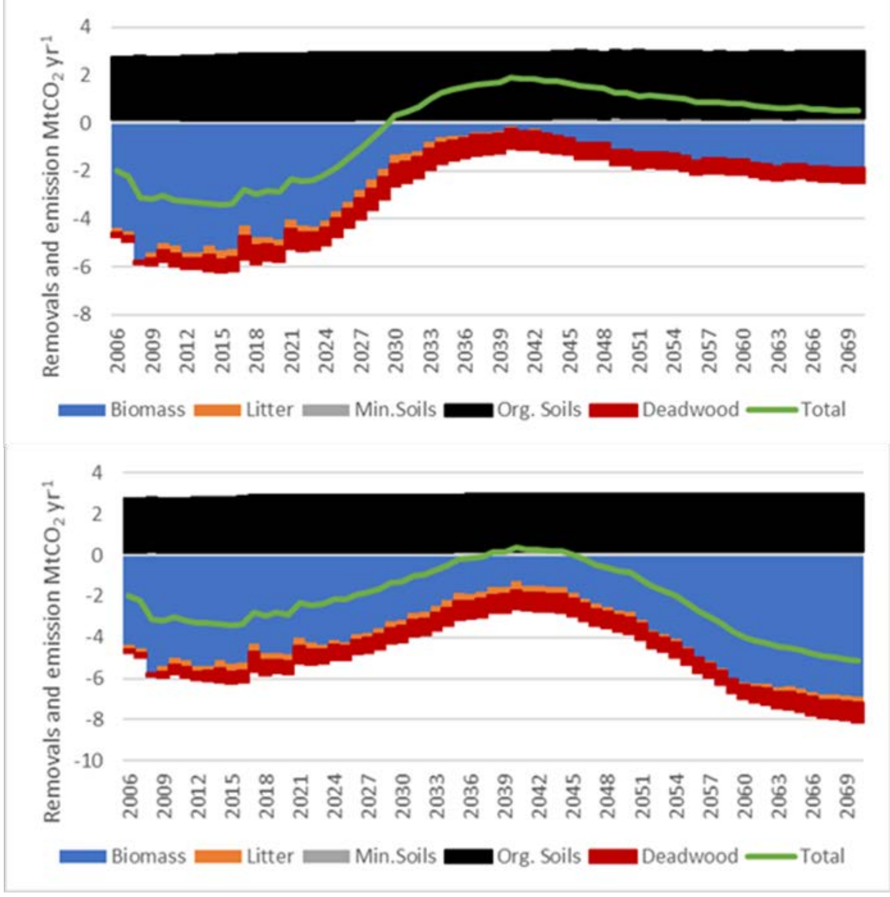


Figure 39: Comparison of GHG profiles for the baseline (top panel) and policy reference scenarios (bottom panel).

Policy and climate change projections

The climate change scenarios, including and excluding CO_2 fertilisation effects, on the total ecosystem flux for Ireland show marked interannual variations, when compared to the REF scenario (*Figure 40*). Total ecosystem fluxes include emissions from organic soils, which are assumed not to be impacted by climate change scenarios.

The impact of climate change growth shifters on biomass fluxes under the climate change scenarios, relative to the REF scenario, appears to be small and does not have a large effect on overall ecosystem fluxes (*Figure 40*). The GDFL and UKSME1 scenarios without CO_2 fertilisation (no CO_2) assumptions suggest that forest growth and biomass gains are slightly lower or equivalent to the REF scenario. The impact of CO_2 fertilisation, under both climate change scenarios, results in a slightly higher biomass sink, increasing over time. CO_2 fertilisation under the UKSME1 scenario appears to have the largest positive impact on NAI (data not shown) and biomass removals (Figure 13).

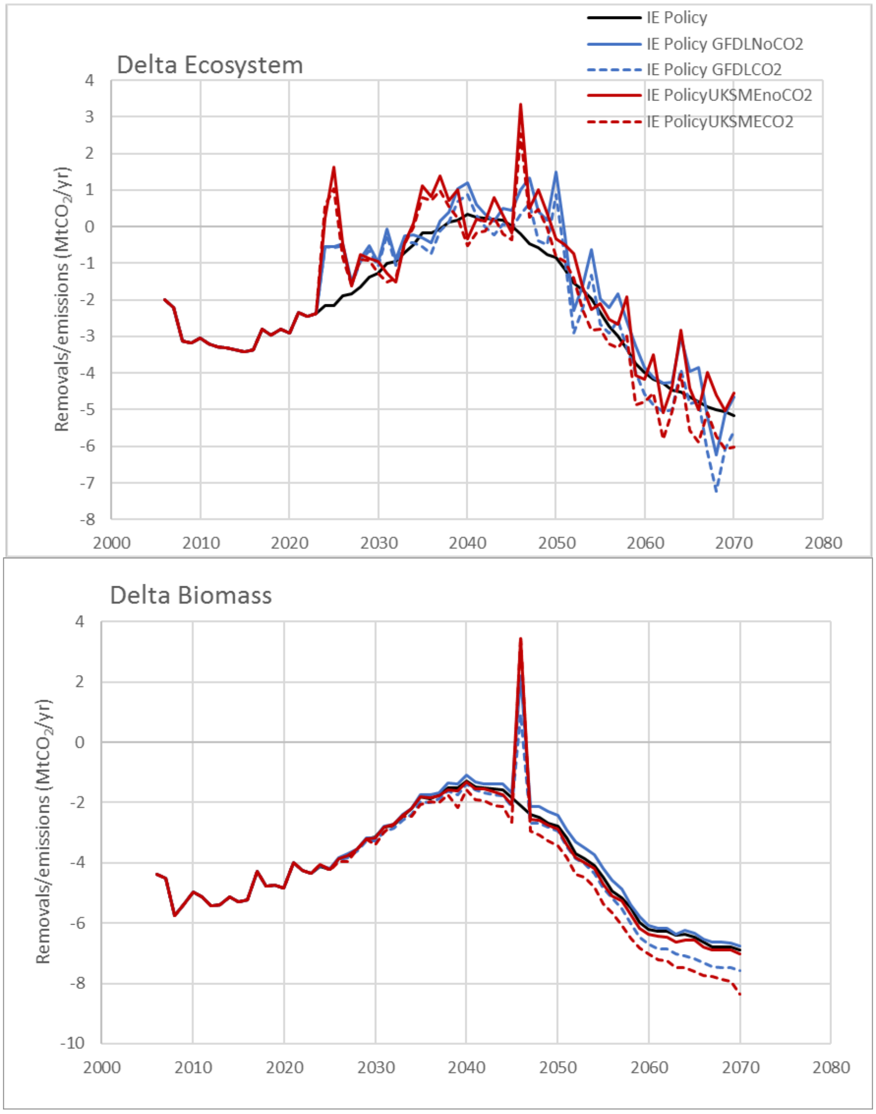


Figure 40: Total ecosystem (top panel) and biomass fluxes (bottom panel) for the policy reference and climate change scenarios.

The level of harvest is the same for all scenarios until the extreme windthrow event in 2046 is implemented, but resulting salvage logging in addition to scheduled harvest under the climate change scenarios has a large transient effect on biomass fluxes for the successive three years until 2049 (*Figure 40* and *Figure 41*). Salvage logging due to the extreme event resulted in an extra harvest of ca. 0.5 Mm^3 and 0.9Mm^3 for the GDFL and UKSME1 climate change scenarios, respectively (*Figure 41*).

The extreme windblow event results in a large and transient sink in the deadwood pool fluxes in 2046 due to the transfer of biomass pools to the deadwood pool (*Figure 42*). However, the deadwood pool sink reduces significantly during and after salvage operations and returns to near REF scenario levels by 2052.

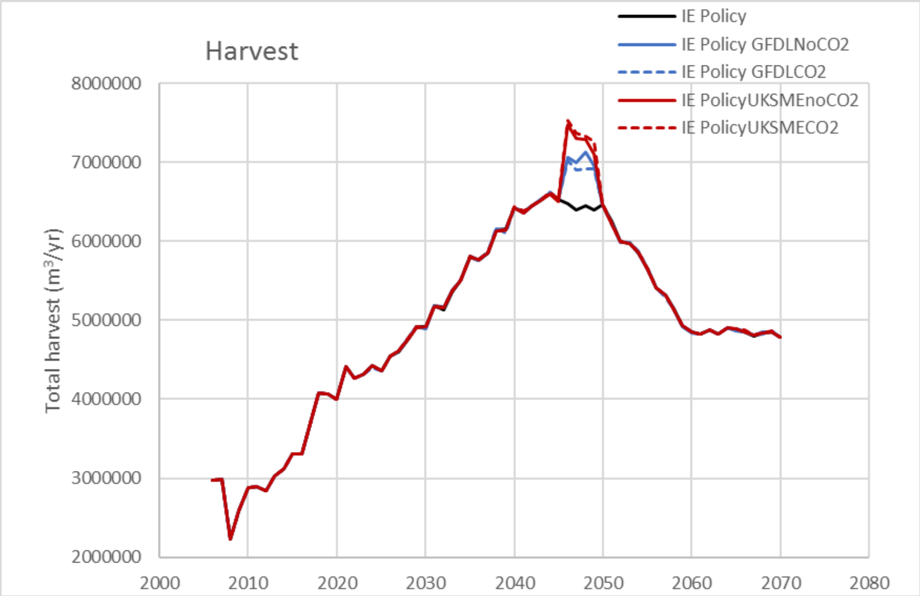


Figure 41: Total harvest for the policy reference and climate change scenarios.

The interannual variation in ecosystem fluxes (*Figure 40*) appears to be primarily associated with large fluctuations in dead organic matter pool fluxes driven by large fluctuations in annual temperature under the climate change scenarios (*Figure 42*). Note that interannual variations of DOM pool fluxes under the REF scenario are negligible because annual temperature was assumed to be fixed based on the mean historical annual temperature.

The annual temperature fluctuations had the largest impact on litter pool fluxes (*Figure 42*), which is consistent with higher turnover rates of the fast aboveground pools, compared to slower and medium DOM pools (see Kurz at al., 2009; Black et al., 2025). Litter emissions were generally higher and more variable under the UKSME1 scenario because annual temperatures were (on higher (average 1.34 Deg. C) and more variable (StDev = 0.63, compared to 0.31), than the
GDFL scenario.

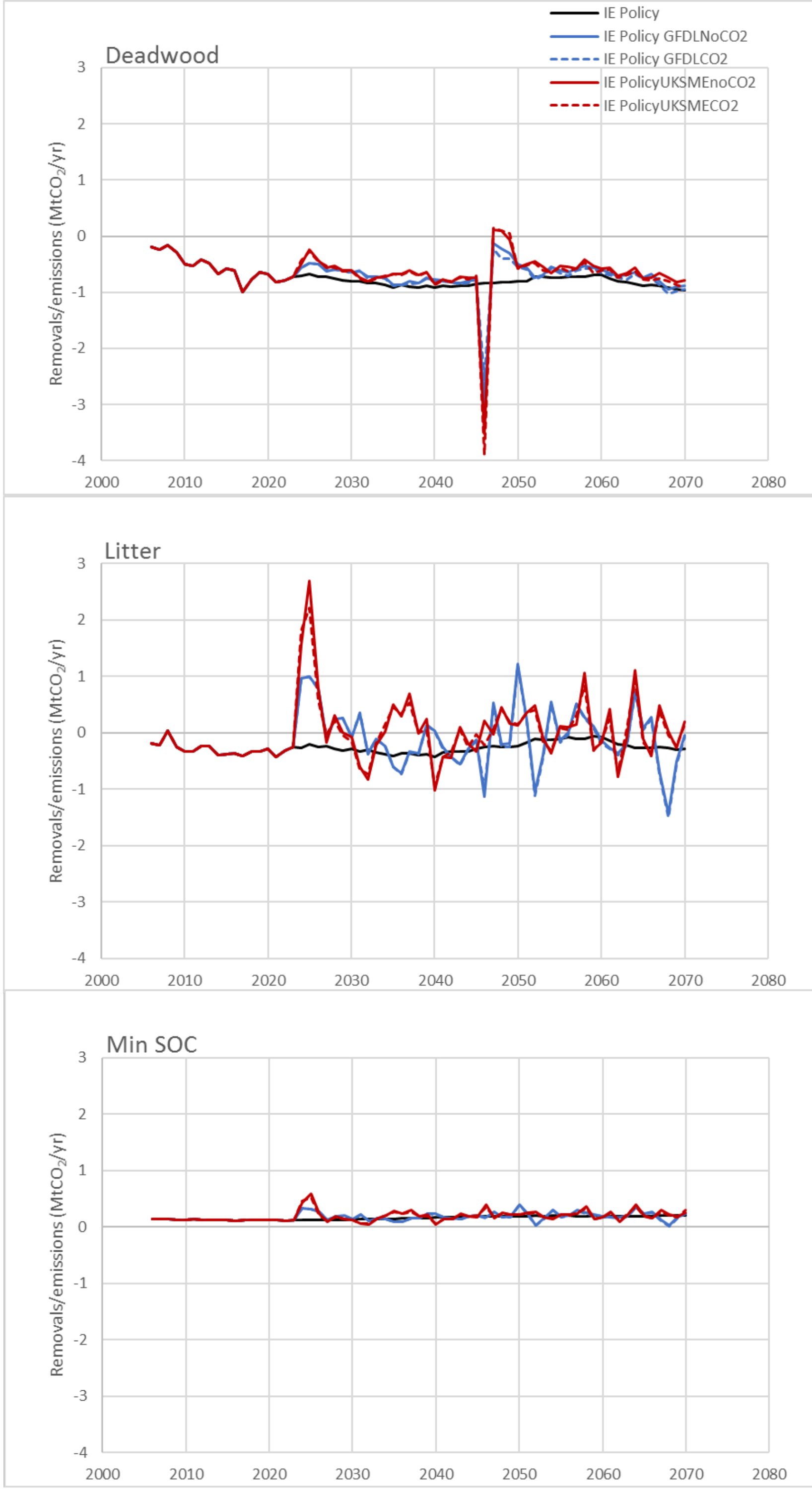


Figure 42: DOM pool fluxes for the policy reference and climate change scenarios.

CBM-IT

Total roundwood removals considered by CBM-IT under the REF scenario were aligned with the amount of harvest used by GLOBIOM-G4M-X from 2024 onward (*Figure* 43, upper panel). This amount is lower than the amount of harvest used in the BASE scenario, as specified in WP6 (see *Figure* 43, lower panel), but it includes a considerably larger share of non-merchantable biomass components and snags removed from 2030 onward within the REF scenario (*Figure* 44).

Model runs including the effect of climatic drivers use the same input data, but they also include the additional effect of salvage logging due to the windstorm occurring in 2049 and bark beetle outbreaks distributed between the following years. Because the intensity of these events is similar across the climate models, the extra amount of salvage logging is nearly identical. This can determine an additional, potential, amount of harvest, spanning between 4.4 and 0.6 million m^3 yr^{-1}, in case of extreme disturbance events (*Figure* 43, upper panel).

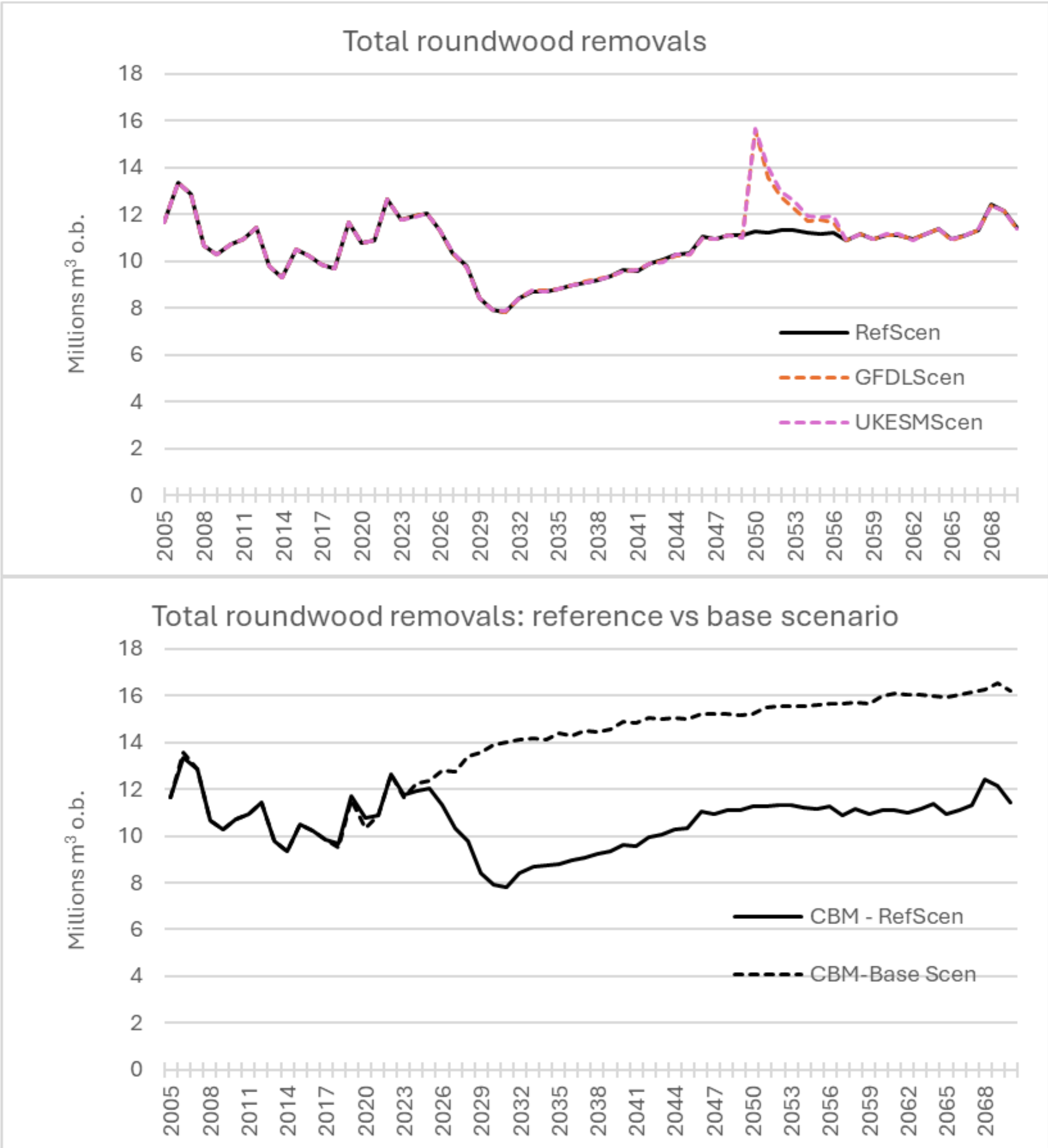


Figure 43: The upper panel reports the total round removals provided by CBM under the reference scenario (RefScen) and under the model runs including the additional effect of climate change, as expected by GFDL-ESM4 and UKESM1-0-LL. The lower panel compares the amount of harvest defined under the reference scenario with the one applied in the base scenario, as specified in WP6.

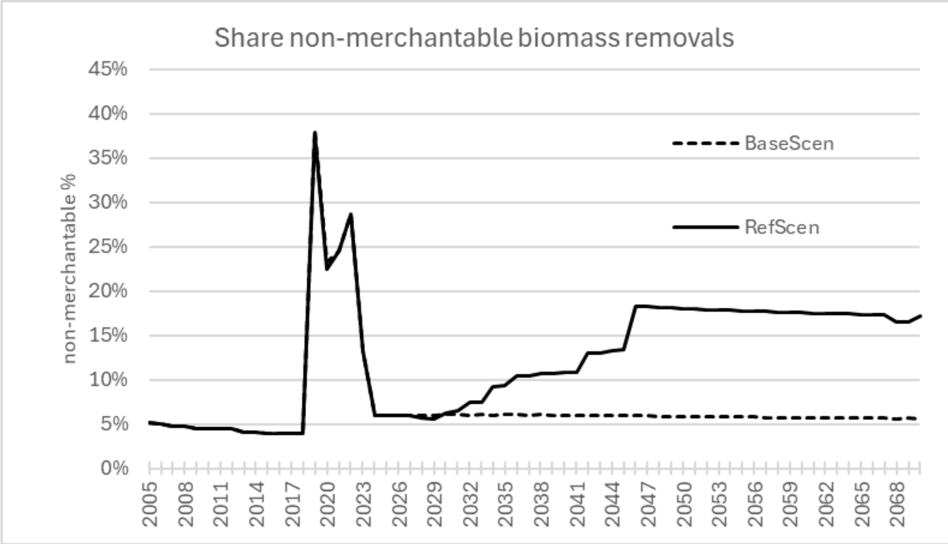


Figure 44: Share of non-merchantable biomass components and snags as extracted by CBM within the base scenario (BaseScen) and the reference scenario (RefScen), within the simulation period 2024-2070. Calibration period 2005 – 2023 also includes the amount of snags removed with salvage logging after the windstorm occurred in autumn 2018.

From 2024 onward, afforestation and deforestation rates in CBM-IT were aligned with the input data used by G4M, applying the same assumptions for all model runs (*Figure* 45).

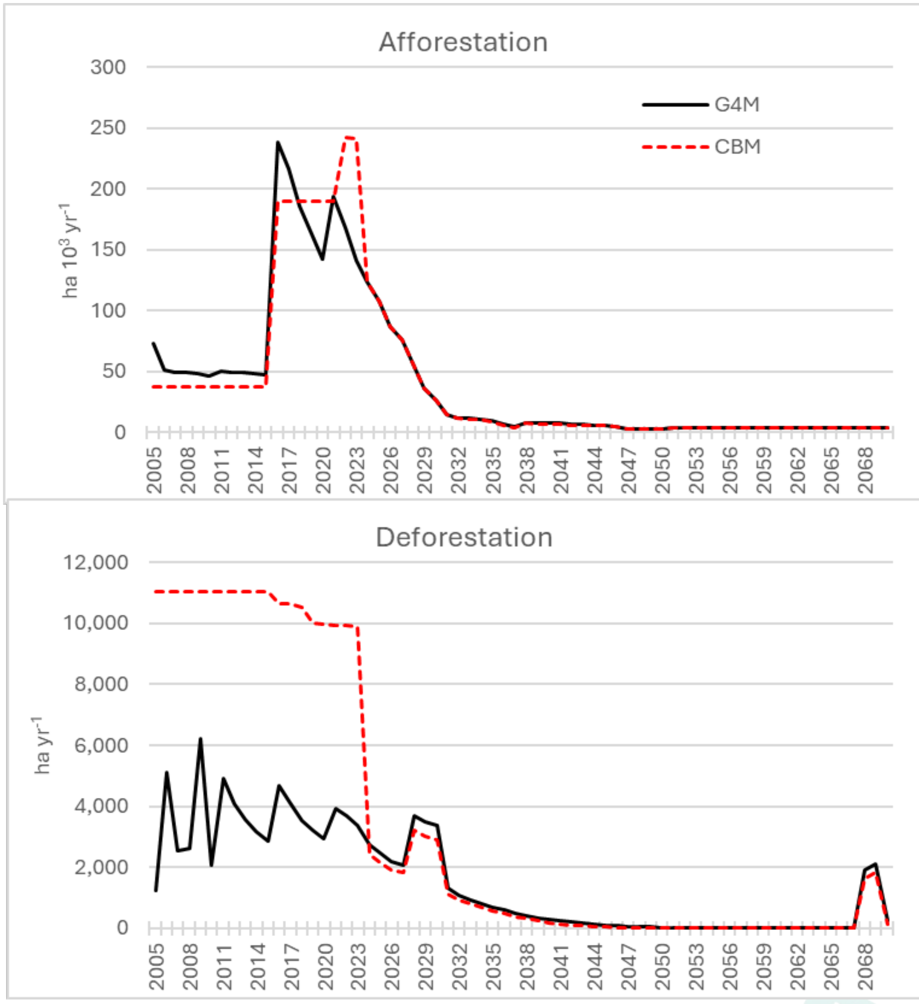


Figure 45: Annual rate of afforestation and deforestation as considered by G4M and by CBM.

In the REF scenario, the area affected by wildfires is assumed to remain constant from 2024 onward; the same area changes across other model runs based on data provided by each climate model (*Figure* 46).

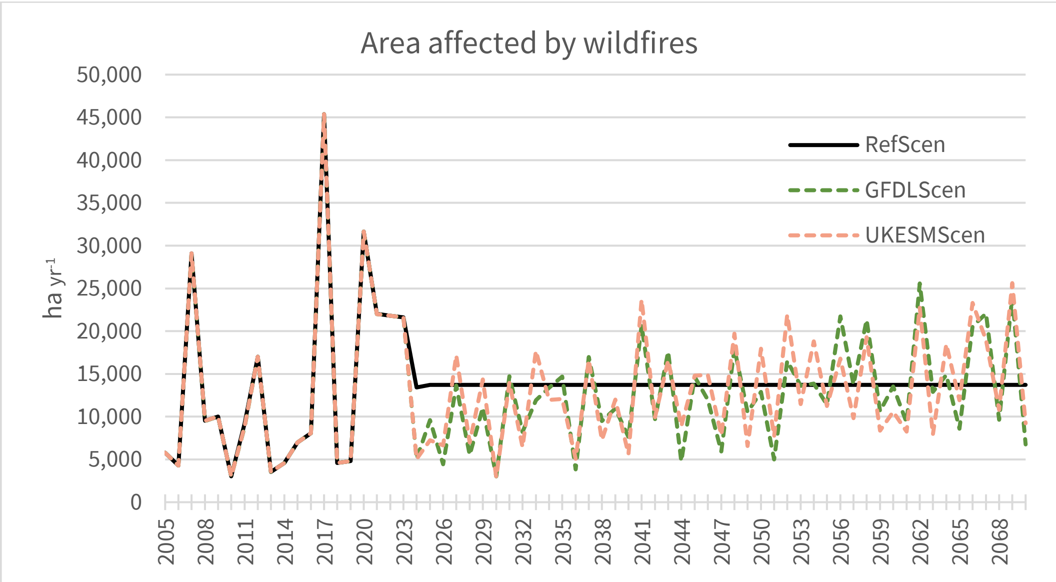


Figure 46: Area affected by wildfires, under the reference scenario and as affected by climate models.

A reduction in harvest levels within the REF scenario, compared to the BASE scenario, results in a marked increase in the living biomass carbon sink—approximately 39% higher under the REF scenario. This change also produces comparable effects within the dead organic matter pool and leads to an overall increase in the total carbon sink, shifting from around -47 Gg CO_2 yr^{-1} to -64 Gg CO_2 yr^{-1} by 2070 (*Figure* 47, upper panel).

Additional climatic drivers, as characterised by GFDL-ESM4 and UKESM1-0-LL, exert a moderate influence on the living biomass pool, but they significantly contribute to interannual variability in the DOM pool (*Figure* 47, lower panel). This, in turn, directly affects the total carbon sink estimated by CBM, which may fluctuate throughout the simulation period 2024–2070 within ranges of -103% to +37% for UKESM1-0-LL and -59% to +25% for GFDL-ESM4 when incorporating their respective climatic drivers (*Figure 48*). Comparable ranges have been documented in earlier studies, such as Pilli et al. (2022), which examined the effects of climate change on the projected evolution of future forest carbon sinks.

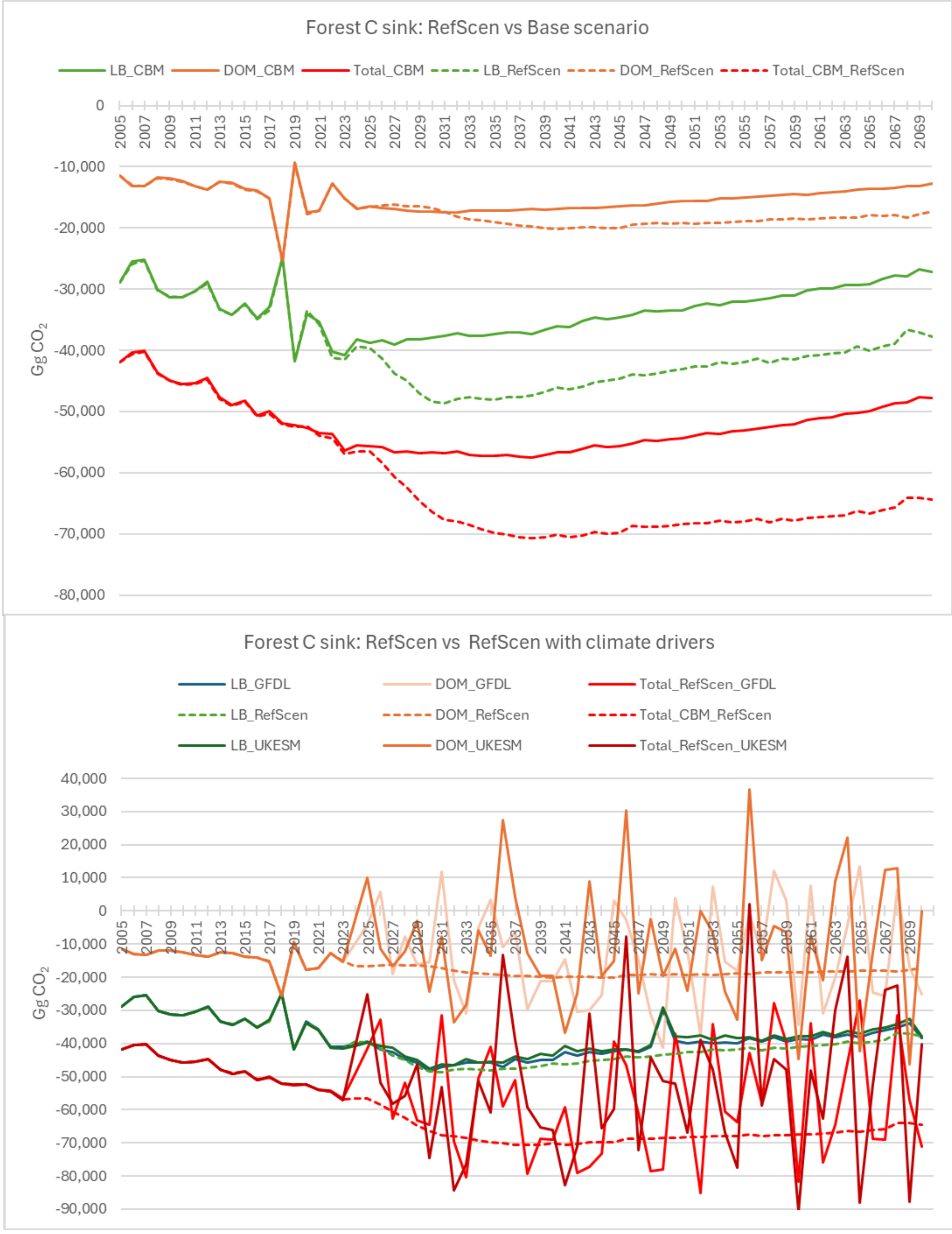


Figure 47: Comparison of forest carbon sink estimates by CBM for living biomass (LB), dead organic matter (DOM), and total carbon pools across reference (dashed line) and base (solid lines) scenarios (upper panel), and reference scenario without and with additional climate drivers (lower panel).

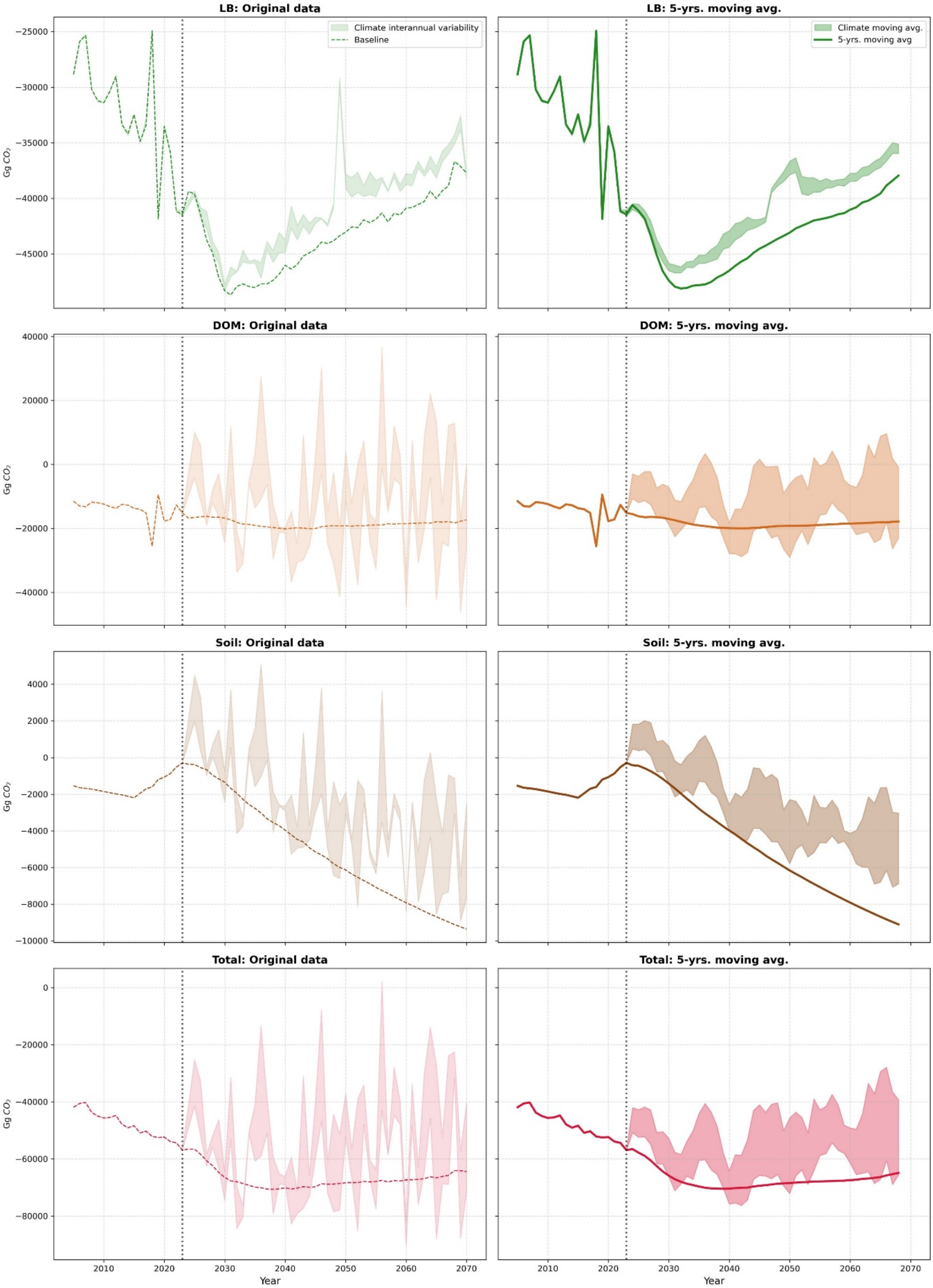


Figure 48: Carbon sink for living biomass (LB), dead organic matter (DOM), soil, and total carbon sink, estimated by CBM within the calibration period (2005 – 2023) and the following simulation period, under the Reference Scenario with and without added climate variables. Left plots use interannual variability in climatic variables. Right plots use a 5-year moving average.

HEUREKA

Under the harvest volume prescribed, the development of Gross (GAI) and Net Current Annual Increment (CAI) appears also to slightly increase over time (*Figure 49*).

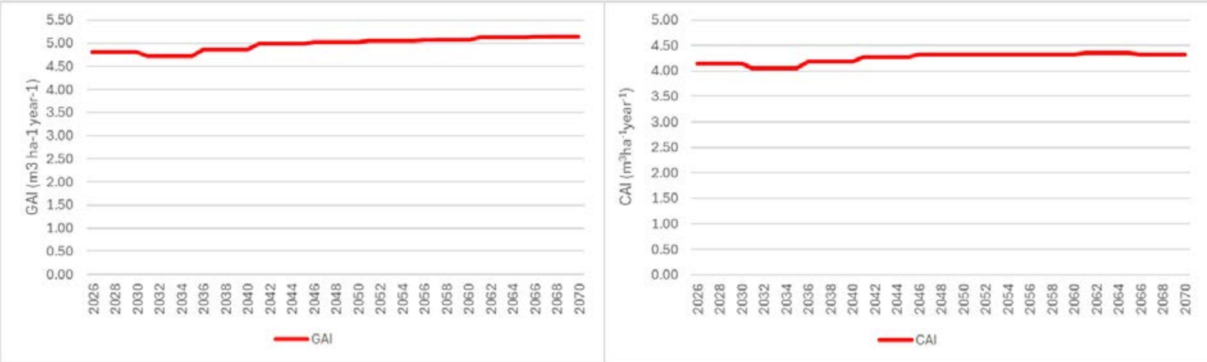


Figure 49: HEUREKA projection of Gross (GAI) and Net CAI (Current Annual Increment).

The projected reduction of harvest under the Policy Reference scenario (relative to the Baseline) allows to increase the above ground biomass CO_2 removals in the long term (by 2050) up to -12 $MtCO_2$/year, in the shorter term the difference is less pronounced with a sink of -4.5 $MtCO_2$/year by 2030 (*Figure 50*).

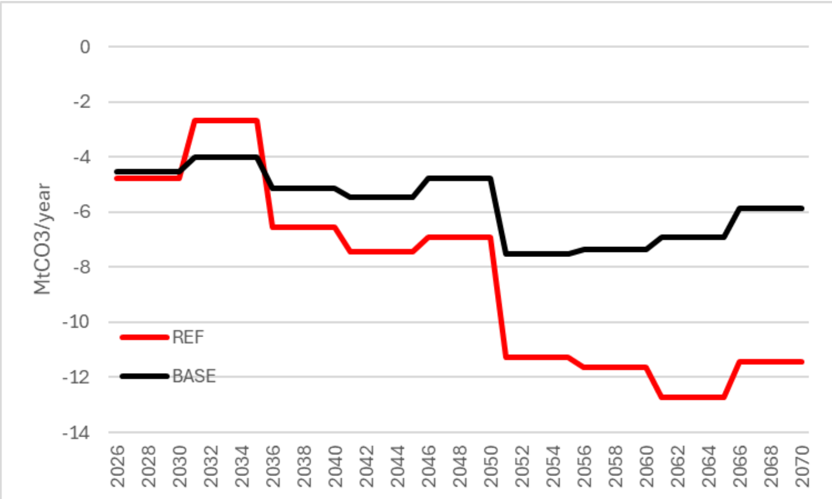


Figure 50: Above-ground biomass emissions according to the Baseline and the Policy Reference scenario.

The total net forest land removals are at -12 $MtCO_2$/year in 2026, according to the Policy Reference scenario, allow to increase in the removals up to -20 $MtCO_2$/year (by 2070), while the total removals are stable or slightly declining under the Baseline (*Figure 51*).

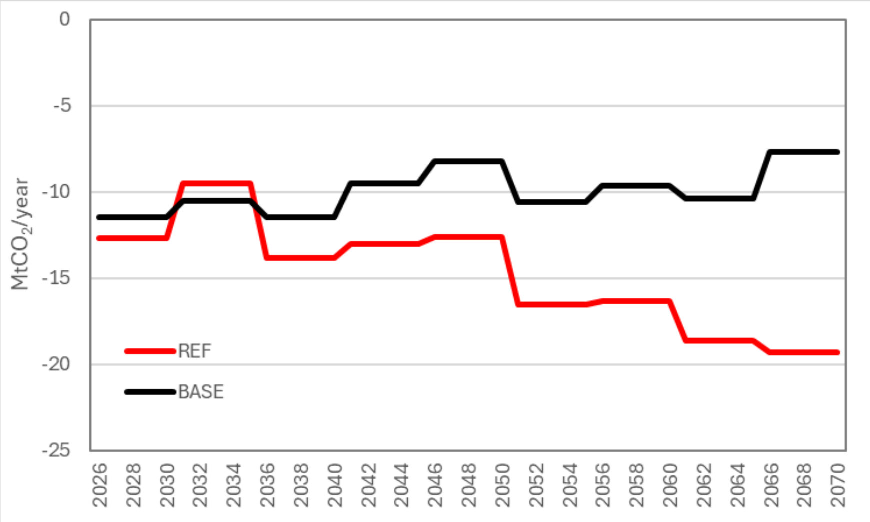


Figure 51: Total net greenhouse-gas emissions and removals from Swedish forests according to the Baseline and the Policy Reference scenario.

3.2.3. Comparison of national and EU model projections

To better understand the alignment of modelling across scales, we compare, when possible, the breakdown of the emissions profiles for the national models (CBMs) and G4M and the aggregated emission profile (CBMs, HEUREKA, G4M).

Living biomass pool

The living biomass pool projections show a very good alignment in the trend of emission pathways between G4M and CBM-IE for Ireland, showing in both cases a decline of removals to 0 $MtCO_2$/year by 2040, followed by an increasing sink afterwards. A good alignment in trend can also be observed in the case of Italy, with an increase of removals by 2030, followed by a slow decline due to the forest aging; however, the G4M project has fewer long-term removals compared to CBM-IT, as already observed in D6.3 Baseline. For the Czech Republic (CBM-CZ), we observe in the short term (by 2040) a good alignment between the trends and levels, but an increasing divergence after 2040 with G4M projecting lower removals, a difference already observed in D6.3 Baseline (*Figure 52*). The factors driving the increased sink strength from 2040 onwards acting in CBM-CZ are: i) a gradual 10% reduction in policy reference scenario harvest removals over the period 2040–2070; ii) a temporary productivity gain following the earlier historical disturbance as the new forest stands age into their peak growth phase; and iii) a growing contribution from afforestation areas, which add new forest carbon sinks at a rate consistent with the assumed afforestation target.

The long-term stable sink observed in G4M is due to a faster ageing after 2030 compared to CBM-CZ. The ageing of the forest causes a long-term increment decline (after year 2040), which compensates for the long-term harvest increase.

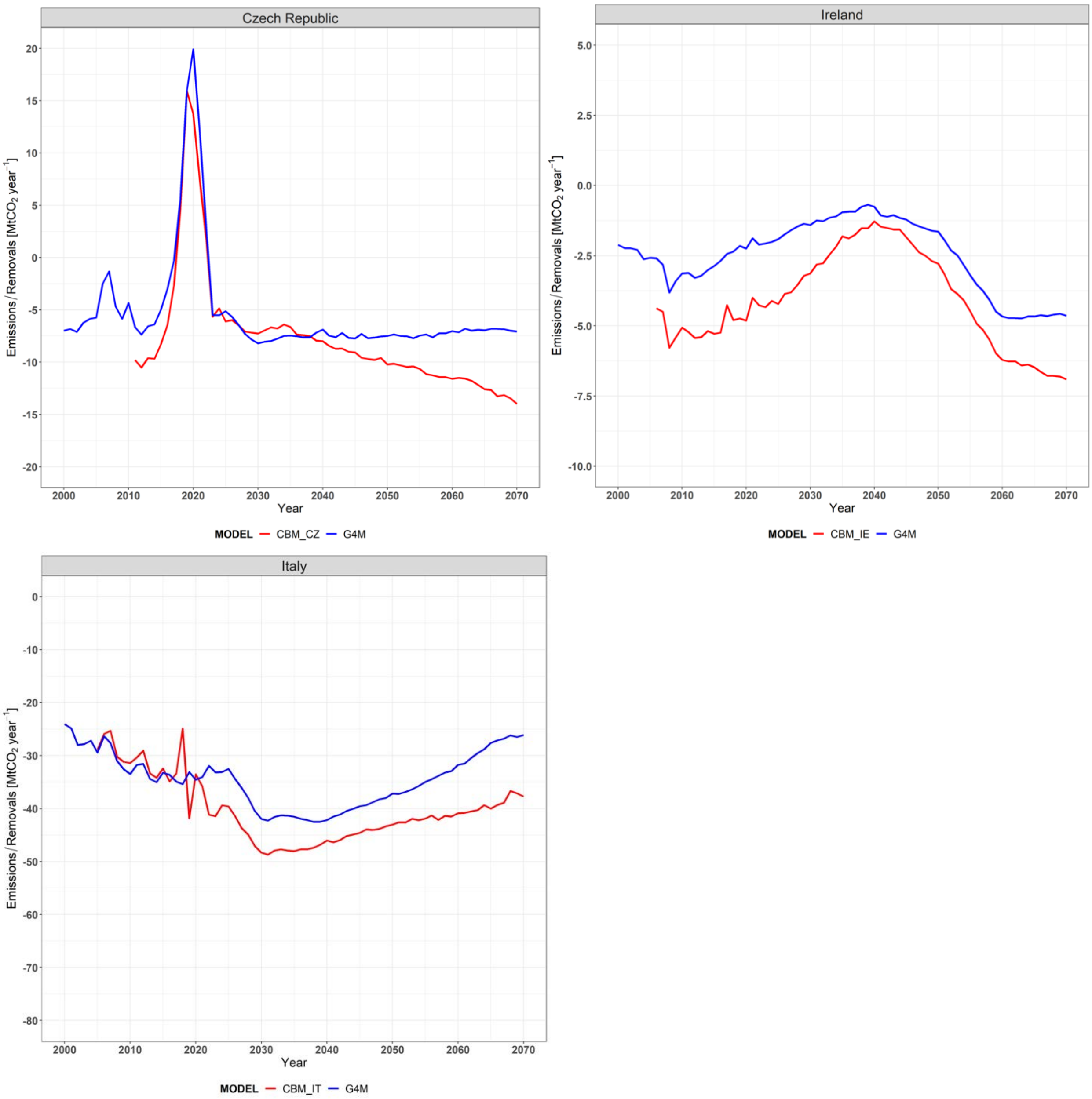


Figure 52: Comparison of the living biomass carbon pool for G4M and the national models (CBM-CZ, CBM-IE, CBM-IT).

Deadwood pool

The comparison of the deadwood pool for the REF scenario shows the same differences between the models as the ones observed for the Baseline (D6.3). Some of the discrepancies can be explained by the different definition of the pool applied in G4M compared to CBM, which also leads to differences in trends in the case of Ireland and Italy (*Figure 53*).

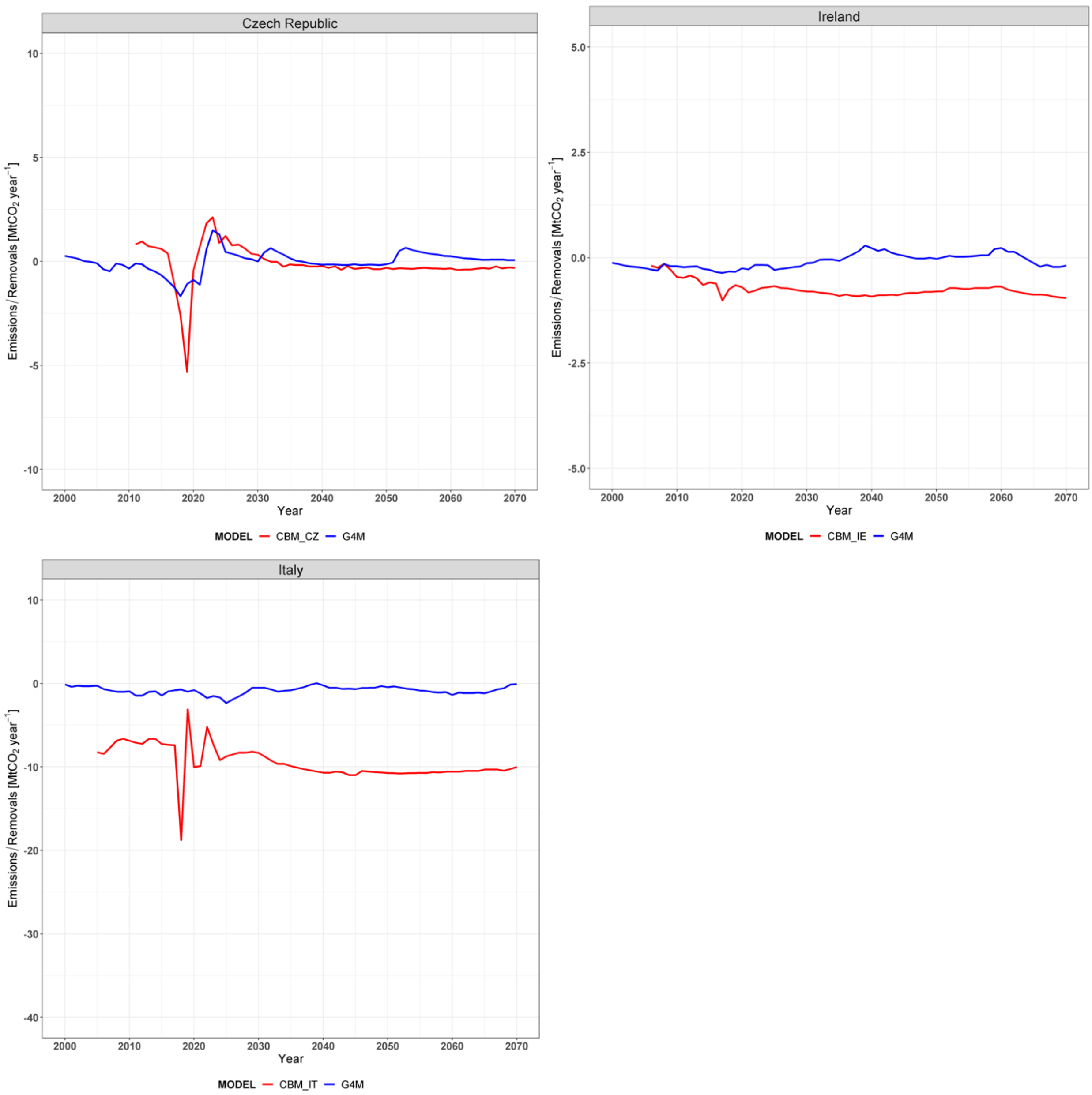


Figure 53: Comparison of the deadwood carbon pool for G4M and the national models (CBM-CZ, CBM-IE, CBM-IT).

Litter pool

As for deadwood, for litter models also have different definitions of the pool (see. Baseline, D6.3). The main difference is observed for Italy with a significant increase over time for CBM-IT (achieving over time 10 $MtCO_2$/year) compared to G4M (*Figure 54*).

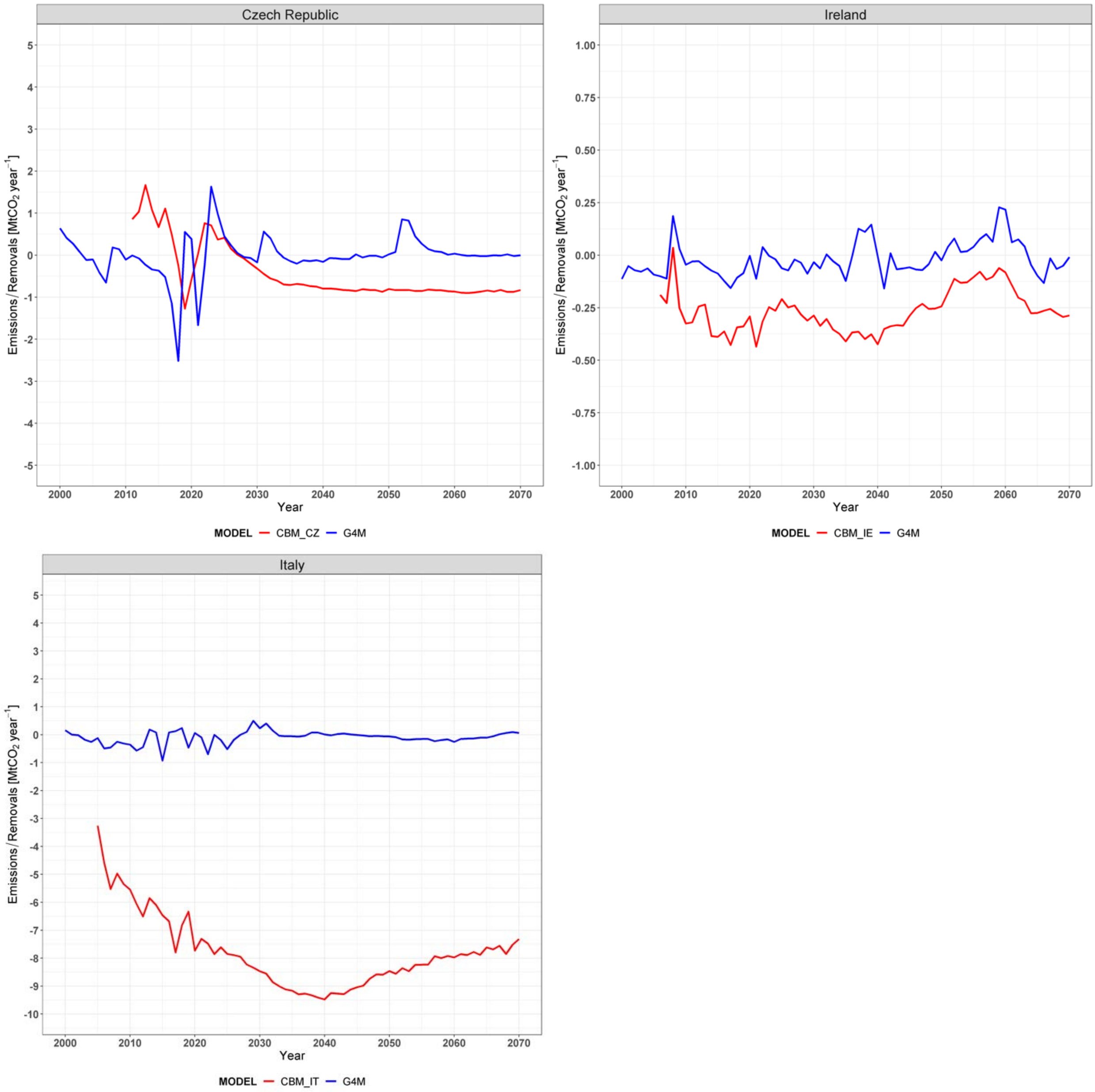


Figure 54: Comparison of the litter carbon pool for G4M and the national models (CBM-CZ, CBM-IE, CBM-IT).

Sum of forest land emissions

The sum of the forest carbon pools (i.e., living biomass, deadwood, litter and soils) shows that over time, the divergence between CBM-CZ, CBM-IE, CBM-IT and G4M tends to increase significantly, with significantly lower sink for G4M (*Figure 55*). The differences in the emission “level” observed during the historical period (i.e. until year 2023) are less critical, because G4M emissions are calibrated a posteriori to the national GHG inventory of the last 10 years (See previous sections). While the difference in future projections “trend” is due to different data and modelling structures and this is more difficult to address. In the case of HEUREKA, there is a good alignment in the long-term (2050) level and trend with G4M but less consistency in the short-term (2030) level.

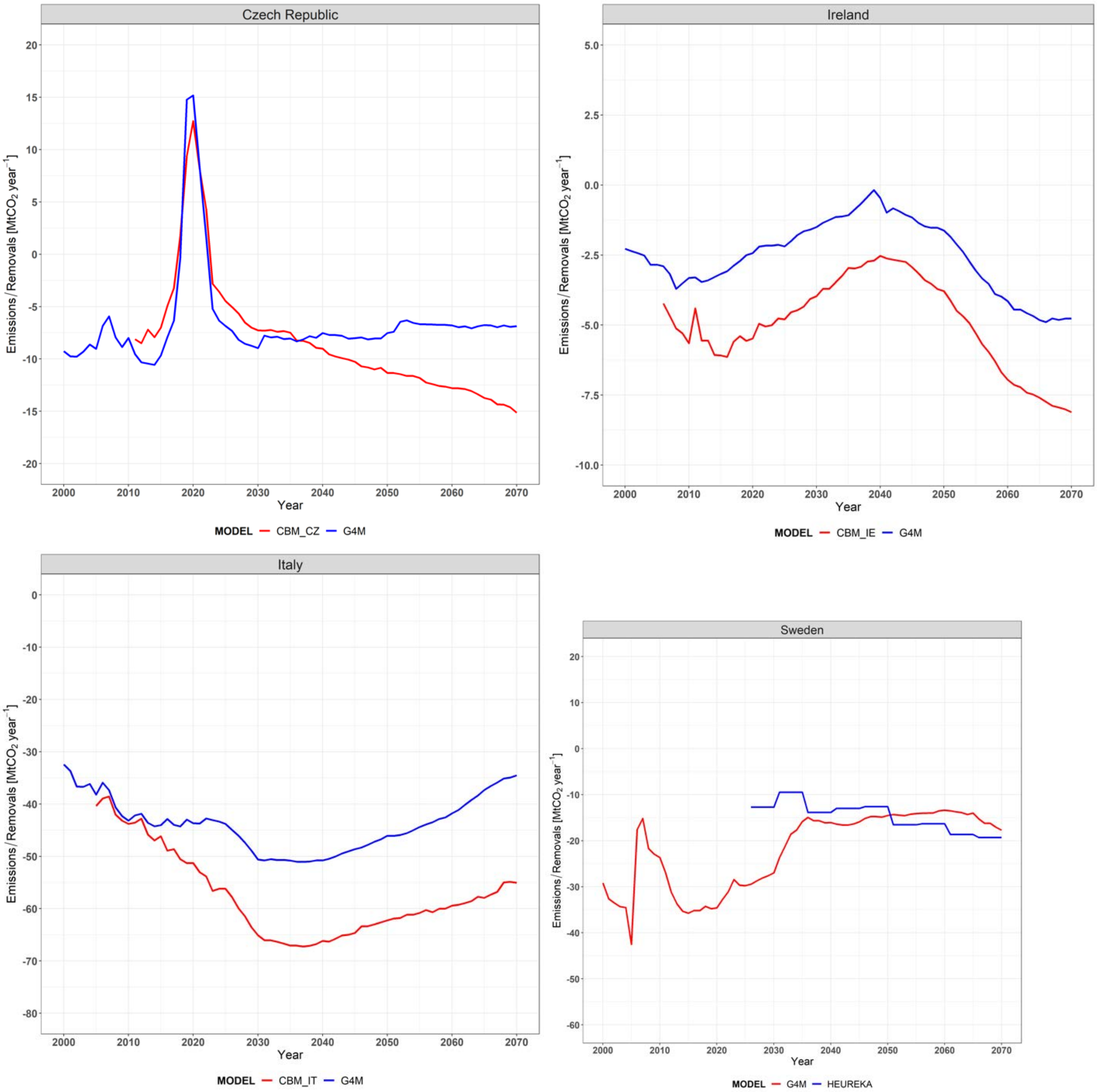


Figure 55: Comparison of total forest carbon (living biomass, deadwood, litter) for G4M and the national models (CBM-CZ, CBM-IE, CBM-IT) and HEUREKA[v].

3.3. Discussion and next steps

The modelling of the Policy REF scenario is based on updated wood demands and afforestation/deforestation aligned to the NECP submitted by Member States. Based on this, we observe a relatively lower demand for forest biomass for bioenergy compared to the BASE (defined in D6.3) as a scenario which does not take explicitly into account recent policies introduced at national EU level but it considers only legacies of past policies. The relatively lower forest biomass demand under REF is also a consequence of allocating a larger share of bioenergy demand to energy crops compared to the BASE scenario and the assumed reduction over time of traditional fuelwood demands. These changes lead to wood harvest volume projections close to the current

[v] For HEUREKA the sum includes also the soil carbon pool because difficult to isolate from the rest of the emissions in the model.

levels. The NECP policy measures lead to more afforestation in some of Member States compared to the BASE scenario. As a consequence of stable harvest and the increase in afforestation, the EU27 forest land and HWP CO_2 removals under the REF scenario remain similar to the current levels with a total removal of -270 $MtCO_2eq$/year by 2050.

When including climate change and natural disturbances impacts (droughts, bark beetles infestations, windstorms, wildfires) under RCP4.5 (i.e., a scenario of global temperatures increase of 2.5-3 °C by 2100), CO_2 removals become more uncertain.
In particular, the uncertainty of the forest land removals is very high and EU forests could reduce their sink significantly over time and even become a source of emissions. These results are highly dependent on the specific GCM used for projecting the climate/disturbances impacts and the inclusion/exclusion of CO_2 fertilization effects. The magnitude and direction of impacts also depend on the region, with Central-South EU experiencing increasing losses of carbon while Northern EU shows both losses/gains of carbon, depending on the specific climate model assumptions.
Moreover, the inclusion of climate change and disturbances shows the higher interannual variability of deadwood and litter pools compared to the living biomass pool, making them very vulnerable pools under climate change.
While modelling the climate and disturbances impacts, we have explicitly included the effects on forest land removals but did not model the potential impacts on the HWP pool storage. The HWP pool could also be impacted in specific years (with occurrence of high disturbances). However, the deviation in the harvested total roundwood was less than 10% in the GLOBIOM-G4M-X when including the disturbances, compared to the noCC scenario, given that the EU model relied on reshuffling harvest locations to meet the same level of total demand in each country. However, a further analysis on the salvaged wood quality would be informative for assessing impacts on HWP pool, but it goes beyond the scope of the present assessment.

The LULUCF sector is expected to deliver more than -300 $MtCO_2$/year by 2050 to align with the EU climate neutrality pathway (EC, 2024), meaning that the forest sector would need to exceed this level of removals to compensate for other emissions within LULUCF (if the other land use categories within LULUCF remain a source of CO_2). Overall, the REF scenario shows that when keeping current harvest levels mostly unchanged, in the best-case scenario the forest sink can stabilize and achieve medium term removals of around -270 $MtCO_2eq$. /year by 2050 (from forest land and HWP). This calls for additional policy measures on top of the measures from the NECP WEM+WAM, to strengthen the EU forest sector contribution to EU climate neutrality.

The REF scenario was modelled under limited/no adaptation of forest management. Under T8.2 “ambitious pathways”, we will test scenarios aiming at counteracting impacts of climate change and natural disturbances. We plan to do this by including specific adaptation measures both in the national and EU models. At the same time, we have largely included the policies in place at the Member State level in the modelling and not considered additional overarching policies that might be considered more ambitious (e.g. NRR, CRCF) and which could further strengthen the EU forest sector carbon removals. The effect of these additional policies together with the stronger adaptation measures are tested in T8.2, the modelling of ambitious policy pathways.

4. Conclusions

This deliverable establishes two complementary foundations for the exploration of more ambitious policy pathways. First, it provides an assessment of policy coherence across the EU forest policy framework, combining a horizontal perspective (EU objectives and EU-level policy instruments) with a vertical perspective (EU objectives and Member State instruments in the case-study countries). This analysis highlights that, by design, the alignment of policy signals varies across objectives and governance levels. It identifies areas of relatively strong alignment, particularly where climate and biodiversity objectives are mutually reinforcing, and areas where tensions and trade-offs require more explicit handling, notably where wood-use ambitions interact with biodiversity safeguards, restoration objectives, and ecological limits. The coherence assessment thereby provides an interpretive frame for understanding where ambitious pathways are likely to face constraints, and where safeguards and enabling conditions will be decisive.

Second, the deliverable operationalises a Reference Policy Scenario that translates recently adopted and implemented policy measures into a consistent modelling baseline for EU forests and the forest sector. Using an EU modelling layer (GLOBIOM–G4M-X) alongside national modelling applications (CBM implementations in Czechia, Ireland and Italy; Heureka in Sweden), the reference scenario provides a model-based pathway for key drivers such as harvest levels, land-use change (including afforestation/deforestation where represented), and forest carbon sink trajectories. This multi-scale approach enables a policy-relevant interpretation of current policy implementation than a purely stylized baseline, while preserving the capacity to identify feasibility constraints and differences in national conditions.

The Reference Scenario provides a clearer picture of the general trend under existing policies. At the EU scale, forests and HWP removals can be stabilized in the long run at current levels in the best-case scenario or they could further decline with increasing climate mediated impacts. However, these outcomes are subject to substantial uncertainty once climate change and natural disturbances are considered, even under a moderate pathway. Under RCP4.5, the magnitude and direction of impacts depend on climate-model assumptions and disturbance dynamics, which can materially affect both long-run sink levels and year-to-year stability. A particularly relevant implication for target-setting is that interannual variability in climate drivers can translate into pronounced interannual variability in dead organic matter (DOM) fluxes, especially in deadwood and litter pools. Thus, short-term deviations in reported removals may reflect climate variability and decomposition responses, not only policy-driven management change.

The gaps and tensions identified through both the coherence assessment and the modelling results of the reference scenario show that it will be difficult to achieve an increasing forest mitigation contribution expected under the EU climate neutrality pathway without the introduction of further policy measures. This Reference Scenario serves as the basis for testing the effect of increasing the policy ambition under the Policy Pathways modelled in ForestNavigator when introducing additional policy-based measures for increasing mitigation and adaptation of EU forests and forest sector while considering the potential synergies and trade-off with biodiversity and bioeconomy. Additionally, the Reference Scenario modelled pathways provide the foundation for illustrating the relevance of combining forest adaptation to climate change together with measures promoting mitigation which together could contribute to a more resilient forest sector. These model-testable ambitious pathways are assessed for feasibility, sustainability, and robustness under climate and disturbance uncertainty. This sequence provides an evidence-based basis for comparing policy options and clarifying the enabling conditions and guardrails needed for credible EU forest-sector contributions to climate and sustainability objectives.

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6. Appendix I: Coherence Assessment - EU Policy Instruments

Land Use, Land Use Change and Forestry (LULUCF) Regulation

The LULUCF Regulation directly governs how greenhouse gas (GHG) emissions and removals from land use, land-use change, and forestry are accounted for toward EU and Member State climate targets. Its primary aim is to ensure that land-based sectors contribute meaningfully to climate mitigation by maintaining and enhancing the EU's carbon sink, in line with the overarching target of net removals of -310 $MtCO_2e$ by 2030. Forests, and in particular managed forest land, afforested areas, and harvested wood products, play a central role in meeting these targets. The Regulation introduces binding national contributions for each Member State, alongside accounting frameworks (e.g., forest reference levels), compliance mechanisms, and flexibilities to manage uncertainties such as natural disturbances.

Renewable Energy Directive (RED)

The RED III aims to achieve the binding quantified renewable energy consumption targets of at least 42.5% by 2030. Given that woody biomass constitutes the largest share of renewable energy in the EU, RED III has significant implications for forests, forest ecosystems, and forest-based value chains. It aims to align the expansion of bioenergy with broader environmental and climate goals through stricter sustainability criteria, greenhouse gas (GHG) savings thresholds, and new safeguards that restrict biomass sourcing from high-carbon, high-biodiversity, or protected areas. Notably, it reinforces the cascading use principle, limits financial incentives for energy-only biomass plants, and prohibits direct support for biomass sourced from industrial-grade roundwood, stumps, or primary forests.

Nature Restoration Regulation (NRR)

The Nature Restoration Regulation (NRR) introduces the first legally binding targets for restoring degraded ecosystems across Member States. It is directly relevant for forests, particularly through its requirements to improve the condition of forest habitat types listed in Annex I of the Habitats Directive and to enhance forest ecosystem biodiversity under Article 12, achieving increasing trends in forest biodiversity indicators (e.g. deadwood volume, carbon stock, native species share).

Carbon Removal Certification Framework (CRCF)

The Carbon Removal Certification Framework (CRCF) is a recently adopted EU Regulation that establishes a voluntary certification system for carbon removals, including those generated through forestry activities such as afforestation, reforestation, and sustainable forest management. While not imposing legally binding targets, the CRCF creates an EU-wide mechanism to quantify, verify, and certify carbon sequestration efforts, with the goal of incentivising their wider uptake across the land use sector. The framework introduces "QU.A.L.ITY" criteria (quantification, additionality, long-term storage, and sustainability) that all eligible activities must meet, alongside independent third-party verification and registry requirements. Forestry-based carbon removals are recognised under the carbon farming category (afforestation and improved forest management). The CRCF's methodologies for forestry activities are under development, with certification expected to begin in 2026.

Forest Monitoring Framework (FMF)

The Forest Monitoring Framework (FMF) is a proposed EU Regulation aimed at improving the consistency, transparency, and granularity of forest-related data collection and sharing across the EU. Its objective is to enhance the knowledge base for forest-related decision-making by establishing a harmonised monitoring system, combining geospatial mapping, a detailed data collection framework, and a data-sharing platform. The FMF introduces a shared responsibility model: the European Commission would monitor large-scale, remote-sensing-based indicators (e.g. forest area, fire risks, tree cover disturbance), while Member States would track ground-level ecological and management indicators (e.g. species composition, primary and old-growth forest extent, wood output, and biodiversity). The framework would feed into the Forest Information System for Europe (FISE) and encourage Member States to voluntarily adopt integrated long-term forest plans addressing biodiversity, climate change, the bioeconomy, and other sectors through 2040 and 2050.

EU Deforestation Regulation (EUDR)

The EU Deforestation Regulation (EUDR) aims to ensure that products placed on or exported from the EU market do not contribute to global deforestation and forest degradation. It requires that companies conduct due diligence to verify that certain commodities and their derived products are deforestation-free, produced in compliance with relevant laws in the country of origin, and traceable to the plot of land where they were produced. Commodities include soy, beef, palm oil, wood, cocoa, coffee, and rubber. Operators must collect geo-location data, conduct risk assessments, and submit due diligence statements before placing products on the market, with enforcement delegated to national competent authorities. The regulation includes provisions for benchmarking countries based on deforestation risk and foresees penalties for non-compliance.

Birds & Habitats Directives

The Habitats and Birds Directives form the legislative backbone of the EU's biodiversity policy and place a strong emphasis on habitat protection, species conservation, and ecological integrity. The Directives collectively establish the Natura 2000 network, which covers approximately 37% of the EU forest area and includes Special Areas of Conservation (SACs) under the Habitats Directive and Special Protection Areas (SPAs) under the Birds Directive. These instruments aim to maintain or restore habitats and species to favourable conservation status, prevent habitat deterioration, and ensure the long-term survival of protected species through spatial protection, legal safeguards, and site-specific conservation measures. They cover a wide range of forest types across biogeographical regions (as listed in Annex I of the Habitats Directive) and also protect critical habitats for many bird species that depend on forest ecosystems.

Soil Monitoring Directive (SMD)

The Soil Monitoring and Resilience Directive is a proposed legislative measure that aims to establish a coherent and harmonised EU-wide framework for assessing and improving soil health, with the overarching goal of achieving healthy soils across the EU by 2050. While not forest-specific, the Directive is highly relevant for forest ecosystems, as it sets out a common methodology for monitoring soil condition, land take, and soil sealing across different land types, including forested areas. By establishing detailed soil descriptors, assessment intervals, and sustainable soil management principles, the Directive contributes to a systematic approach to understanding and managing soil-based ecosystem services, including those vital to forest health, carbon storage, and biodiversity.

Green Claims Directive

The proposed Green Claims Directive aims to tackle greenwashing by establishing common rules for the substantiation, communication, and verification of voluntary environmental claims made by businesses about their products, services, or organisations. Its core objective is to ensure that environmental marketing claims (e.g. “carbon neutral,” “eco-friendly,” or “climate positive”) are truthful, comparable, and evidence-based, thereby enabling consumers to make better-informed, more sustainable choices and ensuring a level playing field across the EU single market. The Directive requires that any explicit environmental claim must be backed by a scientific life-cycle assessment or equivalent evidence, and must account for all significant environmental impacts, trade-offs, and limitations. It also introduces third-party verification requirements before green claims can be made publicly. If a product relies on offsetting to justify claims (e.g. net-zero emissions), this must be clearly disclosed and cannot be used to imply a product is inherently low-impact.

Sustainable Taxonomy

The EU Sustainable Taxonomy Regulation is a cornerstone of the EU’s sustainable finance framework, aiming to redirect capital flows towards activities that contribute to key environmental goals, including climate change mitigation and adaptation, biodiversity protection, and the transition to a circular economy. While it does not mandate specific actions, the Taxonomy sets technical screening criteria for assessing the environmental sustainability of economic activities, including those in the forestry and bioenergy sectors. Through its delegated acts, the Regulation defines sustainability standards for activities such as afforestation, reforestation, sustainable forest management, forest conservation, and bioenergy production, outlining performance benchmarks, safeguards, and disclosure rules. For forest-based industries and forest owners seeking green investment, the Taxonomy’s criteria effectively serve as financial eligibility guidelines, which may shape project design, financing decisions, and investment flows across EU Member States.

3 Billion Trees Pledge

The 3 Billion Trees Pledge, a flagship initiative under the EU Biodiversity Strategy and the EU Forest Strategy for 2030, aims to plant an additional three billion trees by 2030 in order to enhance forest quantity, resilience, and ecosystem function. As a non-legislative, voluntary commitment, it seeks to contribute to biodiversity restoration, climate mitigation, and climate adaptation through a significant increase in tree cover across the EU. The roadmap underpinning the pledge establishes key safeguards to ensure ecological integrity, including adherence to the "right tree, right place, right purpose" principle, the use of native species, additionality (i.e. trees planted beyond business-as-usual), and long-term protection from harvesting. The pledge also promotes agroforestry and nature-based solutions as part of a broader effort to integrate forest expansion into sustainable land use systems. Monitoring and reporting are supported through digital platforms like MapMyTree and the Forest Information System for Europe, with MRV indicators focused on tree species, diversity, and cover change.

Forest Guidelines documents:

Guidelines for Defining, Mapping, and Monitoring Old-Growth Forests

The Guidelines for Defining, Mapping, and Monitoring Old-Growth Forests are a non-legislative instrument developed by the European Commission to support Member States in identifying, protecting, and monitoring primary and old-growth forests. They provide harmonised definitions, a set of structural and compositional indicators (such as native species, deadwood volume, and old trees), and recommendations for using remote sensing and field data to map forest areas likely to meet these criteria. The guidelines also outline best practices for strict protection and compatible low-impact uses, and they suggest funding mechanisms and timelines to support implementation. Though voluntary, the guidelines are designed to help deliver core commitments under the EU Biodiversity and Forest Strategies for 2030.

Guidelines on Biodiversity-Friendly Afforestation and Reforestation, and Tree Planting

The Guidelines on Biodiversity-Friendly Afforestation and Reforestation, and Tree Planting are a non-legislative initiative published by the European Commission to support environmentally sound forest expansion and restoration. Aimed at forest managers, public authorities, and civil society actors, the guidelines promote tree planting and reforestation practices that simultaneously enhance biodiversity, strengthen ecosystem resilience, and contribute to climate mitigation and adaptation. They provide detailed recommendations for planning and implementing tree planting activities, including guidance on species selection, landscape integration, soil and water protection, post-planting management, and the use of natural regeneration wherever feasible. The guidelines reflect the EU's wider objectives under the

Biodiversity Strategy and Forest Strategy, particularly in relation to restoring degraded ecosystems and increasing tree cover in a sustainable and ecologically informed way.

Guidelines on Closer-to-Nature Forest Management

The Guidelines on Closer-to-Nature Forest Management (CNF) are a voluntary instrument developed under the EU Biodiversity Strategy for 2030 to promote a common framework for forest practices that enhance biodiversity, ecosystem resilience, and long-term forest sustainability. Aimed at forest owners, managers, and public authorities, the guidelines provide a structured toolbox of interventions grounded in ecological principles — including promoting natural regeneration, retaining deadwood, preserving forest soils and water systems, and managing harvesting with minimal disturbance. Their overarching goals are to increase structural complexity, align management with natural forest dynamics, and support a shift toward multifunctional, adaptive forest ecosystems. The guidelines are intended to inform national and regional policies, capacity-building, and future incentive structures, including those linked to the Common Agricultural Policy and EU restoration initiatives.

7. Appendix II – Coherence Assessment – Member State Policy Instruments

Czechia

Forest Act No. 289/1995 Coll.

The Forest Act No. 289/1995 Coll. establishes the core legal framework governing forests in Czechia, regulating forest use, management, protection, and regeneration across all ownership types. It lays down obligations for sustainable forest management (SFM), reforestation, species selection, timber harvest limits, and protection measures to ensure forests fulfil their productive, ecological, and social functions. The Act introduces forest zoning (protective forests, special purpose forests, and commercial forests), mandates forest management plans, controls harvest levels, and enforces reforestation within set timelines. It also establishes state oversight, licensing, forest data reporting, and penalties for non-compliance, thus providing the baseline legislation shaping how forests are managed in line with national environmental, economic, and social priorities.

National Council Act no. 114/1992

The Czech National Council Act no. 114/1992 on the Protection of Nature and the Landscape provides the primary legal framework for nature and biodiversity conservation in Czechia. It establishes national and local systems for the protection of ecosystems, species, landscape features, and ecological stability. The Act defines general obligations to conserve nature, regulates interventions affecting protected species and habitats, and sets up four categories of protected areas (national parks, protected landscape areas, national nature reserves, and nature reserves), each with specific restrictions and care plans. It includes provisions for the protection of trees outside forests, regulates the introduction of non-native species, and enables land expropriation and compensation for conservation purposes. The Act also provides a legal basis for public participation, biological assessments, and the coordination of nature conservation authorities.

Ordinance on afforestation of agricultural land

The Czech Government Ordinance establishing the conditions for the implementation of measures for the afforestation of agricultural land sets out the regulatory framework for granting subsidies to support forest establishment on former agricultural land. The ordinance provides three types of financial support: for establishing forest stands, caring for young forests over five years, and compensating for the cessation of agricultural production on the afforested land over ten years. Eligibility criteria cover landowners, co-owners, and lessees, but exclude state-owned land and some fast-growing or plantation-type tree uses. The ordinance sets technical requirements, including minimum plot sizes, species-specific planting densities, and survival rates, and links payment reductions or refusals to compliance performance. It is designed to incentivize biodiversity-friendly, long-term afforestation projects on agricultural land, aligning with EU climate, biodiversity, and land use goals.

Concept of the State Forest Policy until 2035

The *Concept of State Forest Policy until 2035* is a national forestry strategy adopted in 2020 that provides a long-term framework to guide forest management across all ownership types. It aims to halt forest decline, restore vegetation cover, increase resilience to climate change, and ensure the balanced fulfilment of ecological, social, and production functions. The policy is structured around four strategic objectives: (A) safeguarding forest functions for future generations, (B) enhancing biodiversity and ecological stability while maintaining production, (C) ensuring competitiveness and regional development, and (D) strengthening research, education, and innovation in forestry. The accompanying Application Document (2021) translates these objectives into concrete measures up to 2026, addressing urgent challenges like post-bark beetle disaster restoration, climate adaptation, species diversification, soil regeneration, game population control, and enhanced carbon and water cycles. It also anticipates legislative reforms (including to the Forest Act and Hunting Act) and economic instruments (incentives, ecosystem service payments, support for wood processing) to operationalize its goals.

National Action Plan for Climate Change Adaptation

The Czech *National Action Plan for Climate Change Adaptation* (updated 2021–2025) is the main implementation tool of the national Adaptation Strategy, aiming to strengthen the country's preparedness for climate impacts like drought, floods, heatwaves, and windstorms. Developed with broad expert and interdepartmental input, the plan sets out 108 adaptation measures divided into 322 tasks, detailing responsible ministries, deadlines, climate risk relevance, and funding (totalling CZK 139 billion, ~40% from EU sources). For forests, the plan focuses on enhancing ecosystem stability, preventing soil degradation, improving water regimes, and increasing resilience through natural regeneration, species diversification, alternative management practices (e.g., reducing clearcuts), game control, wetland and water retention restoration, and safeguarding native genetic resources. It also emphasizes sustainable biomass use and risk management for pests and diseases. These measures are to be supported through legislative changes, demonstration projects, subsidies, and capacity-building programs.

Strategy of the Ministry of Agriculture until 2030

The *Strategy of the Ministry of Agriculture until 2030* serves as an overarching framework guiding Czech agriculture, food, forestry, water, and rural development sectors, aligning them with the EU Common Agricultural Policy and national priorities. It sets four long-term strategic pillars: sustainable resource and climate action, competitive and sustainable production, territorial development, and adequate food and material self-sufficiency. For forestry, the strategy emphasizes sustainable forest management, protection of soils and biodiversity, restoration using habitat-appropriate and drought-resistant species, natural regeneration, and soil improvement. It also prioritizes boosting the competitiveness of the forestry value chain, including supporting domestic wood use, reducing raw wood exports, updating legal and tax frameworks to favour wood in construction, and fostering higher-value wood products. The strategy proposes concrete measures such as subsidy reforms, demonstration sites, GIS-based administration tools, and the establishment of a forestry and timber fund to promote innovation, education, and market development.

Implementation Plan of the Strategic Framework 2030

The *Implementation Plan of the Strategic Framework Czech Republic 2030* (SFCR 2030) provides concrete steps to achieve the country's sustainable development goals aligned with the UN 2030 Agenda and the Sustainable Development Goals (SDGs). The framework identifies six national priority areas, including resilient ecosystems, and is operationalized through multi-year implementation plans—the current one covering 2022–2025. While non-binding, the plan guides national and local governments, NGOs, businesses, and citizens in addressing policy gaps, using tools such as funding, regulation, projects, and education. For forestry, it sets two key objectives: increasing the proportion of forest land in the national territory and ensuring that the species composition of planted forests matches habitat conditions to prevent further soil degradation. These objectives are implemented primarily through the *Concept of the State Forestry Policy until 2035* and the *Strategy of the Ministry of Agriculture until 2030*, rather than through new standalone measures.

National Biodiversity Strategy (2016-2025)

The *National Biodiversity Strategy of the Czech Republic* (2016–2025) is a cross-sectoral framework aimed at maintaining—and in some areas improving—the country's biodiversity. It defines four priority areas: societal recognition of biodiversity's value; long-term conservation and protection of natural processes; environmentally friendly use of natural resources; and ensuring up-to-date, relevant biodiversity data. For forest ecosystems, the strategy emphasizes sustainable forest utilization, reducing fragmentation, limiting permanent land conversion, retaining deadwood, increasing tree species diversity, restoring degraded soils, improving water retention, and regulating game populations to enable natural regeneration. It also calls for protecting forest genetic resources and expanding protected forest areas. The strategy includes clear timelines and indicators, but its targets (such as increased habitat area, enhanced deadwood retention, and expanded protected forest coverage) are not legally binding. Progress is tracked through measurable actions and coordinated by relevant authorities.

Raw Material Policy for Wood

The *Raw Material Policy for Wood* is a strategic framework that complements the Concept of State Forestry Policy until 2035 by focusing on the downstream use of wood as a renewable material. Its primary aim is to increase the use of wood across public and private sectors, replacing non-renewable or climate-intensive materials, and supporting the circular economy.

The policy sets priorities for ensuring a sustainable domestic wood supply, adapting forest species composition to climate change, enhancing value-added wood processing, and prioritizing material use and recycling over energy use. It proposes regulatory changes (e.g., building codes, public procurement targets), financial incentives (including tax measures), market development, and targeted research and innovation to expand wood use in construction, manufacturing, and daily life. The policy also seeks to strengthen the domestic wood-processing sector, reduce raw wood exports, and increase the use of less common species. Although non-binding, the policy provides a roadmap for investment, legislation, and sectoral coordination, with potential implications for harvest volumes, carbon storage in harvested wood products (HWPs), and climate mitigation strategies.

Ireland

Forestry Act 2014

The *Forestry Act 2014* is Ireland's main legislative framework governing the management, protection, and sustainable use of forests. Replacing the 1946 Act, it empowers the Minister for Agriculture, Food and the Marine to regulate all aspects of forestry, including afforestation, felling, replanting, forest health, biodiversity conservation, forest roads, and timber production. The Act establishes a licensing system for key forestry activities, supported by forest management plans, environmental assessments, and public consultations where relevant. It introduces strong environmental safeguards, including provisions for Natura 2000 sites, native woodlands, and protection against pests, invasive species, and wildfires. The Minister is given broad powers to issue guidelines, enforce compliance, require replanting, and promote afforestation aligned with sustainable forest management (SFM) principles. The Act balances economic, environmental, and social functions, aiming to enhance Ireland's forest cover and forest-based economy while maintaining ecosystem integrity and resilience.

Climate Action Plan 2024

Ireland's *Climate Action Plan 2023* is the core national roadmap for meeting the country's legally binding commitment to reduce greenhouse gas emissions by 51% by 2030 and reach net zero by 2050. Under the land use, land use change and forestry (LULUCF) sector, the plan targets an afforestation rate of 8,000 hectares per year, totalling 28,000 ha during the first carbon budget period, alongside peatland restoration (33,000 ha), rewetting exploited peatlands (30,000 ha), improved grassland management, and hedgerow expansion. The plan's forestry actions are centred on delivering the national Forest Strategy and Forestry Programme 2023–2027, supporting sustainable forest management, native woodland expansion, and harvested wood products, and leveraging Coillte's Strategic Vision, which commits the state forestry company to 28 Mt CO2 additional removals and setting aside 30% of its estate for biodiversity. The plan also recognises the bioeconomy's role in decarbonisation and outlines cross-cutting policies to expand biobased materials, nature-based solutions, and low-carbon construction. While the afforestation target itself is not legally binding, it is central to Ireland's LULUCF mitigation pathway and is closely linked to the country's overarching climate law and carbon budgets.

Forest Strategy 2023-2030

Ireland's *Forest Strategy 2023–2030* provides the national roadmap for expanding and managing forests to deliver climate, biodiversity, economic, and social benefits, guided by the vision of "the right trees in the right places for the right reasons with the right management." It sets directional (non-binding) targets of achieving 18% forest cover by 2050 and ensuring 50% of all new forest establishment is native or broadleaf, aiming to enhance climate resilience, biodiversity, water quality, sustainable wood supply, and rural development. The strategy's five core values — *Forests for Climate, Nature, Wood, People,* and *Economy and Rural Development* — are underpinned by concrete goals, such as optimising forest carbon sequestration, promoting native forest expansion, increasing certified wood production, mainstreaming wood in construction, and creating jobs in the bioeconomy. To operationalise these ambitions, the strategy identifies ten strategic enablers, including regulatory reforms, incentives, land use integration, sustainable management standards, forest health monitoring, workforce development, and technological innovation. It provides the guiding framework for the €1.3 billion Forestry Programme 2023–2027 and supports Ireland's climate, biodiversity, and rural policy agendas.

Forest Strategy Implementation Plan

The *Forest Strategy Implementation Plan*, backed by Ireland's largest-ever forestry investment of €1.3 billion, sets out an action framework to deliver on the national Forest Strategy 2023–2030 through both incentive schemes and non-programme actions. It defines 87 actions aligned with key goals: climate mitigation, biodiversity enhancement, sustainable wood production, rural development, and public engagement. The heart of delivery is the Forestry Programme 2023–2027, a state aid scheme offering grants, premiums, and support to landowners for afforestation, agroforestry, native woodland creation, sustainable forest management, continuous cover forestry, and reforestation. Key commitments include planting 8,000 ha per year, achieving 35% annual broadleaf planting, and ensuring a 20% native species share in all mixed forests. Measures prioritise biodiversity, climate resilience, water protection, forest health, and diversification of the timber economy, alongside initiatives to mainstream continuous cover forestry, expand forest certification, and develop the forest-based bioeconomy.

Forest Biodiversity Guidelines

The *Forest Biodiversity Guidelines* set out mandatory biodiversity measures for all grant-aided forestry projects and activities under Ireland's felling licensing system, ensuring that afforestation, reforestation, and forest management contribute to nature conservation alongside wood production. These non-legally binding but enforceable guidelines require that at least 15% of each forest area be actively managed for biodiversity, incorporating local habitat protection, open spaces (5–10%), native broadleaf planting where suitable, veteran tree and deadwood retention, and maintenance of age and structural diversity. Specific safeguards include aquatic buffer zones, habitat corridors, minimised soil disturbance, and a preference for natural regeneration. The guidelines apply across schemes under the Forestry Programme, such as the Afforestation Scheme and Native Woodland Scheme, and are linked to grant payments and licence compliance. By embedding biodiversity enhancement in site design, species selection, and ongoing management, the guidelines operationalise sustainable forest management principles and reinforce Ireland's commitments under the Forest Strategy, Climate Action Plan, and EU biodiversity frameworks.

Forest Harvesting and Environmental Guidelines

The *Forest Harvesting and Environmental Guidelines* establish mandatory environmental safeguards for all grant-aided forestry projects and felling licence activities in Ireland, ensuring that timber harvesting, road construction, and forest maintenance are carried out in line with sustainable forest management principles. These guidelines cover planning, operations, and post-harvest restoration, with a strong emphasis on protecting soils, water quality, biodiversity, archaeological sites, and the visual landscape. Key measures include careful route and harvest design to avoid sensitive areas, use of brash mats, sediment traps, buffer zones, phased harvesting to promote structural diversity, and strict management of machinery, fuels, and pesticides. Special provisions address the prevention of damage from pests, disease, fire, wind, and frost. Road building guidelines focus on minimising erosion, runoff, and landscape impacts. Compliance is enforced through grant conditions and felling licence requirements, with breaches potentially resulting in loss of financial aid or licence withdrawal.

Forestry Regulations

The *Forestry Regulations 2017* provide the detailed legal framework for implementing the *Forestry Act 2014*, governing how afforestation, felling, forest road works, and aerial fertilisation are licensed and controlled in Ireland. They specify strict requirements for licence applications, including environmental documentation, site notices, maps, and (where relevant) environmental impact assessments (EIA) and Natura Impact Statements for projects affecting European sites. The Regulations ensure that forestry activities undergo thorough environmental screening, public notification, and consultation with relevant authorities where risks to biodiversity, water, archaeology, or human health may arise. They also set clear thresholds (e.g., 50 hectares for afforestation or 2,000 metres for forest roads) to trigger mandatory EIAs, while allowing the Minister to require assessments for smaller projects if they are likely to have significant environmental impacts. Overall, the Regulations play a crucial enabling and safeguarding role, balancing forestry development with biodiversity protection, climate goals, and sustainable land-use planning.

Environmental Requirements for Afforestation

The *Environmental Requirements for Afforestation* set out detailed procedural and environmental standards that all afforestation projects in Ireland must meet to secure a licence, whether or not grant-aided. Issued by the Department of Agriculture, Food and the

Marine (DAFM), they ensure that new forests are designed, established, and managed in ways that protect water quality, biodiversity, archaeology, and landscape values. The requirements apply across three stages (pre-application design, site works, and ongoing management) and include strict criteria on site eligibility, environmental setbacks, broadleaf content, habitat protection, water management, landscape integration, and archaeological safeguarding. Sensitive areas like organic soils, pearl mussel catchments, High Nature Value farmland, and hen harrier habitats are subject to additional restrictions or may be excluded. The requirements also include operational safeguards (e.g., minimising drainage and chemical use, sediment control, contingency planning) and long-term responsibilities for maintaining environmental buffers and preventing invasive species spread. While non-legislative, these requirements are binding conditions attached to all afforestation licences and thus play a critical role in aligning Ireland's forestry expansion, including its national planting targets, with EU environmental directives and sustainability standards.

Bioeconomy Action Plan 2023-2025

The *Bioeconomy Action Plan 2023–2025* provides Ireland with a cross-sectoral roadmap to advance a sustainable, circular, and climate-aligned bioeconomy that maximizes the value of biological resources while safeguarding food security, biodiversity, and natural capital. Structured around seven pillars—governance, research, climate and circular economy, agriculture and forestry, communities, industry, and knowledge—the plan promotes demonstration initiatives, upcycling of biobased materials, advisory support services, and regional innovation. It is underpinned by five guiding principles: sustainability, cascading use of biomass, the precautionary principle, food-first, and local development. For forestry, the plan supports actions like bioeconomy demonstration projects, circular resource use, and innovation services, aiming to align forest biomass use with the highest-value applications (e.g., materials over energy) and to integrate bioeconomy pathways into land-use, carbon mitigation, and ecosystem scenario planning. While not legally binding, the plan influences future forestry practices, biomass mobilization, and land-use strategies, reinforcing Ireland's climate neutrality and circularity goals for 2050.

Land Types for Afforestation: Soil & Fertility

The *Land Types for Afforestation: Soil and Fertility* document defines the eligibility criteria for land to qualify for afforestation under Ireland's Forestry Programme. It sets out two core requirements: (1) soil type and (2) site fertility. Eligible soils include mineral soils, organo-mineral soils with less than 30 cm peat, and (for native woodland creation only) modified fens and cutaway bogs; organic soils exceeding these thresholds are excluded, reflecting climate and carbon budget considerations. Fertility is assessed using a combined soil pH and nutrient index (R+N score), with a minimum threshold of 6.0, and productivity potential (yield class >14 for Sitka spruce under standard phosphorus input). The guidelines ensure afforestation supports climate and biodiversity objectives by avoiding high-carbon soils and limiting planting to sites with sustainable growth potential. While not legally binding, these criteria are mandatory for afforestation projects seeking grants or approvals under the Forestry

Programme and directly shape land eligibility assessments at both application and approval stages.

Italy

Consolidated Law on Forests and Forestry Supply Chains

Italy's *Consolidated Law on Forests and Forestry Supply Chains* (TUFF, adopted 2018) establishes the legal framework for sustainable forest governance, aligning national forestry management with EU strategies and international commitments. It defines forests as part of Italy's national natural capital, with multifunctional roles in climate adaptation, biodiversity, hydrogeological stability, rural development, and the circular economy. The law sets up a multilevel system of forest planning—from the National Forestry Strategy to regional and local management plans—centring on active, sustainable forest management and wide stakeholder participation. It strictly regulates activities like clear-cutting and forest conversion, permitting them only under exceptional, authorized conditions with regeneration or compensation obligations. TUFF promotes ecosystem services, voluntary certification, sustainable non-wood forest product use, and bioeconomy development, while mandating biodiversity conservation, traceability of forest reproductive material, and national forest monitoring. It also provides mechanisms to restore abandoned or degraded forest lands.

National Network of Old-Growth Forests

The *National Network of Old-Growth Forests* (ministerial decree, adopted 2021) establishes a formal framework to identify, manage, and protect Italy's remaining ancient forests, as defined under the Consolidated Law on Forests. Coordinated by the Ministry of Agriculture, Food Sovereignty and Forests, the decree tasks regions with surveying and reporting old-growth areas by March 2025, following criteria set out in accompanying national guidelines. The network explicitly includes UNESCO-recognized ancient beech forests and aims to enhance the protection and biodiversity value of these irreplaceable ecosystems. Regional data must be submitted through a standardized protocol and validated centrally, with results made publicly available.

Definition of General Criteria for the Preparation of Territorial Plans and Forest Management Plans

The *Ministerial Decree on General Criteria for Territorial and Forest Management Plans* (adopted under the 2018 National Forestry Law) establishes nationally harmonized minimum standards for preparing forestry and silvo-pastoral plans at regional (PFIT) and local (PGF) levels. It ensures that sustainable forest management is guided by comprehensive environmental, economic, and social assessments, aligned with broader landscape, biodiversity, climate adaptation, and risk management goals. Territorial Forestry Plans (PFITs) provide medium- to long-term strategic direction at the regional scale, while Forest Management Plans (PGFs) detail local-level interventions, covering silvicultural actions, infrastructure, biodiversity measures, and climate adaptation, all supported by standardized georeferenced mapping. The decree also allows simplified "equivalent instruments" for small properties.

Law 394/1991 on Protected Areas

Italy's *Law 394/1991 on Protected Areas* provides the national legal framework for the creation, classification, and management of protected natural areas, including national parks, regional parks, nature reserves, and marine protected areas. It establishes governance structures such as Park Authorities, outlines planning instruments like park plans and regulations, and defines zoning systems with varying levels of protection—from strict nature reserves to sustainable use zones. The law mandates a three-year national programme to coordinate protected area priorities, management funding, and conservation goals. It prohibits harmful activities like land conversion, resource extraction, and pollution in sensitive zones, ensuring long-term protection of biodiversity and ecosystem services, including forested areas. By locking in land use patterns and providing legal and institutional safeguards, the law plays a foundational role in shaping Italy's conservation landscape and land-use policies.

National Forest Strategy

Italy's *National Forest Strategy* is a 20-year, non-legislative framework adopted to guide the sustainable management, conservation, and enhancement of the country's forest heritage. Its overarching goals are to promote multifunctional and climate-resilient forests rich in biodiversity, support sustainable rural and urban economies, and strengthen societal and global responsibility toward forests. The strategy sets three main objectives: (1) sustainable forest management and multifunctionality, (2) efficient and sustainable use of forest resources for economic development, and (3) improving forest knowledge, governance, and international responsibility. It details operational actions under each objective, such as expanding forest area, improving forest health, promoting local bioeconomies, advancing forest certification, enhancing traceability, supporting climate adaptation, and strengthening research, monitoring, and public awareness. Although non-binding, the strategy directly links to Italy's climate and biodiversity goals and provides a structured framework for national and regional implementation, backed by financial, regulatory, and governance instruments.

Guidelines for the Identification of Old-Growth Forests

The *Guidelines for the Identification of Old-Growth Forests* provide detailed national criteria for identifying, managing, and protecting Italy's ancient forests, supporting the creation of the National Network of Old-Growth Forests. These guidelines define old-growth forests as native, spontaneous woodlands with undisturbed ecological dynamics for at least 60 years, characterized by natural regeneration, senescence phases, and rich biodiversity, including structural elements like deadwood. They set minimum size thresholds (10 hectares, or exceptionally 2 hectares) and allow regions to propose or assess candidate areas, including small "islands of senescence" with old-growth potential. The process integrates public and stakeholder proposals and requires regional review, public consultation, and national registration. While non-legally binding, the guidelines operationalise the legal framework under the Consolidated Law on Forests and Forestry Supply Chains and anticipate future protection, helping to lock in land use and ecosystem conservation over the long term.

National Plan for Adaptation to Climate Change

The *National Plan for Adaptation to Climate Change (PNACC)* provides Italy's strategic framework to reduce climate risks, enhance adaptive capacity, and leverage opportunities under new climate conditions. Developed using a bottom-up approach, the PNACC aligns with the EU Adaptation Strategy and offers national guidance to regions and local authorities for designing their own adaptation plans. It outlines adaptation measures across 18 sectors—including forestry—organized into soft, green, and grey approaches. For forests, it promotes nature-based solutions such as afforestation, reforestation, ecosystem restoration, biodiversity conservation, and active forest management for resilience, alongside structural fire prevention and landscape connectivity. The Plan includes operational guidelines, an action database, effectiveness indicators, and monitoring tools, and although non-binding, it strongly shapes subnational climate adaptation policies and the integration of forest-based solutions into regional planning and EU funding frameworks.

Updated Bioeconomy Strategy and Action Plan

Italy's *Updated Bioeconomy Strategy and Action Plan (2025-2027)* aims to increase the country's bioeconomy turnover and jobs by 20% by 2030 while boosting circularity and sustainability across sectors. For forestry, it promotes sustainable and climate-smart forest management, valorisation of abandoned forests, improved accessibility and logistics, and adoption of the cascading use principle to maximise wood value across material, chemical, and energy uses. The strategy emphasises local supply chain development, resource efficiency, carbon sequestration, biodiversity conservation, and innovation in forest-based materials. It aligns forestry actions with the National Forest Strategy, CAP National Strategic Plan, NECP revisions, and EU Green Deal targets. The non-binding strategy aims to chape national priorities, funding directions, and research investments, influencing biomass use, material substitution, carbon storage in wood products, and forest sector contributions to climate adaptation and mitigation.

Biodiversity Strategy

Italy's *National Biodiversity Strategy 2021–2030* sets a vision to 2050 for preserving and restoring biodiversity to ensure it continues supporting economic prosperity and human well-being amid global change. Aligned with the EU Biodiversity Strategy, it defines two overarching objectives: (A) building a coherent national network of protected areas, targeting 30% land and sea protection with one-third under strict protection—including all primary and old-growth forests; and (B) restoring terrestrial and marine ecosystems, aiming for 30% improvement in conservation status of protected habitats and species, large-scale ecosystem restoration, and improved forest resilience. Forest-relevant measures include expanding forest area, improving sustainable forest management (SFM), restoring degraded forests, enhancing biodiversity, promoting certified native species, advancing climate adaptation and mitigation, and contributing to the EU goal of planting three billion trees.

Sweden

Forestry Act

Sweden's *Forestry Act* provides the legal backbone for sustainable forest management, balancing economic use with environmental, cultural, and societal interests. It obliges forest owners to regenerate forests after harvesting or damage, using appropriate species and methods, and mandates that felling comply with age, area, and conservation restrictions. The Act integrates biodiversity conservation, cultural heritage, soil and water protection, and considerations for reindeer husbandry, alongside sustainable wood production. Clear-felling over 0.5 ha, use of noble broadleaves, operations in protected forests, and activities in sensitive reindeer grazing areas require permits and adherence to specific environmental safeguards. The law also sets requirements for pest control and limits environmental impacts from harvesting operations, making it a binding framework that shapes forest practices across Sweden's public and private lands.

Environmental Code

Sweden's *Environmental Code* provides the overarching legal framework for environmental protection, sustainable land and water use, biodiversity conservation, and public health. It integrates principles of sustainable development, precaution, and polluter-pays, and aligns Swedish law with EU directives. The Code governs environmental quality standards (EQS), environmental impact assessments (EIA), permits for environmentally hazardous activities, water operations, waste, chemicals, and protected area designations (including Natura 2000, national parks, nature reserves, habitat protection areas, and cultural reserves). It also regulates wild species protection, ensuring sustainable management of ecosystems and natural resources. For forestry, the Code works alongside the Forestry Act, setting binding constraints on land use, forest operations near protected areas, biodiversity conservation measures, and environmental standards. As such, it defines the regulatory landscape within which forestry and other land-based sectors operate, influencing harvest levels, land use change, conservation measures, and climate/environmental commitments.

National Forest Programme and Action Plan

Sweden's *National Forest Programme (NFP)* is a non-legally binding strategic framework adopted in 2018 to guide the sustainable development of the country's forest sector, balancing economic, environmental, and social values. Built through multi-stakeholder dialogue, it positions Sweden as a global leader in sustainable forestry and the forest-based bioeconomy. The NFP sets five focus areas, including sustainable forestry with increased climate benefits, multifunctional forest use, innovation in forest-based products, international cooperation, and expanded knowledge and research. The accompanying action plan includes concrete funded measures implemented through regional programmes and periodic updates, such as the creation of over 750 new nature reserves, enhanced forest management, wood construction initiatives, bioeconomy innovation, and biodiversity conservation.

National Strategy for Biodiversity and Ecosystem Services

Sweden's *National Strategy for Biodiversity and Ecosystem Service* (adopted 2014) provides the country's main long-term framework for protecting biodiversity, safeguarding ecosystem services, and integrating nature values into decision-making. Aligned with EU and international goals (including the CBD Aichi Targets), the strategy sets ten milestone targets covering species and habitat protection, invasive species management, genetic diversity, holistic land use, environmental consideration in forestry, and expansion of protected areas—targeting at least 1,142,000 additional hectares of land and freshwater under protection by 2020. It emphasized formal protections (e.g., 150,000 ha of high-nature-value forests) and voluntary set-asides (targeting ~1.45 million ha), though some targets remain unmet as of 2023. While the strategy formally expired in 2020, it continues to influence forestry practices and administrative approaches, notably through voluntary conservation by the forestry sector.

Environmental Quality Objectives

Sweden's *Environmental Quality Objectives (EQOs)* form the central framework guiding national environmental policy, with the overarching generational goal of handing over to future generations a society where major environmental problems are solved, without causing increased environmental or health impacts abroad. Adopted by parliament, the 16 EQOs cover areas including air, water, biodiversity, and land use. For forests, the Living Forests objective aims to safeguard biological production while maintaining biodiversity, ecosystem services, genetic variation, cultural values, and green infrastructure. While the EQOs are non-binding, they steer policy development, voluntary protection efforts, and land-use planning. Indicators track progress on forest protection, biodiversity trends, and structural features like deadwood and large trees, with a clear political ambition to preserve high-conservation-value forests through formal protection or voluntary set-asides.

8. Appendix III: Reference Scenario - EU Policy Instruments

NECP Measures

Member State	Title of measure	Description	Targets	CAP Measure?
Belgium	Concreting by reducing hard coverings in agricultural, natural and forestry uses (Flanders)	*No further description provided*	by at least 20 % by 2050 compared to 2015	no
	Increased storage through the development of additional forests and natural areas by 2030 (Flanders)	The forest extension plan 'Meer bos in Vlaanderen! ' aims to secure 4 000 ha of additional forests by 2024 and the planting of 10 000 ha of additional forests by 2030. The plan aims to expand existing forest complexes, strengthen blue green networks and develop new forests in urbanised areas.	Extension of forests by 4000 ha by 2024 and 10,000 ha by 2030	no
	Prevention of deforestation and loss of old grassland (Flanders)	The strategic vision of the Space Policy Plan for Flanders (BRV) includes the objective of reducing average additional daily land take to 3 ha by 2025 and to 0 ha by 2040. No additional information is given	Average additional daily land take is reduced to 3 ha by 2025 and to 0 ha by 2040	no

Member State	Title of measure	Description	Targets	CAP Measure?
Cyprus	Plant for climate	Plant for Climate Project. The 'Plant for Climate' project was launched in 2019 and aims to increase the production of forest trees by nurseries for planting in non-forest areas. The scheme is open to public or private organisations, such as municipalities, churches, schools, NGOs, businesses, but also individuals wishing to forest public or private land. Beneficiaries shall assume responsibility for providing the resources and care for plantings for at least three years. The Department of Forests provides free seedlings, taking into account the area of the plot of land and the specificities of the site. The provision of free seedlings by the Forests Department is planned to reach 300.000 per year by 2030 – This initiative is supported by the creation of a database (ARC GIS) that records and monitors tree planting actions across Cyprus. The Database makes it possible to ensure the transparency and effectiveness of the actions, while allowing the success of these initiatives to be assessed. The 'Plant for Climate' initiative is based on cooperation with various actors, such as the Pancyprian Volunteering Coordination Council, municipalities, municipal authorities, and other public and private bodies, to ensure the success of afforestation. Successful implementation of afforestation actions is a crucial factor in increasing removals and reducing the impact of climate change.	300,000 trees planted by 2030	no
Denmark	Public afforestation (state and municipalities) + private afforestation	The government will present an ambitious forest plan with a target of establishing 250.000 hectares of new forest in Denmark. The creation of new forests contributes significantly to reaching climate neutrality and, in the long term, net-zero emissions. The Forest Plan should maximise synergies and trade-offs between the multiple purposes of new forests, identify key actors and already existing funds, and consider instruments. Note: a target date for this goal is not given.	Create 250,000 new ha of forest	unclear
Finland	Promotion of forest fertilisation on mineral soils	Part of the Metsähallitus - climate actions in state-owned forests. No additional details given in plan - estimated climate impact for 2030 is 0.46 MtCO2e. Estimated climate impact in 2035 is 0.28 MtCO2e	25,000 ha per year	no
	Preventing the conversion of forests into fields	Part of the Metsähallitus - climate actions in state owned forests. No additional details given in plan - estimated climate impact for 2035 is 0.5 MtCO2e	Approx 1,700-1,900 ha per year	no
	Act on fixed-term support for afforestation	Part of the Metsähallitus - climate actions in state owned forests. No additional details given in plan - estimated climate impact for 2030 is 0.09 MtCO2e. Estimated climate impact in 2035 is 0.11 MtCO2e	3,000 ha per year, of which 40% in peat production areas	no

Member State	Title of measure	Description	Targets	CAP Measure?
	Afforestation of low-yield arable land	No additional details given in plan - estimated impact on climate in 2030 is 0.08 MtCO2e by 2030. Estimated impact in climate by 2035 is 0.08 MtCO2e	9,000 ha in 2024-2028	no
	Ash fertilisation of peatland forests	Part of the Metsähallitus - climate actions in state-owned forests. No additional details given in plan - the estimated climate impact in 2030 is 0.18 MtCO2e. Estimated climate impact in 2035 is 0.40 MtCO2e	26,000 ha per year	no
	Comprehensive planning of peatland forest management (continuous cover forestry)	Part of the Metsähallitus - climate actions in state owned forests. No additional details given in plan - estimated climate impact for 2030 is 0.21 MtCO2e. Estimated climate impact for 2035 is 0.21 MtCO2e	6,000 ha per year	no
France	Incentivising the use of wood material in construction and renovation	The National Forest and Wood Programme (GNP), drawn up by the LAAAF and approved by decree on 8 February 2017, lays down the guidelines for forestry policy for the decade 2016-2026. In particular, it aims to optimise forest levers to adapt French forests to climate change and contribute to mitigation, taking into account the full carbon balance of the forest-wood sector (storage of carbon in living biomass above ground and underground, dead biomass, forest soils, wood products, substitution of wood to replace fossil fuels or competing materials). In particular, it sets an additional wood mobilisation target of 12 Mm3 commercial by 2026 compared to 2015. A number of devices are planned to support the development of wood material, particularly in construction. The Wood Plans I, II, and III (Wood Plan IV covers the period 2021-2024) helped to remove the technical and regulatory brakes for the use of wood in medium and high construction. The purpose of the new French industrial plan, 'Large wooden buildings', is to demonstrate, in a very concrete way by building buildings, the feasibility of building wood at a high height and subsequently democratising the most appropriate technical solutions. Finally, RE2020 (see section B.2) takes into account all the emissions of a new building over its entire life cycle (including the manufacture of materials). A significant development of bio-based products is expected in the coming years following the introduction of this new regulation. The 'bio-based buildings' label, which has been operational since 2013, makes it possible to give greater visibility to new buildings which make a significant effort to use materials of plant and animal origin (wood, hemp, straw, wool, feathers, etc.). Forest-based industries also benefit from a number of financing schemes managed by the French public	12 Mm^3 of commercial wood mobilisation by 2026 compared to 2015	financing schemes managed by the French public investment bank Bpifrance, national calls for projects

Member State	Title of measure	Description	Targets	CAP Measure?
		investment bank Bpifrance116: the Investment Development Loan (PPD) Wood and the Filière Wood Loan for low balance sheet financing, the Wood Fund for investments at the top of the balance sheet. They are also supported by the Accelerator Filière Bois, including advice, training and networking to facilitate their growth.		
	Net Zero Land Take in 2050	Combatting land take: In line with European objectives, the Climate and Resilience Law adopted in 2021 and complemented by the Law of 20 July 2023 enshrined the objective of achieving 'net zero land take' in 2050, with an intermediate milestone of halving the consumption of natural, agricultural and forestry areas between 2021 and 2031 compared to the period 2011-2021. For regions covered by a regional planning, sustainable development and equality plan (all regions outside Corsica and IDF), the reduction at regional level must be at least 54.5 % after national or European projects of major general interest have been pooled.	first intermediate step in 2031 to reduce the consumption of natural, agricultural and forestry areas (i.e. the rate of land take between 2022 and 2031 must be divided by two compared to the period 2012-2021)	no
Greece	Increase woody energy crops to produce biomass (afforestation)	Note: has been removed from final NECP in 2025. Appeared in draft 2023 version of NECP	50,000 ha of degraded forest ecosystems to be restored in greece by planting seedlings by 2030. Additional 192 kt in CO_2eq removals by 2040	does not appear in 2025 NECP
	Increase in removals from wood products	Note: has been removed from final NECP in 2025. Appeared in draft 2023 version of NECP. Increase the production of wood products. No additional details given.	additional 400 Kt CO_2eq removals in year 2040	no
Hungary	Afforestation	NECP provides tree species and groups of tree species used in afforestation (Please let us know if you need this information). Under the national afforestation programme the Ministry of Agriculture and the Ministry of Innovation and Technology (its successor is the Ministry of Energy) agreed on a multi-annual afforestation programme. The National Afforestation Programme aims to increase and maintain forest cover, as well as improve the resilience of existing forests and restore them after damage. Priority will be given to natural regeneration and the use and promotion of indigenous reproductive material,	increasing the country's forest and wood cover from 25% to 27% by 2030: We will plant ten trees for every newborn baby: Every year we will plant one	no

Member State	Title of measure	Description	Targets	CAP Measure?
		including forest reproductive material from drier climatic regions south of Hungary, to adapt to changes in soil conditions caused by climate change. Additionally, more drought-tolerant species and ecotypes will be supported financed by national CO2-commerce surlpuse. The programme organises and finances the afforestation activity of the state-owned forestry companies as ther afforestation activities are excluded from the EAFRD programme financing	million trees – at least ten for every newborn baby and forest cover will be increased to 27% of the area of the country by 2030. Planting of more than 10,000 trees in the interior per year. The expected implementation of afforestation in a given year by 2030 is 23,729 tons of CO2	
	Restoring, preserving and enhancing ecosystems related to agriculture and forestry	The main objective of the National Forest Strategy is to continue on the path started with the National Forest Programme (2006-2015) to reach the 2030 target. One of the main objectives is to increase the wood cover (forest and other tree planting) ratio to 27 % by 2030, which necessitates the planting of approximately 7 thousand hectares of forest annually. The Strategy emphasises the use of forests as a renewable source of energy; the protection of forests, adaptation to climate change; monitoring of the condition of forests, including monitoring of the negative effects of climate change; reduction of climate change effects; the importance of semi-natural forest management. The measures of the strategy aim to maintain or even increase the carbon sequestration of forests. Under the Technical assistance scheme public areas are planted with mature saplings as a public awareness activity. In the first run approx. 500 settlement was provided with max 40 "kits" each (alltogether approx. 12 000 kits), in the second run another 1000 settlement is planned. The saplings and planting accessories as a kit is provided be the National Rural Network, the local communities are asked to plant them and professional foresters, as members, are asked to assist them in every settlement.	No loss of forest area, increase the forest ratio to 27% by 2050, which necessitates the planting of approximately 15 000 hectares of forest annually	no

Member State	Title of measure	Description	Targets	CAP Measure?
Lithuania	Afforestation on private land	The objective of the Land Holdings Programme is to improve the structures of land holdings and to reduce areas of abandoned land. The measures put in place to achieve this aim are: the restoration of productive abandoned land to good agricultural condition, including drainage operations (90ha in 2020 as an assessment criterion); it is intended to provide areas that are not suitable for low-productivity agricultural activity for afforestation, including the formation of anatural frame and the creation of an ecologically stable landscape. aims to increase the country's forest capacity by providing support to private landowners for afforestation, maintenance, and protection (7 years after afforestation)	Afforestation on private land: 3 500 ha by 2030	unclear
	Restoration of peatlands (restoration of hydrological regime in forests)	The status of Natura 2000 habitats 9080 and 91D0 is currently assessed as unfavourable (U1). This is due to climate change and the renewal of old drainage systems in these habitats. In order to avoid emissions from these bog forests, it is envisaged to maintain or restore the hydrological regime	Conversion of forests where it is appropriate to restore hydrological regimes: 4 000 ha by 2030	unclear
	Afforestation on public land	In order to increase the country'sforest areas, around 300 ha of new forests (2023-2030)are planned annually on state- owned land.	300 ha by 2030	unclear
	Improving forest quality	The measure aims to support reforestation with valuable tree species and the conversion of depleted and low-value stands, with the aim of increasing by 2030 forests that are more resilient and more CO2 absorbing	an additional 2 500 ha of better quality forests developed by 2030	unclear
Luxembourg	Establishment of Free Developing Forests without timber harvesting	Article 17 of the Law of 23 August 2023 requires strict protection (no wood harvesting) of 5 % of public forest properties of more than 100 ha. This will lead to an additional strict protection of 2 000 ha of forest (currently 1 250 ha). This measure will be implemented as part of forest management plans. In the short term, this will lead to an increase in deadwood and thus an increase in carbon stock in the forestry sector. On the other hand, this measure reduces the total wood harvesting potential and the substitution effect for building materials or energy sources.	ensure strict protection (no timber harvesting) of 5 % of public forests over 100 ha. This will lead to additional strict protection of 2 000 ha of forest (currently 1 250 ha	unclear

Member State	Title of measure	Description	Targets	CAP Measure?
	Establishment of strictly protected areas in public forests with limited timber harvesting	In line with the European Biodiversity Strategy, the PNP3 aims to protect 30 % of the national territory, of which 10 % is strictly protected (including all primary and virgin forests). This means that the PNP3 aims to create a network of forest protected areas (forest reserves) of a minimum of 30 % of all forests and 10 % of strictly protected forests. The objective is to increase the area of undisturbed forest areas, with limited exploitation. The PNP3 aims to designate an additional 7.500 ha of forest reserves (10.000 ha by 2030). In addition to these forest reserves, 10 % of forests are to be protected in the form of integral forest reserves, i.e. without any intervention. In the short term, this will lead to an increase in deadwood and thus an increase in carbon stock in the forestry sector. On the other hand, this measure reduces the total wood harvesting potential and the substitution effect for building materials or energy sources. Increase of Protected Areas of National Interest (ZPIN).	aims to protect a minimum of 30 % of all forests and 10 % of strictly protected forests. The aim is to increase undisturbed forest areas, with little or no use. The PNPN3 aims to designate an additional 7.500 ha of Forest Reserves (10.000 ha by 2030)	unclear
	Limitation of harvesting levels in vulnerable public natural forest ecosystems	The PNPN3 and the public forest management rules require that wood harvesting in public folio forests be limited to 80 % of the increase for carbon sequestration and storage and to 60 % in climate broadleaved stands of public forests in order to enhance their resilience. This limitation currently applies to all public beech forests, accounting for 22 % of Luxembourg's total forest area (18.500 ha). This will lead to an increase of 3 m^3 of wood per hectare per year in these forests and should at least compensate for natural degradation by the impacts of climate change.	require limiting harvesting levels to 60 % of the natural increase in biomass in natural forests vulnerable to climate change. This limitation currently applies to all public beech forests, representing 22 % of Luxembourg's total forest area (18.500 ha)	unclear
	gradual reduction of land take and concentration of development in the most appropriate locations	Among the policy objectives of the draft PDAT, the first two have a major impact on the reduction of CO2 emissions: gradual reduction of land take and concentration of development at the most appropriate locations. The first objective is to reduce land take to zero in 2050, precisely to preserve agricultural and forest land inter alia for its capacity to absorb CO2. Combined with multifunctional development while preserving and developing the intra-urban green grid, the concentration of development allows a significant reduction in the need for motorised travel and an increase in the quality of life. Moreover, this approach limits diffuse, costly and harmful urban development for	move towards zero in 2050 to preserve agricultural and forest land inter alia for their CO2 absorption capacity	unclear

Member State	Title of measure	Description	Targets	CAP Measure?
		landscape quality. Finally, anticipatory infrastructural planning is possible as we know where urban developments will be carried out		
Poland	Forest and tree interventions under the CAP (includes afforestation, agroforestry and biodiversity enhancement in private forests, among others)	A group of interventions under Pillar II of the CAP for farmers who may receive support for: afforestation of agricultural land, the creation of field trees, the establishment of agroforestry systems and the enhancement of the biodiversity of private forests. Forest and tree interventions contribute to carbon sequestration and thus to climate change mitigation. They also have beneficial effects on soils and water conditions, including preventing erosion and increasing retention in rural areas. They also have important functions in protecting biodiversity and enhancing the landscape. They are an important element in addressing the effects of drought, reducing water losses from the soil and contributing to reducing surface run-off.	17565 ha	unclear
Slovakia	Afforestation of agricultural land	Transfers of unused agricultural land to forest land. The measures of the Rural Development Plan of the Slovak Republic for the period 2014-2020 provide financial support for the measures included in the WEM scenario, such as: • afforestation of nonagricultural land; • the establishment of fastgrowing tree stands on agricultural land;	increase forest area by clearing and including 'white' areas in forest plots in the range of 100 ha by 2030	unclear
	Motivating forest managers to start a process of transition to close-to-nature forms of forest management	The measures stem from another NLP strategic objective, such as the introduction of close-to-nature forms of forest management (Strategic Goal II), which can also be expected to have higher crop reserves of biomass and hence of carbon embedded in forests. The measure is intended to encourage forest managers to initiate a relatively complex and long-term process of forest transition to closeto-nature forests, at least ¼ of Slovakia's forest areas, for which a transitional increase in both operational and overhead costs is foreseen, especially at the outset.	covering at least 1/4 of Slovakia's forest area	unclear
Spain	Creation of afforested woodland (includes reforestation)	Under this measure, the promotion of afforestation activities (conversion, by human activity directa, of land without forest for a period of at least 50 years into forest land by plan, sowing or anthropic promotion of natural regeneration) and reforestation (conversion by direct human activity of non-wooded land to woodland through planting,	Reforestation of 16.000 hectares per year between 2020 and 2050 (a 4% increased	unclear

Member State	Title of measure	Description	Targets	CAP Measure?
		seeding or anthropic promotion of natural regeneration, on land that was afforested but currently deforested) with an estimated potential of 16.000 ha/year are considered.	in the area of forest land)	

9. Appendix IV: Selected NECP policy measures included in GLOBIOM-G4M-X

Category	Country	NECP measure/target	Model assumption	Model implementation
Forest management	Austria	Salvage logging and fast reforestation after hazards	Simulate salvage logging and forest regeneration as soon as the damaged trees are detected. The amount of salvage logging is limited to the harvest capacity of 1.5 times the average harvest level in the country. Regeneration occurs after salvage logging.	Implemented, feasible
Afforestation	Belgium	By 2030, Flanders aims to create 10 kha of additional forest	Setting a lower bound of afforestation area for 2030, while observing the general condition: no afforestation in protected grassland and heathland	In 2021-2030, 11.6 kha is projected, while in 2024-2030, only 5 kha, thus feasibility depends on the period, which is not stated in the policy description.
Protection and conservation of old-growth and primary forests	Croatia	10% strict protection target, including primary and old-growth forests in 2030	Primary forests are considered protected; therefore, no harvest, salvage logging, or deforestation is allowed. Old-growth Forest is included in the extension of the protected area to 10% that is set aside in 2025.	Implemented, feasible
Afforestation	Croatia	Planting 1 billion trees, including planting in cities and agroforestry (400-900 kha)	Setting a lower bound of afforestation area for 2030, while observing the general condition: no afforestation in protected grassland and heathland (342 kha)	Implemented, but not feasible to achieve the original target; maximum feasible afforestation area in 2024-2030 under current land-use constraints: 8 kha.
Afforestation	Cyprus	Planting 300 thousand trees by 2030	Setting a lower bound of the afforestation area for 2030	Implemented as 300 thousand trees planted by 2030. Feasible or not depends on the interpretation. 300 thousand trees will take approximately 300-400 ha. G4M plants in total 555 ha during 2024-2030. However, if the policy assumes planting of 300 thousand trees per year then it is not feasible. Because rough spatial resolution of G4M it does not observe all available land that may be critical for Cyprus.
Afforestation	Denmark	The Danish Nature Agency establishes approximately 300 ha of forest each year.	Setting a lower bound of afforestation area for 2030, while observing the general condition: no afforestation in protected grassland and heathland (500 kha)	Implemented, feasible
Reduced forest management in protected	Estonia	The objective of this measure is conservation of carbon in existing forests. Number of hectares benefitting from support under	Set-aside old-growth forest and reduced intensity of forest management in valuable forest	Partially implemented, feasible.

Category	Country	NECP measure/target	Model assumption	Model implementation
zones (in or outside Natura2000 zones)		Natura 2000 or Directive 2000/60/EC - 339 084 ha (total for 2023 - 2029).		The area of 10% strict protection forest is 27 kha and the area of the 30% protection extension forest is 272 kha.
				Currently, in our implementation, the 10% area of strict protection forest is set aside.
Afforestation	Finland	Afforestation of low- yield fields suitable for afforestation of 9 kha in 2024–2028	Setting a lower bound of afforestation area for 2030, while observing the general condition: no afforestation in protected grassland and heathland (1217 kha)	Implemented, feasible
Deforestation	Finland	Preventing the conversion of forests into fields, approximately 1.7–1.9 kha annually	Checking the deforestation trend (projection of afforestation and deforestation depends on dynamics of land required for agriculture, energy crops, short rotation plantations as well as agriculture land rents and wood prices).	Implemented, feasible
Afforestation	Germany	Afforestation of approx. 33.3 kha (in 2026-2030?)	Setting a lower bound of afforestation area for 2030, while observing the general condition: no afforestation in protected grassland and heathland (1261 kha)	Implemented, feasible
Afforestation	Hungary	Minimum afforestation rate: planting of approximately 7 thousand hectares of forest annually.	Setting a lower bound of afforestation area for 2030, while observing the general condition: no afforestation in protected grassland and heathland (278 kha)	Implemented (afforestation rate of 7 kha/year). The afforestation rate of 7 kha/yeah can be achieved only in 2024-2029 because of the amount of land available for afforestation by 2030.
		Wood cover (forest and other tree planting) will be increased to 27% of the area of the country by 2030 (our calculation: 2 511 702 ha of forest)		According to our estimation, the share of forest area was 22% in 2023 (HU reports 2,074 kha of total forest land for 2023 in its 2025 GHGI with the total country area of 9,303 kha).
		The expected implementation of new forest plantations in a given year by 2030 is 385,000 tons of CO2		1 million trees take 0.4 - 1 kha – such afforestation rate is feasible. But it is not enough to reach forest area of 27% of the country area (2074 kha in 2023 and 2512 kha in 2030, the net afforestation rate should be 70 kha/year that is more than 3 times greater than the maximum historical afforestation rate).
		Contribution to the country's forest and wood cover from 25% to 27% by 2030.		Currently G4M simulates a total forest area of 2079 kha
		The expected implementation of afforestation in a given year by 2030 is 23,729 tons of CO2		

Category	Country	NECP measure/target	Model assumption	Model implementation
		Plant one million trees per year (at least ten for every newborn baby) and the forest cover will be increased to 27% of the area of the country by 2030		
		The expected implementation of the post-newborn afforestation program in a given year by 2030 is 11,755 tons of CO2.		Likely, HU takes into account not only forest but also other wooded land in its initial estimate of trees cover share of 25% of the country area, and planting trees not only as afforestation but also outside, e.g. agroforestry.
Deforestation	Hungary	No loss of forest area;		Implemented, feasible.
Afforestation	Latvia	Afforest 10.28 kha by 2030	Setting a lower bound of afforestation area for 2030, while observing the general condition: no afforestation in protected grassland and heathland (704 kha)	Implemented, feasible
Afforestation	Ireland	Aligned to national WAM projection for afforestation area.	Setting a lower bound of afforestation area for 2030 (50 kha),	Implemented, feasible
Afforestation	Lithuania	Around 300 ha of new forests (2023- 2030) are planned annually on state- owned land. Afforest 3.5 kha of private land by 2027	Setting a lower bound of afforestation area for 2030, while observing the general condition: no afforestation in protected grassland and heathland (704 kha)	Implemented, feasible
Afforestation	Portugal	Support afforestation of non-agricultural land	Setting a non-zero lower bound of afforestation area, while observing the general condition: no afforestation in protected grassland and heathland (855 kha)	Implemented, feasible
Afforestation	Romania	Afforest 65 kha by 2030	Setting a lower bound of afforestation area for 2030, while observing the general condition: no afforestation in protected grassland and heathland (460 kha)	Not reachable currently. Partially, because agricultural land price increases and wood price decreases in 2020-2030-2040. Currently, G4M afforests 43 kha in 2024-2030 and about 53 kha in 2021-2030. The afforestation rate in 2016-2023 reported by Romania was only 3.4 kha/year, while it should be increased to 9.3 kha/year in 2024-2030 to reach the target.

Category	Country	NECP measure/target	Model assumption	Model implementation
Expansion of forest under strict protection	Slovakia	Extension without intervention regime to 75 % of national parks by 2030, i.e. an increase of around 130 kha compared to the current situation.	Set-aside of the 10% of forest area as strict protection forests, about 149 kha	Implemented, feasible
Afforestation	Spain	Minimum afforestation 16 kha/year	Setting a lower bound of afforestation area for 2030, while observing the general condition: no afforestation in protected grassland and heathland (3446 kha)	Not reachable because of too much protected grassland. Not enough land for afforestation. Currently G4M afforestation is about 11 kha/year in 2024-2030.
Afforestation	Netherlands	Forest area by 2030 to be 407 kha due to afforestation of 15-19 kha	Setting a lower bound of afforestation area for 2030, while observing the general condition: no afforestation in protected grassland and heathland (191 kha)	Netherlands has a declining total forest area in recent years, i.e. deforestation is greater than afforestation. The total forest area in 2023 is 362.4 kha. Afforestation rate should be 6.43 kha/year to reach 407 kha in 2030 with zero deforestation and about 9 kha/year if deforestation continues. In 2020-2023 the afforestation rate was 2 kha/year and deforestation rate – 2.8 kha/year. With currently implemented increasing afforestation rate of up to 7 kha/year and deforestation rate declining below the historical range G4M simulates total forest area of 385.8 kha in 2030. Thus, the target is hardly reachable but can be approached by hard forcing the model. It can be implemented in the next stage.