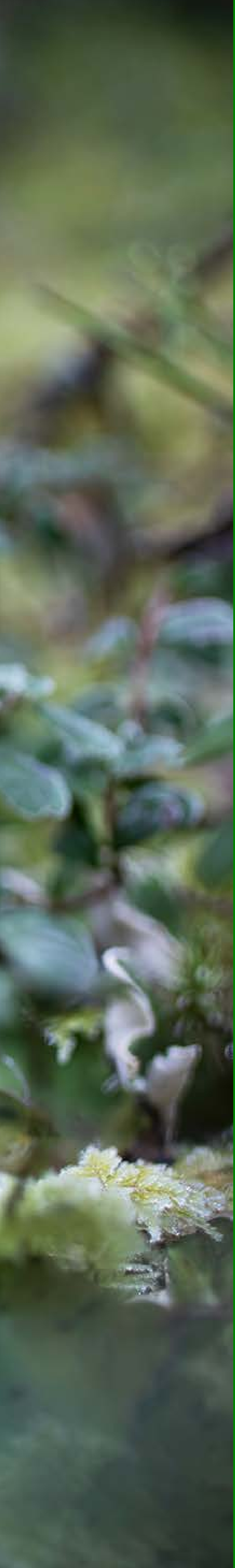

MEMORANDUM

Biodiversity integration in the LULUCF Regulation

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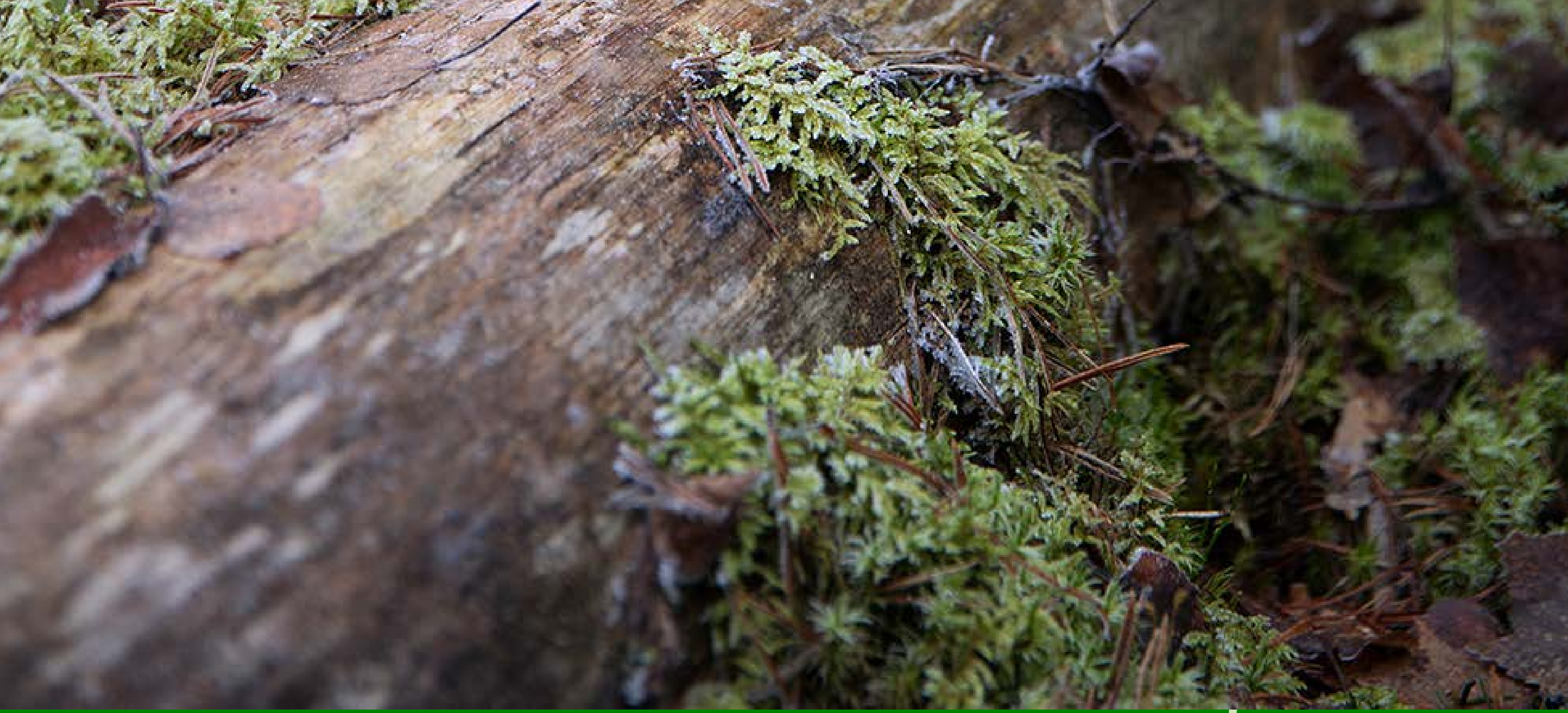
SYKE



MEMORANDUM

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Background of the assignment

The amended LULUCF Regulation, which would cover the compliance period 2026–2030, aims to enhance the link between climate change mitigation and safeguarding biodiversity (European Commission 2021a). The European Commission's proposal for the biodiversity integration is, however, insufficient and the proposed approach to the integration would not be able to guarantee proper acknowledgement of the biodiversity concerns. As it stands, the draft regulation mainly obliges the Member States to report on the areas designated for the conservation of biodiversity in more detail and to assess the benefits of carbon storage in these areas (see Annex III, European Commission 2021a). There are no strong or clear incentives to safeguard biodiversity as part of climate action.

Experts at the Finnish Environment Institute (SYKE) were assigned by Ville Niinistö, MEP, to consider potential ways to strengthen biodiversity integration in the draft LULUCF Regulation. The main question of the assignment was to consider whether the regulation could create a clear incentive to halt biodiversity loss and even improve biodiversity over time in managed forest land. In this paper, managed forests refer to productive and poorly productive forests available for wood

supply on mineral soils and peatlands. The analysis does not include unproductive land (production capacity below 0.1 m^3 ha^{-1} a^{-1}), which include sites such as treeless mires, mires with sparse growth of trees, exposed bedrock, boulder fields and fells. Unproductive lands are not used for the purposes of commercial forestry and therefore fall outside the scope of this paper. According to the EU's Biodiversity Strategy for 2030 (European Commission 2020), all peatlands are carbon-rich ecosystems, as are old forests, in which carbon is sequestered in both trees and soil.

The assignment was to consider potential negative and positive incentives for Member States to promote the safeguarding of biodiversity and their connection to climate governance. An additional question concerned the reporting obligations for Member States: what kind of data are currently available for reporting on the state of biodiversity in commercial forests and how reporting could be developed in the future.

The assignment was carried out by a team of eight SYKE experts in October–December 2021. Due to the tight schedule, this paper is largely limited to the context of the LULUCF Regulation[1]. The paper views the EU as a whole, although it describes some observations from Finland as examples that demonstrate what biodiversity integration means. Other EU legislation or ongoing legislative procedures that touch on the scope of the LULUCF Regulation (such as the EU's Sustainable Forestry Taxonomy [2], the sustainability criteria for forest biomass in the Renewable Energy Directive[3] or the Effort Sharing Regulation[4]) are only referred to in passing in this paper. This paper does, however, comment on the initiative for the restoration regulation set out in the EU Biodiversity Strategy (European Commission 2020). The outcome of the assignment is this memorandum.

1 Regulation (EU) 2018/841 of the European Parliament and of the Council of 30 May 2018 on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework, and amending Regulation (EU) No 525/2013 and Decision No 529/2013/EU, OJ L 156, 19 June 2018, p. 1.

2 Regulation (EU) 2020/852 of the European Parliament and of the Council of 18 June 2020 on the establishment of a framework to facilitate sustainable investment, and amending Regulation (EU) 2019/2088, OJ L 198, 22 June 2020, p. 13. For further details of the contents per sector, see EU Taxonomy Compass available at <https://ec.europa.eu/sustainable-finance-taxonomy/index.htm> (last accessed 30 March 2022).

3 Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources, OJ L 328, 21.12.2018, p. 82.

4 Regulation (EU) 2018/842 of the European Parliament and of the Council of 30 May 2018 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No 525/2013, OJ L 156, 19.6.2018, p. 26.

State of biodiversity in forests and links to climate change mitigation

Forest biodiversity has declined as part of Earth's sixth mass extinction. Commercial forestry and other uses of forests have changed the natural characteristics of forests in Finland in the long term; the amount of old-growth forests, large and old trees and dead wood in particular have decreased significantly compared to the natural state. This has led to the decline and degrading of both forest species and forest habitats. Similar developments have been observed in other EU countries (see e.g. Bauhus et al. 2017). According to data compiled by the EEA, the status of forests is bad or poor in the EU (85%) (EEA 2020).

Of the 22,418 species evaluated in the Finnish assessment of threatened species, a total of 2,667 species (11.9%) were classified as threatened, and 1,912 species (8.5%) were classified as near threatened (Hyvärinen et al. 2019). Forests are the most important habitat for threatened species, with 833 threatened species living primarily in forests (31.2% of all threatened species). Forests are also the secondary habitat of 226 threatened species. 40% of threatened forest species are old-growth forest species. (Hyvärinen et al. 2019.) The Safeguarding of Declined Species in Forestry – Lajiturva Project (2019–2021, SYKE, Tapio Oy and the Finnish Forest Centre) found that there are 2,579 threatened or near threatened species in various primary habitats in mainland Finland whose cause of threat is forest management activities – 57% of these are forest species, 15% of species live in rock outcrop habitats, 10% in rural biotopes and cultural habitats, 8% in mires, 7% in aquatic habitats and 3% in shore habitats (Hyvärinen et al. 2019, see Table 1 in Kärkkäinen et al. 2021).

In the assessment of threatened habitat types, 48% (186) were assessed as being threatened in the whole of Finland, 59% (186) in Southern Finland (hemiboreal, southern boreal and middle boreal forest vegetation zones) and 32% (81) in Northern Finland (northern boreal forest vegetation zone) (Kontula & Raunio 2018). Further, 18.3% (71) of the habitat types were assessed as being near threatened in the whole country: 11.4% (36) in Southern Finland and 17.0% (43) in Northern Finland (Kontula & Raunio 2018). In the assessment of threatened habitat types, the main causes of threat were deemed to be forestry (forest management activities), which were specified in more detail for forest habitat types (Kontula & Raunio 2018).

Forest habitats were divided into heath forests, herb-rich forests and a number of special forest types (Kouki et al. 2018a). There were 34 forest habitat types to be assessed, and taking into account site-fertility class level assessments, a total of 40 types were assessed. Of the forest habitats assessed in the whole of Finland (n = 34), three quarters (76%) were assessed as threatened and one fifth (21%) as near threatened, the proportion of threatened habitats being highest in heath forests in Southern Finland (Kouki et al. 2018a). It should be noted that the proportion of threatened habitats in Southern Finland is significantly higher than that in Northern Finland: in Southern Finland, 79% of habitat types were assessed as being threatened, while the percentage was 56% in Northern Finland (Kouki et al. 2018a).

In addition to safeguarding biodiversity, forests also play a very important role in mitigating climate change (see e.g. Grassi et al. 2017). In 2017, forests and harvested wood products sequestered 13% of anthropogenic emissions in the EU (Lindner et al. 2017). The most important carbon pool in forests is the soil; in the EU, for example, 36% of forests' carbon pool is in living biomass, 10% is in litter and decaying wood, and soil organic carbon (SOC) account for 54% (Böttcher et al. 2021 and references therein). In Europe, peatlands (mires and peatland forests) hold four to five times more carbon than forests (Swindles et al. 2019). It is soil carbon that is often overlooked in the carbon balance of forests – a rhetoric that is based solely on promoting the rapid growth of forests in the name of climate change mitigation easily mixes the concepts of carbon sink and carbon stock, and often the total carbon balance of forests, which includes soil carbon, is not even understood. A carbon pool is a carbon sink only when it absorbs more carbon than it releases into the atmosphere, i.e. carbon stock is increasing. From the point of view of climate change mitigation, it is important to both maintain and increase existing carbon stocks – logging destroys forests' carbon stocks and reduces carbon sinks for decades. Implementing bioeconomy plans by reducing forest carbon sinks and producing short-lived wood products requires even more drastic reductions of emissions in other sectors (see e.g. Hukkinen et al. 2019).

Forests also buffer extreme temperatures and thus mitigate the effects of the warming climate on species. A recent global study suggests that extremely hot temperatures under forest canopies will warm less than in non-forested open habitats (De Lombaerde et al. 2022). This means that preserving forest canopies in a changing climate is not only important for securing carbon sinks and carbon stocks, but forests also safeguard biodiversity and contribute to adaptation to climate change in many ways (including water retention). The links between biodiversity and carbon sequestration or storage can work in multiple directions. Some studies have found that more biodiverse forests sequester and store more carbon (see e.g. Buotte et al. 2020), but the results depend on the level of analysis and the biodiversity and carbon metrics used, so it is not possible to assume there is a linear positive correlation even if synergies can be found in many cases (Wardle et al. 2012, Di Marco et al. 2018, Forsius et al. 2021).

More background information on both the state of forest biodiversity in the EU and the role of forests in mitigating and adapting to climate change can be found in the recent publication by the European Commission (Science for Environment Policy 2021).

The current draft of the LULUCF Regulation and its legal basis

The inclusion of the land use sector within the EU's climate law framework in 2018 was a major step forward in establishing a holistic climate policy for Europe. The LULUCF Regulationis an integral component of the EU 2030 climate and energy framework. The LULUCF Regulation is based largely on the no debit rule, which requires EU Member States to ensure that emissions from the LULUCF sector do not exceed removals in the period from 2021 to 2030. In other words, the LULUCF sector may not become a net source of GHG emissions. To measure emissions and removals from the LULUCF sector and show compliance with the no debit rule, Member States must apply accounting rules divided between five land accounting categories: afforested and deforested land; managed cropland, grassland and wetland; managed forest land; harvested wood products; and natural disturbances. Member States must prepare and maintain accounts for each category to ensure that the no debit commitment in the LULUCF sector is met. There are two compliance periods: 2021-2025 and 2026-2030. Since carbon dioxide emissions related to the use of biomass (including wood) are reported in the LULUCF sector as changes in carbon pools, the LULUCF Regulation provides a solid foundation for calculating these emissions. The use of biomass can replace fossil fuels and emissions from their production and use. Such avoided emissions are indirectly reflected in the greenhouse gas inventory of the country and in the sector in which the emissions are avoided, and they fall outside the scope of the LULUCF Regulation.

The Fit for 55 package of July 2021 introduces several revisions to the LULUCF Regulation, including a commitment to increase the EU's carbon sinks to levels above 300 million tonnes of CO_2 equivalent by 2030 (European Commission 2021c). These removals are to be distributed as binding targets for Member States to increase their net carbon removals in the land use and forestry sector for the period from 2026 to 2030 and to significantly simplify compliance rules.

The current LULUCF Regulation pays little attention to aspects of biodiversity. The preamble to the LULUCF Regulation, which has no binding legal force but guides its interpretation (recital 12), states that the LULUCF sector has a direct and significant impact on biodiversity and ecosystems services and that for this reason, an important objective of policies affecting this sector is to ensure that there is coherence with the Union's Biodiversity Strategy objectives. Article 8 of the LULUCF Regulation provides for the accounting of managed forest land, i.e. the so-called reference levels. The Member States must determine their forest reference level based on the criteria set out in Section A of Annex IV. Point A (f) of Annex IV sets out that '*the reference level should be consistent with the objective of contributing to the conservation of biodiversity and the sustainable use of natural resources, as set out in the EU forest strategy, Member States' national forest policies, and the EU biodiversity strategy*'. Although the biodiversity criterion in the annex is binding, it is loosely worded and does not, in fact, provide sufficient protection against biodiversity loss. Compliance with the criteria set out in Section A of Annex IV would be a one-off with the proposed LULUCF Regulation, as the reference levels would be waived during the Regulation's second period of commitment. Hence the complex forest reference level approach to accounting of emissions and removals from managed forest land would be applied in the first compliance period only.

The importance of the links between climate change mitigation and biodiversity is highlighted in a number of points in the explanatory memorandum of the proposal for the LULUCF Regulation of July 2021. [5] The proposal also states that the amendments to the LULUCF Regulation will align the LULUCF Regulation with EU policies that promote biodiversity.[6] However, proposals related to the actual legislative part of the Regulation are scarce. It is proposed that

5 European Commission, COM (2021) 554 final, p. 2, 113 and 93.
6 European Commission, COM (2021) 554 final, p. 2.

the first paragraph of Article 14 (compliance checks) of the LULUCF Regulation include a requirement for Member States to include a compliance report that "*shall include an assessment of: ...c) synergies between climate mitigation and biodiversity*".[7] The amendment means, in practice, an addition to the compliance report and requires the reporting of the above-mentioned synergies, and does not, for example, impose legal obligations to take into account biodiversity considerations.

The proposal for the new Renewable Energy Directive[8] includes a proposal to revise the sustainability criteria for bioenergy to safeguard forest biodiversity. The proposal prohibits, for example, the sourcing of forest biomass for energy production from primary forests, peatlands and wetlands and allows it from highly biodiverse forests only on condition that it does not jeopardise nature conservation purposes. The revised Renewable Energy Directive would set sustainability criteria for the harvesting and conservation of soil quality and biodiversity. Part 3 of Annex III to the Governance Regulation[9] sets out the monitoring and reporting methods in the LULUCF sector. The proposal for the LULUCF Regulation includes a proposal to amend Part 3 of Annex III to the Governance Regulation so that the methodologies for monitoring and reporting would include:[10]

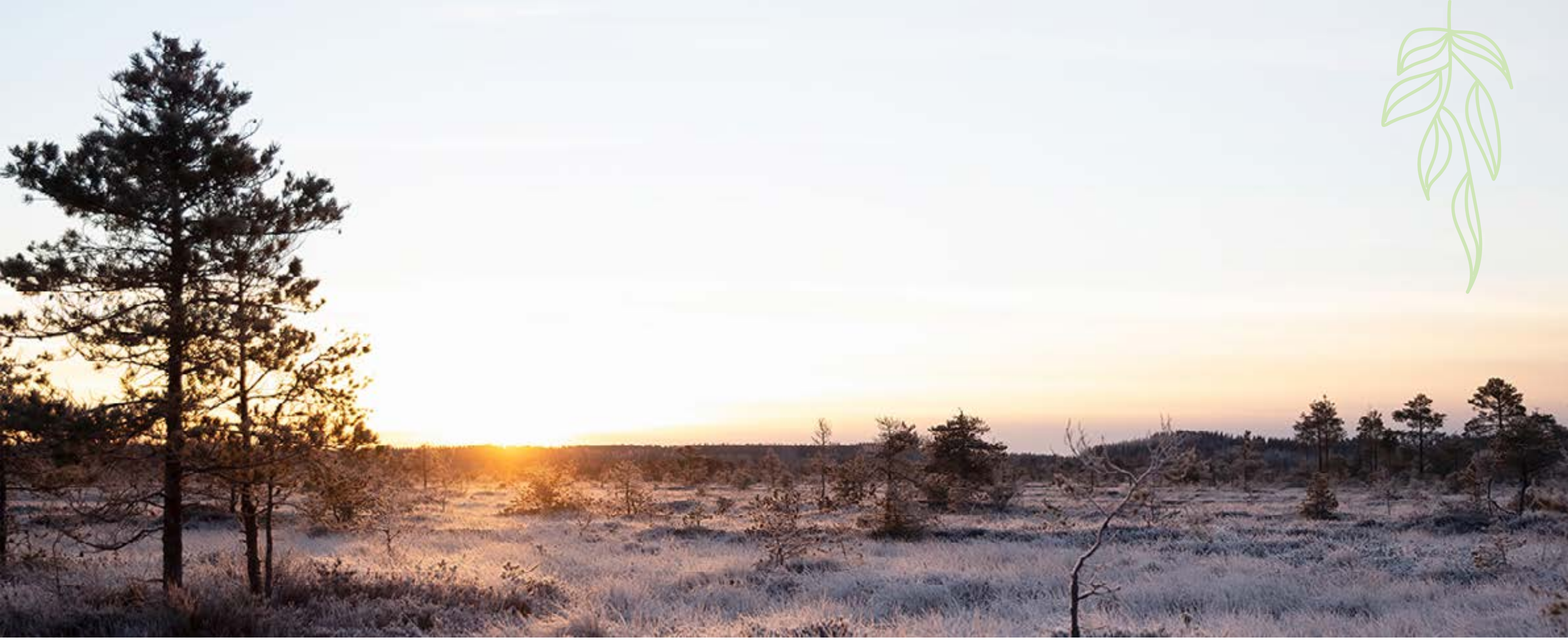
(a) a system for the monitoring of land use units with high-carbon stock land, as defined in Article 29(4) of Directive 2018/2001;

(b) a system for the monitoring of land use units subject to protection, defined as land covered by one or more of the following categories:

- Land with a high biodiversity value as defined in Article 29(3) of Directive 2018/2001;

Although the LULUCF Regulation must be considered as an integral part of the other legislative proposals in the Fit for 55 package and as a set of policy measures, the provisions proposed for the LULUCF Regulation to integrate biodiversity remain weak. The provisions, *per se*, do not oblige any specific actions to be taken in relation to biodiversity within the scope of the LULUCF Regulation, nor do they provide an incentive to safeguard biodiversity as part of climate action. The provisions only apply to the reporting obligation, the content of which is not described in the proposal.

7 European Commission, COM (2021) 554 final, p. 27.
8 European Commission, COM (2021) 557 final.
9 Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action, amending Regulations (EC) No 663/2009 and (EC) No 715/2009 of the European Parliament and of the Council, Directives 94/22/EC, 98/70/EC, 2009/31/EC, 2009/73/EC, 2010/31/EU, 2012/27/EU and 2013/30/EU of the European Parliament and of the Council, Council Directives 2009/119/EC and (EU) 2015/652 and repealing Regulation (EU) No 525/2013 of the European Parliament and of the Council, OJ L 328, 21.12.2018, p. 1.
10 European Commission, COM (2021) 554 final, p. 70.



Proposals to strengthen biodiversity integration

The proposals take into account the following premises or restrictions:

1. Biodiversity integration must be based on national *biodiversity indicators*, which already collect information in the Member States across the EU or almost across the entire EU. The indicators need to be monitored frequently enough to identify trends in biodiversity while the new LULUCF Regulation is in force.

2. Indicators reflecting the state of biodiversity must relate specifically to the biodiversity of *managed forests* on mineral soils and peatlands (mires).

3. The link between the biodiversity elements to be selected and *the objectives of climate change mitigation* should be demonstrable in as straightforward a manner as possible in order to justify amending the LULUCF Regulation in this respect.

Each proposal is assessed separately as to how well the above premises are fulfilled and if there are any potential weaknesses or areas of development in either national or EU-wide contexts. More specific details of the proposals, such as the status of habitats or species as reported in the Red List assessments carried out in Finland and/or reported in relation to the Directive, have been compiled as annexes to this memorandum. Actual incentives and their potential links to climate governance are discussed in the next chapter.

PROPOSAL 1:
Forest habitats in the Habitats Directive

Proposal 1 integrates the conservation status of forest habitat types in the Habitats Directive into the LULUCF Regulation, so that depending on the trend of the status, a Member State either has additional flexibility (positive trend) or is subject to stricter obligations (declining trend).

OBJECTIVE:
To turn forest habitat types with an unfavourable conservation status under the Habitats Directive into favourable, especially with regard to the structure and functions of the habitats.

General

The EU Habitats Directive[11] identifies certain forest habitat types that the Member States are committed to improving. Potential habitat types to be included in the LULUCF biodiversity integration in Finland are in particular (see also Annex 1):

1. Bog woodland (i.e. fens and mires) (91D0*)
2. Western taiga (9010*)
3. Fennoscandian herb-rich forests (9050)
4. Coniferous forests on, or connected to, glaciofluvial eskers (9060)

The overall assessment of the conservation status of habitat types under the Habitats Directive in Finland's report in 2019 (conservation status of habitat types for the period 2013–2018, Ympäristöhallinto 2020) was unfavourable-inadequate and the trend was decreasing for both the habitat type bog woodland (91D0) and Western taiga (9010), unfavourable-inadequate and stable for

11 Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora, OJ L 206, 22.7.1992, p. 7.

herb-rich forests (9050), and the status of esker forests (9060) was unfavourable-bad and decreasing (Table 1). Information on the definitions of habitat types under the Habitats Directive can be found in the guides (Airaksinen & Karttunen 2001, European Commission 2013, SYKE and Metsähallitus 2020) and their conservation status in Finland in Annex 1.

It is estimated that bog woodlands cover an area of about 19,170 km² in Finland, of which 2,310–2,440 km² (12–13%) are protected. It follows that the majority of bog woodlands (14,260–14,490 km²) are located outside the current network of protected areas. Bog woodlands are important habitats in terms of carbon sequestration and storage, and the restoration of suitable sites in commercial forestry areas will be beneficial for the climate, water bodies and biodiversity. Some bog-woodland sites with non-altered hydrology and natural or semi-natural tree cover may meet the criteria for primary and old-growth forests under the EU Biodiversity Strategy (European Commission 2020). The most valuable bog-woodland sites in terms of biodiversity should be protected, and for commercial forestry areas, in all the spruce mires and other peatland forests, rotation management should be replaced with continuous-cover management with sufficiently large groups of retention trees.

Code	**Habitat type**	**Boreal 2019**					**Alpine 2019**				
		Range	Area	Structure and functions	Future prospects	Overall assessment	Range	Area	Structure and functions	Future prospects	Overall assessment
91D0	Bog woodlands*	FV=	U1=	U1-	U1	U1-	FV	FV=	FV=	FV	FV=
9010	Western taiga*	FV=	U1-	U1-	U1	U1-	FV=	FV=	FV=	FV	FV=
9050	Herb-rich forests	FV=	FV=	U1=	U1	U1=	FV=	FV=	U1-	U1	U1=
9060	Esker forests	FV=	FV=	U2-	U2	U2-					MAR

Table 1. Conservation status of bog woodlands, natural forests, herb-rich forests and esker forests in Finland's Habitats Directive report in 2019. Abbreviations: FV: favourable, U1: unfavourable-inadequate, U2: unfavourable-bad, =: stable trend, +: increasing trend, -: decreasing trend, MAR: marginal occurrence, * = priority habitat at risk of disappearing for the conservation of which the Community has particular responsibility. Extract from Finland's report on the conservation statuses of habitat types under the EU Habitats Directive for the period 2013–2018 (Ympäristöhallinto 2020).

It is estimated in the Habitats Directive report that there are approximately 12,990 km^2 of forests belonging to Western taiga in Finland, of which 9,286–9,628 km^2, i.e. a majority, are in the network of protected areas (71–76%). Approximately 3,362–3,704 km^2 of these so called natural forests are located in commercial forests. Most of the natural forests (12,000 km^2) are located in the boreal region. Of these, 8,900–9,100 km^2 are protected and 2,900–3,100 km^2 are in commercial forests. The alpine zone is estimated to have approximately 990 km^2 of natural boreal forests, of which 386–528 km^2 are protected and 462–604 km^2 are not. For the purposes of monitoring under the Habitats Directive, natural forests also include thin-peated spruce and pine mires. The high quality, good and excellent sites located outside the network of protected areas most likely satisfy the definition of primary forests and old-growth forests under the EU Biodiversity Strategy 2030 and should be strictly protected accordingly.

In the Habitats Directive report, it is estimated that there is a total of approximately 1,500–3,600 km^2 of herb-rich forests in Finland, of which only approximately 100–140 km^2 are in the network of protected areas (less than 10%). The majority of the herb-rich forests are located in the boreal region; the alpine region is estimated to have only about 9 km^2 of herb-rich forests (mainly mountain birch forests), most of which (approx. 7.3 km^2) are in protected areas. Of the herb-rich forests, those with old, natural or seminatural forest cover meet the characteristics of old-growth forests, but only some of the herb-rich forests are in this category (SYKE & Metsähallitus 2020). The biodiversity of herb-rich forests and their positive climate impact can also be enhanced through the nature management of commercial herb-rich forests.

The area of esker forests in Finland has been estimated at 7,000 km² in the Habitats Directive report, of which only a small part is protected (approx. 378–440 km²). A large part of esker forests are conventional commercial forests, in which biodiversity and carbon sequestration can be improved by having groups of retention trees and game thickets and through continuous-cover management, for example. Management plans should promote biodiversity and, where possible, carbon sequestration, especially in Natura 2000 areas with esker forests. Note, however, that the habitat type sun-exposed esker forests is assessed as vulnerable in the Red List evaluation of Finnish habitat types, and the factors behind their decline include the lack of forest fires, and eutrophication. Thus, just the opposite nature management actions are recommended for the sun-exposed esker forests to keep their canopies open and to remove their humus layer e.g. by burning to impoverish them (Kouki et al. 2018a).

The connection between safeguarding biodiversity and mitigating climate change

The EU Biodiversity Strategy 2030 emphasises that we need to increase the coverage of conservation areas and amplify the nature management of commercial forests in order to halt the loss of biodiversity and adapt to climate change (European Commission 2020). Increasing protection and developing nature management measures also play a key role in improving the conservation status of forest habitats. In particular, protection and restoration of bog woodlands and the remaining natural forests in commercial forests would provide synergies both in terms of mitigating climate change and safeguarding biodiversity (see also Böttcher et al. 2021, Science for Environment Policy 2021). Securing carbon pools in peatlands is a key issue in mitigating climate change. The most valuable sites in terms of biodiversity should be protected permanently while the water balance and, consequently, the carbon balance in peatland forests can best be regulated by abandoning ditch network maintenance measures and by adopting continuous-cover management (Lehtonen et al. 2021).

Strict protection of natural forests would also secure the carbon pools on these sites, which are very valuable in terms of biodiversity. According to latest studies, old-growth forests can also function as small carbon sinks for a long time; more carbon is stored in needles, leaves and dead wood instead of stemwood (Gundersen et al. 2021, Akujärvi et al. publication in preparation). In Finland, the protection of forests that are valuable for biodiversity has been implemented mainly through the voluntary programmes METSO (since 2008, the current 2014–2025 programme) and Helmi (2021–2030). As the need for protection increases, the level of funding for the programmes would need to be increased significantly, and it would be justified for some of the additional funding to come from the funds allocated to climate change mitigation. The motivation for revising the level of funding could be based on the future goals for the LULUCF sector. The programmes' human resources requirements should also be assessed. The pressure to develop commercial forest certification schemes so that they would cover more extensively the links between safeguarding biodiversity and climate change mitigation could also increase with the application of the LULUCF Regulation. The development of the PEFC certificate, which is the one used especially in Finland, has been very ineffective in terms of safeguarding biodiversity (see e.g Perustelut ELY-keskusten vetäytymiselle PEFC-standardityöryhmästä 26.3.2021).

In terms of herb-rich forests and esker forests, nature conservation measures do not always go hand in hand with climate change mitigation. In the nature management of herb-rich forests, they may be kept open so that deciduous trees that need a lot of light, including valuable broad-leaved trees that are important for biodiversity, can regenerate. The measures often involve very light selection cutting, and large trees that store large amounts of carbon should in particular always be preserved and secured as valuable future dead wood. Protecting valuable herb-rich forests would also support climate change mitigation. When it comes to nature managing of esker forests, sufficient openness, breaking up and removing the humus layer and prescribed (controlled) burning will benefit species adapted to these habitats, but these measures are not particularly climate-friendly, especially with regard to the short-term carbon emissions from prescribed burning. The burned wood is, however, quickly replaced as sites regenerate, and much of the carbon is slowly released from partially burned, charred dead wood. It should also be noted that the share of prescribed burning and restoration burning of Finland's greenhouse gas emissions is negligible (estimated at 1.3 kt CO_2e in 2018, while in the same year Finland's total emissions excluding the LULUCF sector were 56.4 Mt CO_2e, Statistics Finland 2020).

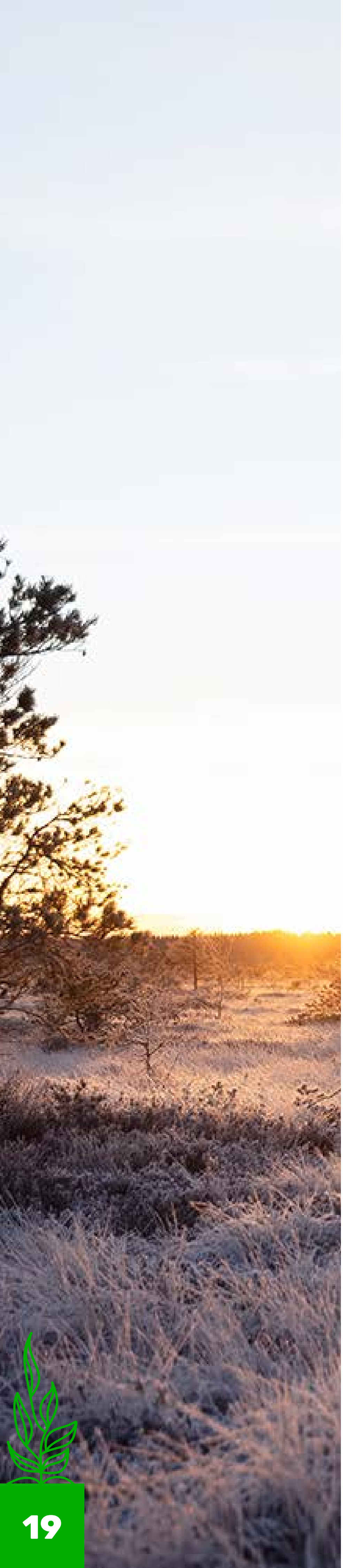
Proposal strengths and weaknesses

The Member States submit reports on the conservation status of habitats in the Habitat Directive to the European Commission at regular intervals; the most recent reporting took place in 2019. The next reports under the Habitats Directive are to be submitted in 2025 and 2031, after which the reporting will possibly be carried out every ten years (cf. the national assessment of the threat status of habitat types in Finland). Reporting under the Habitats Directive currently fulfils the first two of the above-mentioned premises, i.e. the reports produce EU-level indicator data on the biodiversity of commercial forests sufficiently regularly. The information is compiled in the European Environment Agency databases and is accessible to everyone.

The status of habitat types under the Habitats Directive must also be improved through the EU Biodiversity Strategy (European Commission 2020). The Strategy states that 30% of areas the conservation status of which is unfavourable are expected to show an improvement by 2030. In addition, those currently with a favourable status must not show any deterioration in their status or trends by 2030. A recent assessment of the impacts of the EU Biodiversity Strategy 2030 on Finland (Kärkkäinen & Koljonen 2021) states that less than half of the habitat types in the boreal region under the Habitats Directive are seen as having the potential to improve their conservation status through active management measures by the year 2030.

Expert assessments of forests were pessimistic, as the problem with forest types is the slow improvement in structure and function. Measures would be required on such large extent and so quickly that success within this timeframe was not considered possible. For example, it was found that only a few percent of the known area of herb-rich forests currently has a favourable status, so improvement should be achieved on thousands of hectares in less than ten years. In terms of bog woodlands, the report mentioned a number of measures that could be taken to improve their status: more effective protection, more effective restoration outside protected areas, the exclusion of unprofitable drainage sites from maintenance and the exclusion of pristine mires from forestry activities. (Keränen et al. 2021.) Lowering the intensity of forest-management activities in peatland forests would also have an impact on climate change mitigation as the maintenance of ditch networks and rotation forestry operations that are based on clear cutting release carbon from both peatland and trees.

The Biodiversity Strategy sets out measures to step up the implementation of existing legislation together with entirely new commitments, measures, goals and governance systems (European Commission 2020). The Commission is preparing a new legal framework (regulation) for the restoration of biodiversity on the basis of the Strategy which would include binding targets for the restoration of damaged ecosystems, including the most carbon-rich ecosystems. The initiative is likely to address the habitat types and species under



the Habitats Directive (and potentially the Birds Directive[12]). Should the obligation to improve the conservation status of habitat types and species also be part of the LULUCF instrument, the Member States would have a strong, complementary "double incentive" to improve the status of habitats (and potentially also species, please see below) by stepping up protection and conservation activities.

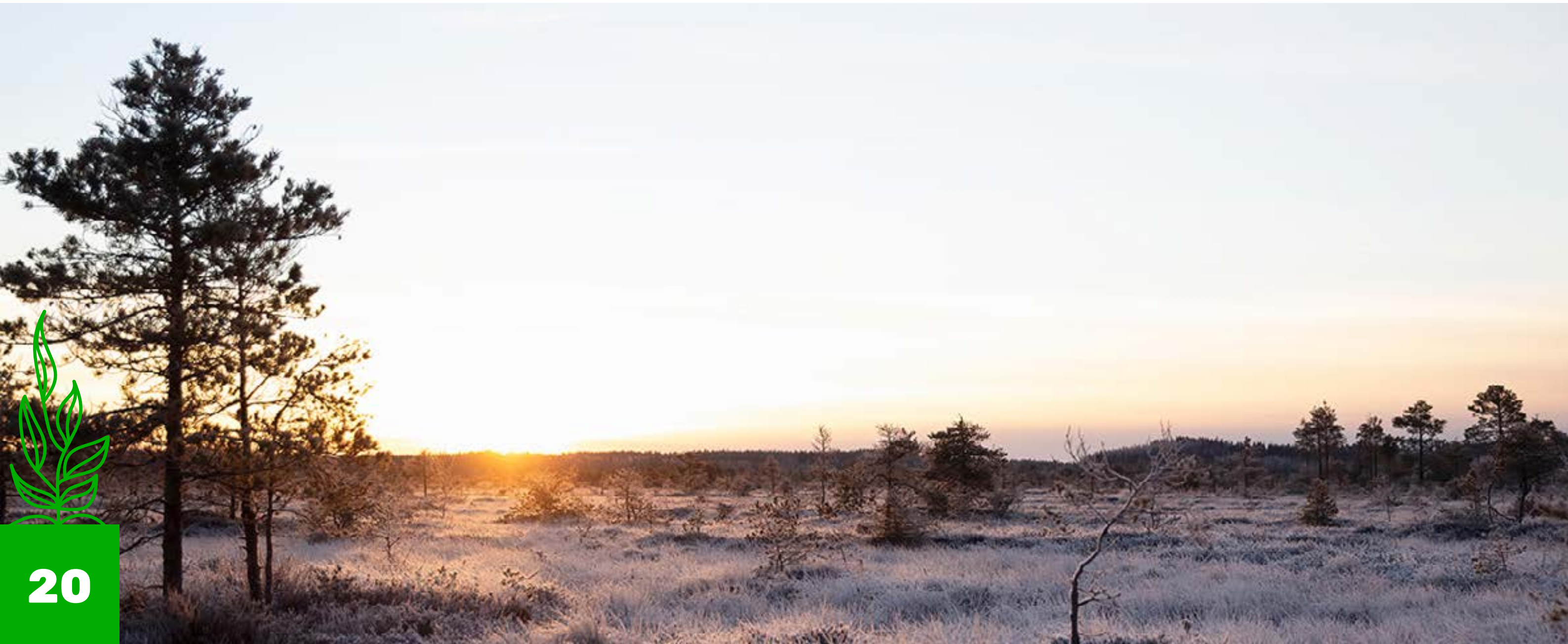
However, expanding the coverage of conservation areas and increasing large-scale nature management measures in commercial forests while boosting commercial roundwood removals is difficult if not impossible. In a recent analysis, calculations were made for six scenarios which differed in terms of roundwood removals (72.4–80 million m^3), the coverage of the conservation-area network and commercial forest nature-management measures (retention trees, broad-leaved tree mixture and rotation lenght) (Kärkkäinen et al. 2021). According to the analysis, doubling the area of conservation areas in the southern and central parts of Finland, significantly stepping up the nature management of commercial forests and increasing the roundwood removals to 80 million m^3 cannot take place at the same time if felling opportunities are to be maintained in the future. Annual increment of growing stock stopped at roundwood removals of 72.4 Mm^3 and started to decrease at the roundwood removals of 80 Mm^3 in the scenarios in which more nature-management measures were used. The total volume of the growing stock took a sharp downturn when either of the felling volumes was applied in scenarios in which the coverage of conservation-area network was also expanded (see Figure 20 in Kärkkäinen et al. 2021). This is due to the fact that as the area of felling sites grew, fell-

12 Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds, OJ L 20, 26.1.2010, p. 7.

ing was increasingly carried out in younger forests. Annual increment of growing stock also decreased due to the increase in selection cutting activities.

Kärkkäinen et al. (2021) did not assess the development of carbon sinks in forests, but it can be concluded from the development of the total volume of the growing stock that felling activities caused carbon sinks to shrink significantly or even to become sources of emissions in scenarios with increased conservation measures, and forests became large sources of emissions in the scenarios in which the protected area was expanded in addition to increasing nature-management measures in commercial forests. In order to maintain forest sinks at the level required by the current LULUCF Regulation (approx. 24 Mt CO2 in 2021–2025, excluding harvested forest products), roundwood volumes should be well below the 72.4–80 Mm^3 level[13] if the scenarios outlined in Kärkkäinen et al. (2021) regarding nature management measures and the increase in the protected area materialise. The Commission's LULUCF proposal does not set out a reference level for sinks in forest land but there is an overall obligation for the LULUCF sector, which is 17.8 Mt CO_2e per year for Finland in the period 2026–2030 according to the Commission's proposal. The net emissions from the LULUCF sector's land use categories other than managed forest land were approximately 10 Mt CO_2e in 2020, so the development of these net emissions determine the size of forest sink at which the obligation can be met. It can be roughly estimated to be 20–25 Mt CO_2e in Finland.

13 According to the forest model comparison published by the Finnish Climate Change Panel, changing the volume of felled trees between 40–80 Mm3 reduces the carbon sink of forests by an average of 0.9–1.7 Mt CO2/Mm3 (Kalliokoski et al. 2019).



PROPOSAL 2:
Forest species in the Habitats and Birds Directives

Proposal 2 integrates the conservation status of forest species in the Habitats and Birds Directives into the LULUCF Regulation, so that depending on the trend of the status, a Member State either has additional flexibility (positive trend) or is subject to stricter obligations (declining trend).

OBJECTIVE:
For the trend in status or population under the Habitats and Birds Directives to become favourable for as many species as possible

General

When a forest species is defined to be a species the primary or secondary habitat of which is forest on mineral-soil sites or mires (see Hyvärinen et al. 2019), excluding species that are only occasionally observed in mainland Finland or are exclusively observed in the Åland Islands, there are 50 such forest species in Finland under the Habitats Directive and 35 under the Birds Directive. Mammals (Mammalia), beetles (Coleoptera) and vascular plants (Tracheophyta) are the forest species with the highest numbers in the Habitats Directive. The majority of forest birds in the Birds Directive are sedentary birds.

Organism group	Species in Annex II to the Habitats Directive	Species in Annex IV to the Habitats Directive	Species in Annex I to the Birds Directive	Migratory birds corresponding to the species listed in Annex I to the Birds Directive	Species in the separate annexes
Tracheophyta	7	7	0	0	II and IV: Cinna latifolia, Pulsatilla patens, Moehringia lateriflora, Ranunculus lapponicus, Cypripedium calceolus, Diplazium sibiricum, Calypso bulbosa
Bryophyta	6	0	0	0	II: Cephalozia macounii, Plagiomnium drummondii, Dicranum viride, Herzogiella turfacea, Scapania carinthiaca, Buxbaumia viridis
Mammalia	6*	12*	0	0	II and IV: Lynx lynx, Ursus arctos, Pteromys volans, Canis lupus II: Gulo gulo, Rangifer tarandus fennicus IV: Sicista betulina, Plecotus auritus, Myotis brandtii, Pipistrellus nathusii, Eptesicus nilssonii, Myotis nattereri, Myotis daubentonii, Myotis mystacinus
Aves	0	0	27	8	I: Falco columbarius, Milvus migrans, Picus canus, Aegolius funereus, Surnia ulula, Bubo bubo, Lullula arborea, Caprimulgus europaeus, Aquila clanga, Sylvia nisoria, Strix nebulosa, Aquila chrysateos, Pernis apivorus, Tetrao urogallus, Dryocopus martius, Lanius collurio, Ficedula parva, Picoides tridactylus, Bonasa bonasia, Luscinia svecica svecica, Circus cyaneus, Asio flammeus, Pandion haliaetus, Lyrurus tetrix, Dendrocopos leucotos, Glaucidium passerinum, Strix uralensis Migratory birds: Buteo buteo, Phylloscopus trochiloides, Motacilla flava, Oenanthe oenanthe, Phylloscopus borealis, Tringa erythropus, Emberiza rusticus, Tarsiger cyanurus
Reptilia & Amphibia	1	2	0	0	II and IV: Triturus cristatus IV: Rana arvalis
Mollusca	2	0	0	0	Vertigo genesii, Vertigo geyeri
Hemiptera	1	0	0	0	II: Aradus angularis
Coleoptera	11	4	0	0	II and IV: Cucujus cinnaberinus, Osmoderma eremita, Phryganophilus ruficollis, Pytho kolwensis II: Xyletinus tremulicola, Stephanopachys linearis, Agathidium pulchellum, Boros schneideri, Oxyporus mannerheimii, Stephanopachys substriatus, Mesosa myops
Lepidoptera	4	4	0	0	II and IV: Euphydryas maturna II: Euphydryas aurinia, Xestia borealis, Xestia brunneopicta IV: Lopinga achine, Maculinea arion, Parnassius mnemosyne
Total	38	29	27	8	

* Finland has a reservation in Annex II for Lynx lynx (lynx), Ursus arctos (bear) and Canis lupus (wolf), and in Annex IV for Canis lupus (wolf) in the reindeer herding area

Table 2. Forest species in the Habitats and Birds Directives by organism groups. Includes species for which forests are the primary habitats and species for which forests are important but secondary habitats (Hyvärinen et al. 2019). Species that are only occasionally observed or are exclusively observed in the Åland Islands are not included in the table (Table 6.3 in Mäkelä & Salo 2021).

Of the 85 forest species listed in Table 2, 42 species (49%) are classified as threatened species in Finland, 12 (14%) as near threatened and the remaining 31 species (36%) as least concern (Hyvärinen et al. 2019). Of these, the causes of decline related to forestry among threatened and near threatened species are, in the order of severity, forest management activities (19 species), decreasing amounts of decaying wood (17 species), reduction of old-growth forests and the decreasing number of large trees (12 species) and changes in the tree species composition of forests (seven species) as well as the reduction of burnt forest areas (seven species) – future threats to these species are also similarly distributed (Hyvärinen et al. 2019). See Annex 2, which describes the conservation status of these species in Finland in more detail.

The connection between safeguarding biodiversity and mitigating climate change

The survival of species populations is influenced by many factors, some of which are more strongly linked to human impacts and others that are more or less independent of these (e.g. random variations in small populations, variations caused by climate and weather, changes in species interactions). At the slightest level, measures related to climate governance should be carried out in such a way that there is no negative trend in the conservation status of species. Declining trends in a species would lead to a sanction on the 'do no significant harm' principle.

Species can also serve as indicators of their forest habitat types. For example, species that live in spruce mires or old-growth forests indicate the status of these habitats – a habitat in good condition has viable populations of species, while a habitat in poor condition lacks the species. The protection of natural and seminatural spruce mires and old-growth forests would have an equally positive impact on indicator species as on the storage of carbon sequestered in these habitats (see also Lehtonen et al. 2021).

Most of the forest species in the table are species that live in spruce mires and old-growth forests in natural state, such as *Pytho kolwensis, Boros schneideri, Cucujus cinnaberinus, Agathidium pulchellum, Cephalozia macounii* and *Herzogiella turfacea*, and which have unfavourable conservation status. Their conservation status can be improved by protecting old-growth forests and spruce mires. Many owls and hawks prefer old-growth forests for nesting, and also *Ficedula parva, Picoides tridactylus* and *Xestia borealis* prefer such forests. *Dendrocopos leucotos* needs old, decaying deciduous trees in its habitat, and it would be possible to increase their number by increasing the number of retention trees in managed forests. Increasing the number of retention trees was also highlighted as a climate action that would promote the growth of carbon stocks in a recent study by the Natural Resources Institute Finland (Lehtonen et al. 2021).

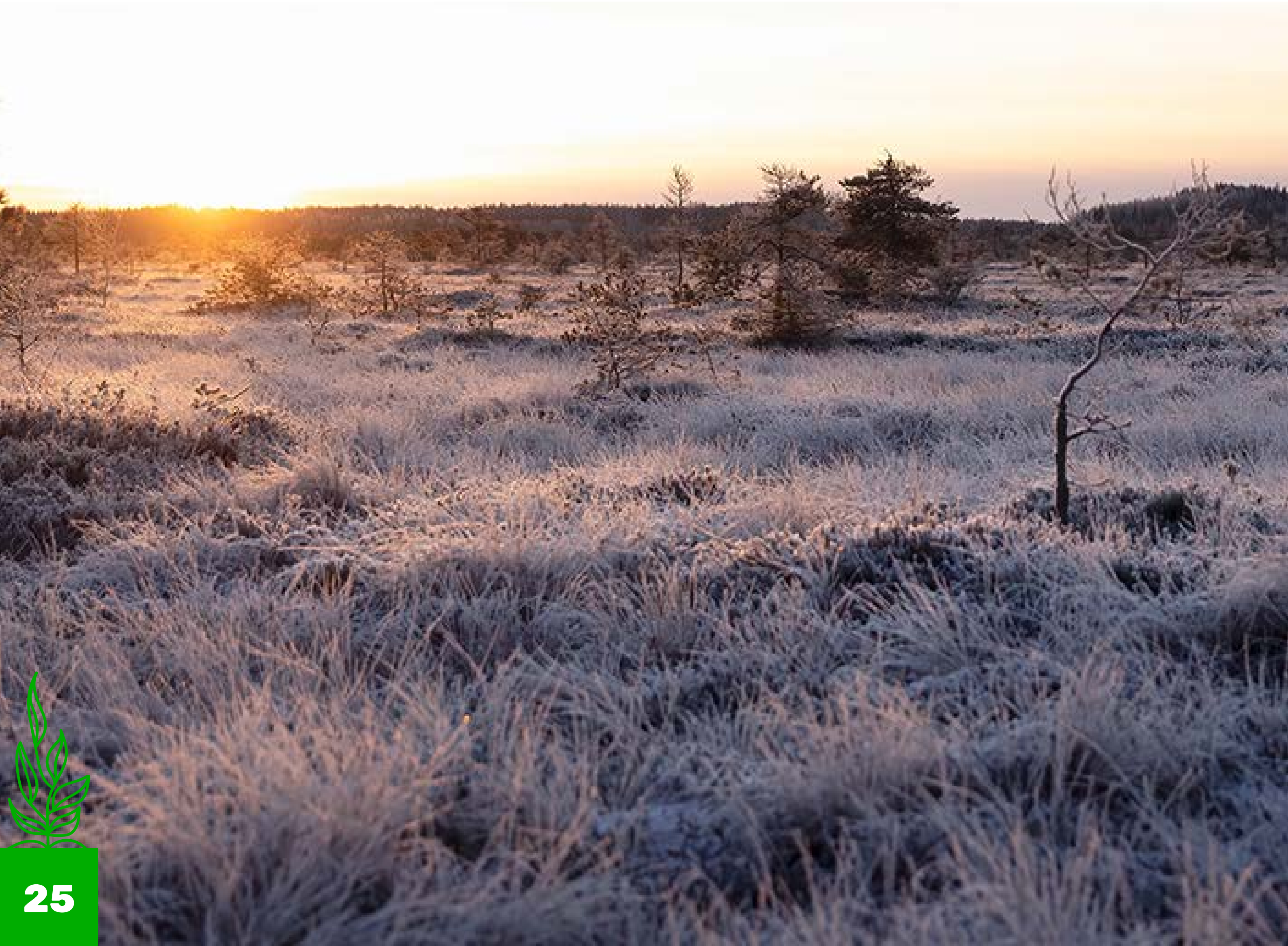
Species that benefit from esker forests and forest fires include *Pulsatilla patens* and *Aradus angularis*. Conserving waterway habitats such as brook-side habitats protects *Cinna latifolia*, but also species that depend on aquatic environments such as *Margaritifera margaritifera*, *Unio crassus* and *Ophiogomphus cecilia*. Migratory fish benefit from wooded buffer zones along waterways as water gets warm more slowly in shade. Buffer zones also act as permanent carbon pools. Occurrences of *Cypripedium calceolus* and *Calypso bulbosa* must be better protected during forest management activities. They are species of calcareous old-growth coniferous forests and herb-rich forests that can decline or disappear because of regeneration cuttings. Measures should focus in particular on occurrences of these species outside protected areas, their additional protection and nature management in managed forests.

Proposal strengths and weaknesses

Reports under the Habitats and Birds Directives cover a relatively large number of species, the conservation status or the population trend of which must be regularly monitored and improved by the Member States. Although the species pool varies from one Member State to another, many forest species are included. They meet premises 1 and 2: existing indicator data on managed forest biodiversity is already collected across the EU and at sufficiently short intervals (over a six-year cycle) to allow trends in the conservation status of species to be monitored.

The EU Biodiversity Strategy sets out a target of a 30% improvement in the status of both habitats and species (European Commission 2020). According to a recent estimate, 36% (27 species) of the species under the Habitats Directive were estimated to have the potential to improve their status by additional measures by 2030 in Finland (Keränen et al. 2021). These include these forests species mentioned in the table above: *Canis lupus, Gulo gulo, Stephanopachys substriatus, Euphydryas aurinia, Maculinea arion, Parnassius mnemosyne, Calypso bulbosa, Cypripedium calceolus, Pulsatilla patens* and *Scapania carinthiaca*. Of these, *Calypso bulbosa* and *Cypripedium calceolus* are examples of species that would benefit from lighter management activities or restricted management of commercially managed forests (Keränen et al. 2021).

Member States do not report country-specific conservation statuses but species-specific trends in population size under the Birds Directive. In the EU Biodiversity Strategy, the 30% improvement target applies to nesting species with a declining short-term trend; a total of 94 such species are estimated to be found in Finland. According to an expert assessment, the trend for only 11% of these (11 species) could be changed by 2030 (European Commission 2020). Four of these were classified as forest species in the assessment (on different grounds than in the table above), but there is uncertainty about the reasons for the variation in the populations of all these species and the assessment does not offer any clear measures to improve the situation. The birds identified as forest species according to the table above were, insofar as they were included in the assessment, identified as species the status of which is unlikely to be improved by 2030. The assessment highlights the negative effects of forestry (fragmentation, reduction of old-growth forests and large nesting trees) for species such as *Buteo buteo* and *Aegolius funereus*, and observes that conservation of nesting forests in particular would be key to improving the status of the species. (Keränen et al. 2021.)



PROPOSAL 3:
Biodiversity indicators for managed forests based on National Forest Inventories

Proposal 3 links the trends in the volume of dead wood and the number of large old trees to the LULUCF Regulation, so that depending on the trends of these biodiversity indicators, a Member State either has additional flexibility (positive trend) or is subject to stricter obligations (declining trend).

OBJECTIVE:
To increase the volume of dead wood to at least 10 cubic metres per hectare in managed forests, and to increase the number of old, large trees to at least 4–8 tree specimens per hectare in managed forests.

General

Finland, along with most of the forested Member States, carries out the National Forest Inventories (NFI). Natural Resources Institute Finland gathers information on how much data related to biodiversity and deforestation each country collects for their inventories. Efforts have been made to develop NFI-based biodiversity indicators, especially for the forest habitat types under the Habitats Directive, and studies show that defining them on the basis of NFI data is relatively complex and requires further development (Alberdi et al. 2019, Kovac et al. 2020).

In Finland, NFI data have been collected for a hundred years; the results of the first two years, 2019–2020, of the ongoing 13th inventory have just been completed. The LULUCF calculation in Finland and also in many other Member States is based on NFI data, so using the same data in relation to biodiversity indicators would create a natural link between climate governance and the goals of increasing biodiversity. Member States' obligation to collect and report NFI-based data could be relative to the types of land use in each country. For example, countries with a small forested area could be subject to a lighter reporting obligation.

Relationship to climate change mitigation

It is possible to identify numerous structural characteristics of forests that are important for both biodiversity and climate change mitigation (e.g. Science for Environment Policy 2021), but there are features that are clear and relatively easy to measure:

1. Volume of dead wood in managed forests
2. Number of old trees/stands in managed forests

These structural characteristics are important for biodiversity across the EU. Their significance for Red-Listed species and habitats in Finland is described in more detail in Annex 3. Immediate protection of carbon pools in old-growth forests, increasing the number of old, large trees in managed forests, by measures such as developing systems for saving retention trees, and growing carbon pools in dead wood (increasing the volume of dead wood) are measures that enhance climate change mitigation and are in line with the goals of safeguarding biodiversity (e.g. Lehtonen et al. 2021, Science for Environment Policy 2021).

Target volume of dead wood and means to achieve the target

Natural forest landscapes have largely consisted of old-growth forests with a lot of different types of dead wood in addition to living trees. The volume of dead wood in old-growth forests is approximately 100 cubic metres per hectare in Southern Finland, while the volume is at its lowest, only some twenty cubic metres per hectare, in treeline forests in Northern Finland (Siitonen 2001). There is more dead wood in fertile than in poor forest site types, and the volume of dead wood is at its highest after major disturbances that regenerate forests such as forest fires and storms, which can leave behind hundreds of cubic metres of dead wood per hectare (Siitonen 2001). The assessment of threatened forest habitat types used estimates based on research of the volume of dead wood in natural state on sites of different site-fertility classes and their successional stages, i.e. in the different heath-forest habitat types, in Southern and Northern Finland (Kouki et al. 2018a). Current understanding is that under natural conditions, before any marked human influence, 50–95% of the forests were old, at least 150-years old, and the rest were younger successional stages regenerated by various large-scale disturbances such as forest fires (Berglund & Kuuluvainen 2021). Using a conservative estimate that half of the forests were old-growth, at least 150-years old, and the rest younger successional stages, weighted average calculated over site-fertility classes and successional stages for dead wood volumes was 94 cubic metres per hectare for coniferous dominated heath forests (excluding the presently rare barren heath forests) in Finland as a whole under natural conditions.

The average volume of dead wood on forest land in the entire forested area in Finland – including both managed and protected forests – was the same in the first comprehensive inventory of dead wood (the 9th National Forest Inventory, NFI 9, 1996–2003) as in the most recent measuring round, 5.8 m^3/ha (NFI 12, 2014–2018; Forest statistics by the Natural Resources Institute Finland). According to the most recent results from the first two measurement years of NFI 13 (2019–2020), the volume of dead wood has increased in Southern Finland and is now 4.9 m^3/ha on average. The decrease in the volume of dead wood previously observed in both protected areas and managed forests in Northern Finland appears to have stopped, and it is now 7.7 m3/ha on average (Natural Resources Institute Finland bulletin 19/10/2021).

The network of protected areas has expanded considerably since the first decade of this century, especially in Northern Finland, where more forests with high volumes of dead wood have been protected (Korhonen et al. 2020). The volume of dead wood in the network of protected areas in Southern Finland has doubled (approx. 10 → 20 m^3/ha, Korhonen et al. 2020), while the volume of dead wood in protected areas in Northern Finland has decreased (approximately 25 → 20 m^3/ ha, Korhonen et al. 2020).

The volume of dead wood in managed forests in Finland has decreased: although the average volume in managed forests in Southern Finland has increased slightly (approx. 2.7 → 3.9 m^3/ha) – the increase has been approx. 1.2 m^3/ha in about 15 years – in managed forests in Northern Finland it has decreased much more in the same period (approx. 7.6 → 4.8 m^3/ha); the decrease is approx. 2.8 m^3/ha (Korhonen et al. 2020).

Overall, the reduced volume of dead wood in managed forests has been partly compensated by the increased volume of dead wood in protected areas, and the total volume of dead wood has remained roughly unchanged. New dead wood in forests has mainly resulted from natural disturbances, especially the increase in droughts and storms, and the impact of leaving retention trees in commercial forests has been small (Korhonen et al. 2016, 2020).

A tenth of the natural dead-wood volume, approximately 10 m^3/ha, could be a suitable target for conventional commercially managed forests, a target that Metsähallitus, which manages and protects state-owned forests in Finland, had already set for its conventional managed forests in its environmental guide for forestry in 2004 (Heinonen et al. 2004). This would mean a growth target of 0.44 m^3/ha per year in Southern Finland until 2030, which would be less than the progress observed in the protected areas of Southern Finland, but six times higher than the increment achieved in managed forests to date. However, threatened dead wood-dependent organisms have commonly been observed only in stands where the amount of dead wood is sufficiently high, in the order of 20–40 m^3/ha (e.g. Junninen & Komonen 2011). If these goals were to be achieved in managed forests only with the help of living retention trees – one of the main purposes of which is to increase the volume of dead wood in managed forests – the volume of retention trees should be significantly increased from their actual volume in managed forests with PEFC certification (less than 3 m^3/ha, Siitonen et al. 2020). If the long-term target for dead wood was 10 m^3/ha, this would be achieved by raising the current volume of retention trees tenfold (3 → 30 m^3/ha), and if the target was 20 m^3/ha, a twentyfold increase in volume (3 → 60 m^3/ha) would be required compared to the current level (see Keto-Tokoi et al. 2021). The same target can be set for managed forests in Northern Finland, where the actual trend has been a decrease in the volume of dead wood.

The simplest and most cost-effective ways to achieve higher volumes of dead wood is to minimise the destruction of existing coarse dead wood in felling operations and soil preparation, and to put an end to the harvesting of large-diameter dead wood as energy wood for heating and power plants and small-scale housing. In addition to increasing the number and size of retention trees, the current Forest Damages Prevention Act could also be amended to allow larger quantities of natural dead wood to be left in managed forests. It would also be very important to stop all harvesting – including selective cuttings – in valuable woodland key habitats in managed forests so that their dead-wood volumes could eventually reach the natural levels.

Target amount of old, large trees and means to achieve the target

In their natural state, forests are mostly made up of old-growth forests, and the number of large, old tree specimens is high. The assessment of threatened forest habitat types used estimates based on research of the density of old, large trees in natural state on sites of different site-fertility classes and their successional stages in Southern and Northern Finland (Kouki et al. 2018a). Based on a conservative estimate (at least half of the forests would have been old-growth forests of at least 150 years old, see above, Berglund & Kuuluvainen 2021), the average number of large trees in natural state weighted by the area of heath-forest habitat types (see above) would be approximately 42 trees per hectare in Finland as a whole.

Both the theory of ecology and empirical data show that in many forest species their occurrence is compromised and their abundance is clearly reduced when the area of habitats suitable for these species – such as old-growth forests – is reduced to less than 10–20% of their natural area. If this principle is directly applied to species dependent on old, large trees, the occurrence of these species would be jeopardized by a decline in the number of these trees in managed forests to less than 4–8 per hectare in Finland as a whole. According to the National Forest Inventory, there are now 3.1 large (≥ 40 cm) trees per hectare in all forests (managed forests and protected areas), 5.7/ha in the southern boreal forest zone, 1.2/ha in the middle boreal forest zone, and 2.3/ha in the northern boreal forest zone (NFI 11 (2009–2013), Henttonen et al. 2019). There are, however, only 1.0 trees that are both large and old (≥ 150 years) per hectare, 0.6/ha in the southern boreal forest zone, 0.4/ha in the middle boreal forest zone, and 2.2/ha in the northern boreal forest zone (Henttonen et al. 2019). 43% of the large and old trees were located in protected areas (which, however, only covered 10% of the surveyed forests), and 6% of the trees were retention trees in commercially managed forests (Henttonen et al. 2019).

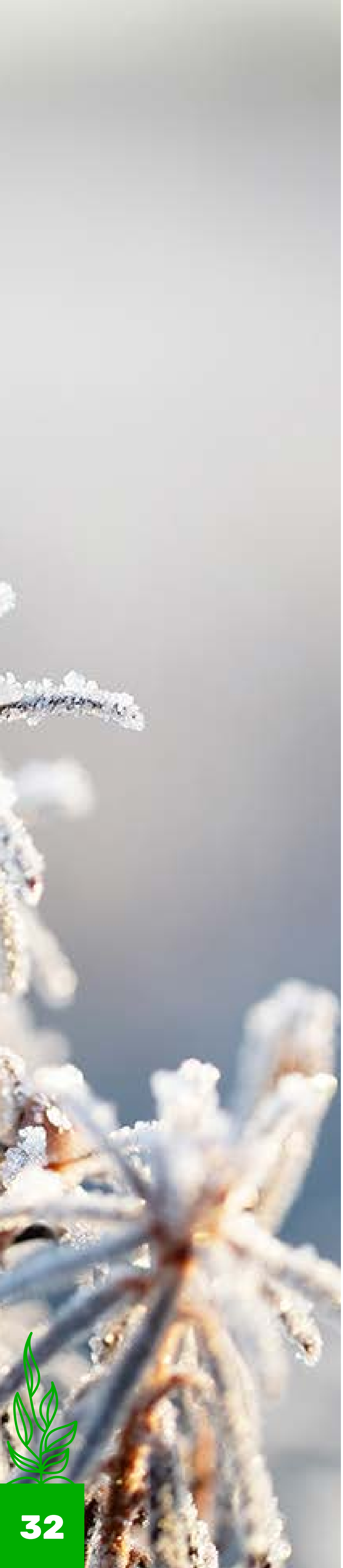
The means to achieve the higher target number of old, large trees in managed forests is to increase the number and size of living retention trees by stopping all harvesting – including selective cuttings – in valuable woodland key habitats in managed forests, and to end the harvesting of large deciduous trees that are of little value, such as aspens, as energy wood for heating and power plants and small-scale housing. The existing old-growth stands in managed forests, which are valuable in terms of biodiversity, should be protected. Most of the old, large trees in commercial forests are located in such stands.

Proposal strengths and weaknesses

Finland's LULUCF reports take dead wood into account as part of the YASSO model of calculating the amount of soil carbon. Carbon stored in dead wood is used as an input value in soil carbon calculations, and it is based partly on modelling and partly on data collected from NFI sites. The amount of carbon stored in dead wood is not reported separately, however, but together with litter and soil organic carbon (Statistics Finland 2021). In general, the modelling of forest mortality and also of the status of dead wood is challenging and often based on scarce site data that often do not include representative samples of stands in natural state. Most EU countries report changes in carbon pool in dead wood, and this category is a net sink in most of these inventories. However, some Member States do not report dead wood or changes in soil carbon pools at all. (EC 2020, p. 26)

In this respect, the development of both tree mortality modelling and LULUCF reporting would play a key role in increasing the focus on dead wood.

There is already an incentive to increase the carbon pool of dead wood above the reference level in terms of larger sinks in the current LULUCF Regulation. Member States have a limited use of a sink over the reference level for managed forest land to offset emissions from other LULUCF categories, so that Member States meet the condition that the LULUCF sector does not exceed accounted emissions (the no debit rule). The limit is 3.5% of a Member State's base year or base period emissions; approx. 2.5 Mt CO2 per year for Finland. However, this limit does not apply to sinks resulting from the growth of carbon pools of dead wood (or products of the mechanical forest industry). This means that increasing carbon pools of dead wood will be taken into account in full, regardless of whether the reference level is exceeded or not. Using a sink over the reference level for managed forest land is, however, limited only to the LULUCF sector, so the benefit of increasing the carbon pool of dead wood also depends on the extent to which a Member State needs it to offset the accounted emissions from other LULUCF categories and whether it can sell this sink to other Member States.



Links between the proposals and climate governance

Incentives to increase carbon sinks in forests would probably be generally positive from the point of view of safeguarding biodiversity. *More stringent sink commitments* (e.g. sufficiently ambitious Member State-specific sink targets for the 2026–2030 commitment period) would encourage limiting felling activities, extending rotation periods and reducing the harvesting of dead wood, which would also benefit biodiversity. More stringent sink commitments would also steer Member States to examine the bigger picture of climate change mitigation from outside the LULUCF framework. However, stringent sink commitments could also increase the intensive fertilisation of forests and, at worst, even lead to afforestation of such open areas (e.g. rural biotopes), which are valuable for biodiversity. Therefore, the perspective of safeguarding biodiversity should be more firmly integrated into climate governance, even if these elements have traditionally been addressed by different regulatory mechanisms in the EU (see also Böttcher et al. 2021).

The prospects of including the three proposals described above concerning biodiversity considerations in the LULUCF Regulation vary. Possible links to climate governance can be roughly divided into three categories (see also Table 3):

1. Fallback plans.

   This category does not have any direct link to the size of carbon stocks or sinks, but the obligation to safeguard biodiversity is formed following the 'do no significant harm' principle. A biodiversity feature must not, therefore, be weakened as a result of the climate governance measures taken; if it is, it could lead to some kind of sanction. The difficulty with this model is the monitoring of impacts and the obligation to verify them: it is difficult to prove when the trend in the status of a certain forest species or habitat type is a direct result of climate governance measures or when it is affected by other factors, for example.

2. A more complex category includes incentives and sanctions that are directly linked to the potential uses of the sink commitment, the part exceeding it or the flexibilities.

   In practice, an incentive in this category would work in such a way that, were the trends in a biodiversity feature positive, a Member State could make more use of the part exceeding the sink commitment than in a situation where the trends are not so favourable. Sanctions would work in the opposite way, i.e. if the trend in a biodiversity feature does not go in the desired direction, the size of the Member State's sink commitment could be increased (the Member State would have to acquire additional sink rights or lose flexibilities).

   In the current LULUCF Regulation, dead wood and harvested wood products have an inbuilt incentive as they are categorised as sinks, without a limit, even for the part that exceeds the reference level, unlike net removal resulting from forest sinks that exceed the reference level[14]. The incentive effect, however, depends on the overall size of carbon sinks in forests and whether the reference level is exceeded, because of dead wood and harvested wood products, by more than the limit for the excess above the reference level for carbon sinks in forests.

   It could also be possible to relax a Member State's LULUCF net sink commitment if the Member State engaged in nature management measures in commercially managed forests and expanded protected areas, and if this could be deemed to unduly reduce its opportunities to harvest forests in

14 Article 8 of the LULUCF Regulation: 'Where the result of the calculation referred to in paragraph 1 of this Article is negative in relation to a Member State's forest reference level, the Member State concerned shall include in its managed forest land accounts total net removals of no more than the equivalent of 3.5 % of the emissions of that Member State in its base year or period as specified in Annex III, multiplied by five. Net removals resulting from the carbon pools of dead wood and harvested wood products, except the category of paper as referred to in point (a) of Article 9(1), in the land accounting category of managed forest land shall not be subject to this limitation.'

order to meet the LULUCF obligation. However, an incentive such as this entails the risk that biodiversity features have a delayed response to forest management activities, and positive trends will subsequently turn negative due to the increased harvesting activities caused by the relaxed sink commitment. It might also be difficult to determine under what conditions and to what extent the sink commitment could be relaxed.

3. The third category aims to integrate the desired biodiversity benefits directly into the LULUCF calculation. Better quality GHG inventory and biodiversity data could be an additional LULUCF incentive.

   Developing the calculation so that the final sink commitment contains features that affect the status of biodiversity as unambiguously as possible would be the most sustainable solution in the long term, as integration would thus be the most complete. Scientific research on the integration of biodiversity and carbon data already exists (e.g. Forsius et al. 2021), and it can be concluded that carbon sinks or stocks can be secured and increased fairly evenly in forested habitats, while the priorities for safeguarding biodiversity are usually spatially clearly distinguished. A mere change to the calculation would not, therefore, ensure that the actual measures to safeguard biodiversity (e.g. increasing the volume of dead wood or establishing protected areas) would be optimal in terms of spatial distribution. Developing the calculation would be easiest with regard to NFI-based biodiversity indicators, of which for example dead wood and forest fertility classes are already partly taken into account in the current LULUCF calculation in Finland.

Connection to climate governance	Forest habitats in the Habitats Directive	Forest species in the Habitats and Birds Directives	NFI-based biodiversity indicators for managed forests
1: Fallback plans	The status of habitats must not deteriorate as a result of measures relating to the LULUCF Regulation without a specified sanction.	The status of species must not deteriorate as a result of measures relating to the LULUCF Regulation without a specified sanction.	The volume of dead wood and the number of old, large trees in managed forests must not decrease as a result of measures relating to the LULUCF Regulation without a specified sanction.
2: Connection to the sink target	Positive trends in forest habitats (e.g. 30% of the area of forest habitats develops in a positive direction) would allow for additional flexibilities or a lower sink target.	An improving status of forest species (e.g. 30% of species occurrences develops in a positive direction) would allow for additional flexibilities or a lower sink target.	A sufficiently significant positive trend in the volumes of dead wood and the number of old, large trees in managed forests would allow for additional flexibilities. Negative or insufficient development would impose a greater sink commitment on a Member State.
3: Changes to the LULUCF calculation method	Factors for increasing or decreasing the sink target depending on the direction of changes in trends in habitats.	Factors for increasing or decreasing the sink target depending on the direction of changes in trends in species.	Including dead wood and old, large trees in the LULUCF calculations in all Member States: a larger carbon pool in areas with a lot of dead wood and old, large tree specimens.

Table 3. This table contains examples from each proposal of different ways to incorporate the obligation to safeguard biodiversity in the LULUCF Regulation.

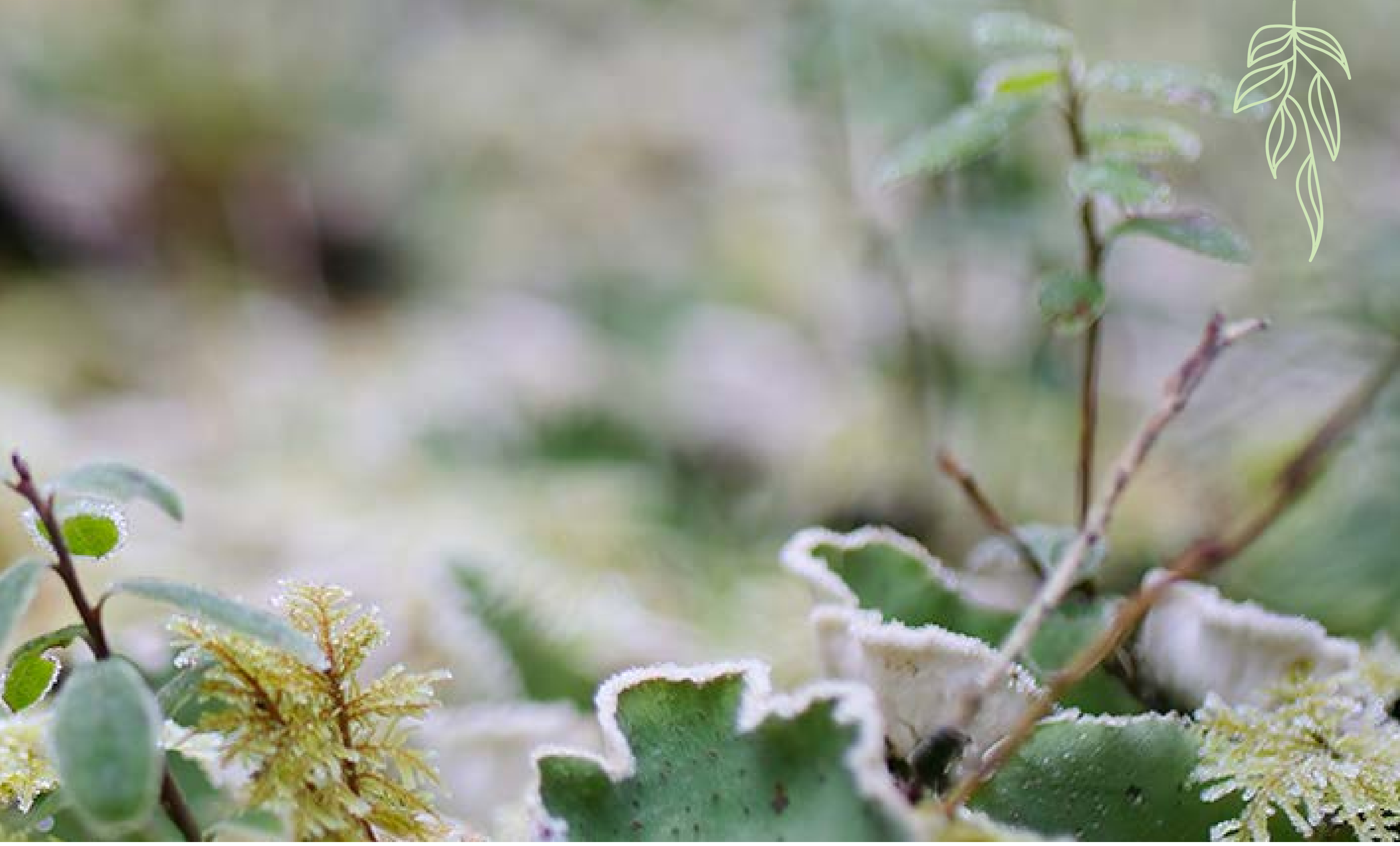
There are various risks involved in regulating the LULUCF sector and developing regulations in a manner that would also make it possible to achieve biodiversity objectives. The risks vary depending on the type of incentives and sanctions to be introduced. The realisation of the risks depends on a number of factors outside the scope of the LULUCF Regulation, such as the global development of the timber and wood product markets and in climate and environmental policies. Some of the known risks are described below.

In the EU, the tightening of the sink commitment implies a more ambitious climate obligation, unless the obligations for the effort-sharing sector or the emissions trading sector are relaxed accordingly. Sink commitments can affect harvesting operations within and outside the EU if their impacts are reflected in the forest industry's use of wood. This will depend on how Member States implement the sink commitments in their national policies and how the impacts thereof are reflected in the price of timber and harvesting operations. If harvesting operations are moved from one Member State to another or outside the EU due to sink commitments, the environmental benefits achieved thanks to the sink commitments will be reduced (the leakage effect).

There are some doubts about the reliability of the data used to determine sinks and biodiversity indicators, which can lead to inconsistent steering effects in terms of climate and biodiversity objectives. The reliability of the data may vary considerably from one Member State to another. If the data are not sufficiently reliable, there is a risk that the data will offer a distorted picture of the carbon sink or biodiversity criteria in relation to the actual situation, which may lead to inappropriate imposing of incentives or sanctions. It is essential to try to use the best data available, and improving the quality of the data should be encouraged (Böttcher et al. 2021). This can be achieved by taking into account the quality of the data in relation to the sink commitments or the potential uses of sinks, for example, but the implementation may involve issues regarding fairness.

Potential incentives and sanctions included in the LULUCF Regulation to safeguard biodiversity will affect the ways in which sinks are used to achieve climate objectives. These incentives and obligations raise various issues of fairness. The current situation with regard to carbon sinks and biodiversity indicators, as well as the potential to increase carbon sequestration or improve the status of biodiversity, may be considerably different from one Member State to another. There is a risk that some Member States would have unduly strict regulations, while they would be relatively relaxed in others. This could undermine the acceptability of the proposed regulation and lead to adverse effects. The fact that Member States have different starting levels should be taken into account, although it could be challenging to build a completely fair system (see also Böttcher et al. 2021 on national net sink and restoration targets).

Extending the rotation periods for commercially managed forests, protecting old-growth forests and increasing the volume of dead wood would provide biodiversity benefits, and they would also secure and increase carbon pools (Lehtonen et al. 2021) and, consequently, increase the net carbon sink of forests. The measures may, however, expose forests to natural disasters in some areas and lead to intensive forest management operations in commercially managed forests that are outside the scope of these measures. An increase in natural disasters or the mere anticipation of risk may have adverse effects on forest carbon sinks if such natural disasters are extensive, managed forests are harvested at a younger age or harvesting operations are carried out outside the EU. NFI results show that since the amended Forest Act entered into force, the regeneration age of forests in Finland has already decreased by about 10 years in both Southern and Northern Finland between 2010 and 2017 (Kniivilä et al. 2020). Yet protected areas and increasing the volume of dead wood do not automatically increase the damage caused by bark beetles, for example, but can also have a reverse impact. Natural enemies of bark beetles live in forests in natural state, the populations of which are bigger in protected areas than in managed commercial forests (e.g. Martikainen et al. 1999).



Areas that could be developed in reporting

EU Member States collect data from various sites for a number of purposes, some of which overlap with the objectives of climate change mitigation and preventing biodiversity loss, which are the subjects of this paper. Acquiring and processing such a comprehensive collection of data into a usable and comprehensible form is expensive and slow. It is, therefore, worth evaluating the data directly or in view of developing the data so that it is useful for the purposes of climate change mitigation and preventing biodiversity loss (see also Science for Environment Policy 2021).

The European Environment Agency (EEA), for example, collects and provides data and maps together with related information on different environments. Similarly, the EU's Copernicus programme provides Earth observation data for the EU's needs. The data provided by these two bodies play a key role in the design and development of indicators in the EU, since many countries cannot afford to produce such data by themselves. It has been proposed that the EEA's role as a quality assurance agent for LULUCF reporting should be strengthened (Böttcher et al. 2021).

Biodiversity data collected from forests include data on forest canopy cover and tree species composition . The problem for Finland is that the quality of the data collected internationally is often not good enough to be useful for the purposes of creating indicators. The same applies to the other EU Member States (see e.g. Science for Environment Policy 2021).

Developing ecosystem accounting

Climate change mitigation and preventing biodiversity loss are strongly linked to ecosystem accounting. Ecosystem accounting is a way of producing indicator data on the status of habitats and species so that it is taken into account on equal terms with economic indicators (Oinonen et al. 2021). This would mean that the size, quantity, distribution and condition of ecosystems are comparable with public economy accounting so that ecosystems and the goods and services they provide could be better taken into account when calculating the green gross domestic product and other economic indicators.

It is trees that connect ecosystem accounting and the land use sector's climate policies; the volumes of dead wood and large old trees are indicators used in ecosystem accounting to provide information on important carbon stocks as well as the status of ecosystems and resources that are vital to biodiversity. Other potential benefits in terms of developing ecosystem accounting and the LULUCF Regulation could be indicators related to carbon sequestration and the impact of harvesting on recreational use, forest species and habitats, for example. This memorandum proposes some of these be used in the LULUCF biodiversity integration. A survey was carried out in 2021 on indicators that could be used across the EU. The project proposed that the variables to be monitored were the NFI-based volume of dead wood and the tree cover density assessed by the Copernicus programme (European Commission 2021b). The same data sources are widely used to monitor the status of the network of protected areas.

Ecosystem accounting is not yet implemented consistently in Finland or in any other country, but the data and collection methods are still under development. In the action plan of Finland's Biodiversity Strategy (Valtioneuvosto 2012), ecosystem accounting and related research and development efforts relate in particular to action 41: "Initiate the research programme, included in the Government Programme, aimed at assessing the financial impact of biodiversity and ecosystem services, as part of the green economy research entity" (Valtioneuvosto 2012). The UN Statistical Commission accepted some[15] of the ecosystem accounting system as an international statistical standard (United Nations 2021). Amendments to EU legislation are being prepared on this basis. The aim is for the legislative amendment to Regulation (EU) No 691/2011 to enter into force in 2023. The first reports on data for the reference year 2023 would need to be completed in 2025. If implemented, the amendment will make it easier to make comparisons between countries and to monitor the achievement of the sustainable development goals, and, possibly, also to draft LULUCF reports in the future.

15 Ecosystem accounting consists of five core accounts, three of which have become standard; they use biophysical variables and indicators derived from these. The accounts are ecosystem extent accounts, ecosystem condition accounts and ecosystem services flow accounts. The UN Statistical Commission did not accept the other two core accounts, which are monetary, as a standard but as good international statistical practices and valuation recommendations.

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Annex 1.

Proposal 1: The conservation status of forest habitat types in Finland and other small-area forest habitat types

Biodiversity rich habitats

Bog woodland (91D0*)

Bog woodland comprises spruce mires and pine mires. In the guide to inventories of habitat types under the Habitats Directive (SYKE & Metsähallitus 2020), the minimum tree canopy cover of bog woodland is 5–10%. The habitat type bog woodland (91D0*) under the Habitats Directive is a priority habitat at risk of disappearance and which the Community has a particular responsibility to protect; such priority natural habitat types are indicated by an asterisk (*). This habitat type includes, in part or in whole, 24 types or combinations of the 50 mire habitat types and 19 habitat type combinations identified in the habitat type threat status assessment, 16 of which are classified as threatened and five as near threatened in Finland (Kaakinen et al. 2018a, b). According to the threat status assessment, especially wooded, fertile mire habitat types, different kinds of spruce mires in particular, are threatened (Kaakinen et al. 2018a, Kokko et al. 2020). The endangerment of mire habitats is much more pronounced in Southern Finland than in the north of the country: of all types, 83% were classified as threatened in Southern Finland (in the hemiboreal, southern boreal and middle boreal forest zones) and 26% in Northern Finland (the northern boreal forest zone) (Kaakinen et al. 2018a, Kokko et al. 2020). Almost similar proportions of the mire habitat types in these areas were assessed as having a declining trend, mainly due to the draining effect of ditching and other land use activities in areas around pristine mires, as well as harvesting and soil preparation on wooded mires (Kaakinen et al. 2018a, b, Kokko et al. 2020). Similarly to mire habitat types, the mire complexes and mire succession series of the land uplift coast are threatened in Southern Finland, and 79% of these were assessed as having a declining trend in the country as a whole (Kaakinen et al. 2018a, b, Kokko et al. 2020). The reasons for the decline are the same: changes in the hydrology caused by ditching and other land use activities in the areas as well as harvesting on the wooded parts of the mires (Kaakinen et al. 2018a, b, Kokko et al. 2020). Of the 24 mire habitat types and mire complexes in the habitat type bog woodland, 18 (69%) were assessed as declining, five (19%) as stable and one (4%) habitat type's trend in state was unknown.

Western Taiga (9010*)

Under the Habitats Directive, the habitat type Western Taiga (natural forests) (9010) includes, in part or in whole, 21 forest habitat types (Kouki et al. 2018b), two mire habitat types (Kaakinen et al. 2018b), two fell habitat types (Pääkkö et al. 2018) and one Baltic Sea habitat type (Reinikainen et al. 2018) of the habitat types identified in the habitat type threat status assessment, i.e. a total of 26 habitat types. Of these, 20 are classified as threatened and three as near threatened in Finland, and the most significant future threats to these habitats, weighted according to the severity of the threat, are: (1) the decline in the volume of dead wood; and (2) the decline in the number of old-growth forests and old trees (Kouki et al. 2018a). This habitat type has also been determined at EU level as a priority habitat that is at risk of disappearance and which the Community has a particular responsibility to protect; such priority natural habitat types are indicated by an asterisk (*). In general, the most threatened habitat types of heath forests in Finland overall are old-growth forests and forests on barren sites, and the proportion of threatened habitat types is clearly higher in Southern Finland than in Northern Finland (Kouki et al. 2018a). In Finland overall, of the 26 habitat types potentially included in the category Western Taiga under the Habitats Directive, 12 (46%) were assessed as still having a declining trend, five (19%) were deemed stable and nine (35%) as improving (Kaakinen et al. 2018b, Kouki et al. 2018b, Pääkkö et al. 2018, Reinikainen et al. 2018). The decline was assessed to be the result of quantitative and qualitative changes caused by various forest management activities, but the trend of some habitat types was estimated to be improving due to the increase in the volume of dead wood and the number of large trees, for example (Kouki et al. 2018b).

Herb-rich forests (9050)

The habitat type herb-rich forests (9050) under the Habitats Directive includes, in part or in whole, 16 forest habitat types (Kouki et al. 2018b), five Baltic Sea habitat types (Reinikainen et al. 2018), four fell habitat types (Pääkkö et al. 2018) and one mire habitat type (Kaakinen et al. 2018b) of the habitat types identified in the habitat type threat status assessment, i.e. a total of 26 habitat types. In Finland, 19 of these have been classified as threatened and six as near threatened. For the forest habitat types under the Habitats Directive that include herb-rich forest habitats, the most significant future threats, weighted according to the severity of the threat, are changes in tree species composition, and almost equally significant are the decline in the volume of dead wood and the number of old-growth forests and old trees, as well as forest regeneration and management activities (Kouki et al. 2018a), the latter of which was also a significant threat to the Baltic sea and mire habitat types that include herb-rich forests. In Finland overall, of the 26 habitat types potentially included in the category herb-rich forests under the Habitats Directive, 20 (77%) were assessed as still having a declining trend, five (19%) were deemed stable and one (4%) as improving (Kaakinen et al. 2018b, Kouki et al. 2018b, Pääkkö et al. 2018, Reinikainen et al. 2018).

Esker forests (9060)

The habitat type esker forests (9060) under the Habitats Directive includes, in part or in whole, 11 of the habitat types identified in the forest habitat type threat assessment (Kouki et al. 2018b). In Finland, 10 of these have been classified as threatened and one as near threatened. For the forest habitat types under the Habitats Directive that include esker forests, the most significant future threats, weighted according to the severity of the threat, are the decline in the volume of dead wood, the reduction of burnt forest areas and other areas in the early stages of natural succession and the decline in the number of old-growth forests and old trees, and almost equally significant threats are forest regeneration and management activities and changes in tree species composition (Kouki et al. 2018a). In Finland overall, 10 (91%) of the 11 habitat types potentially included in the category esker forests under the Habitats Directive were assessed as still having a declining trend, and one (9%) as improving (Kouki et al. 2018b).

Other small-area habitat types that are important for biodiversity

The following forest habitat types under the Habitats Directive may be, or are likely to be, forests in a natural state or in a state similar to a natural state or old-growth forests that are suitable for strict protection under the EU Biodiversity Strategy and/or are in need of management measures. Rare small-area habitat types (9020, 9190, 9080 and 91E0) require further assessment and, potentially, separate inventory projects. Old-growth esker forests and the late succession stages of forests on the land uplift coast overlap with old-growth forests. However, due to the small area of the habitat types, their impact on climate change mitigation is limited.

Old broad-leaved deciduous forests (9020*)

It is estimated that there are about 8 km² of old broad-leaved deciduous forests in the boreal region of Finland, of which approximately 2.6–3.4 km² are protected. This habitat type includes herb-rich forests at a late stage of succession in a natural or similar state (stands are generally older than the regeneration age) (SYKE & Metsähallitus 2020). This habitat type probably meets the criteria for old-growth forests, but younger broad-leaved deciduous forests are also very important for biodiversity. This habitat type has also been determined at EU level as a priority habitat at risk of disappearance and which the Community has a particular responsibility to protect; such priority natural habitat types are indicated by an asterisk (*).

Old oak forests (9190)

A very scarce and rare habitat type in Finland, which includes heath forests with oak trees and in which trees are old (more than 100 years) (SYKE & Metsähallitus 2020). It is estimated that there are only 0.57 km² of forests of this type in Southern Finland, of which approximately 0.14–0.22 km² are in protected areas.

Coastal wooded swamps (9080*)

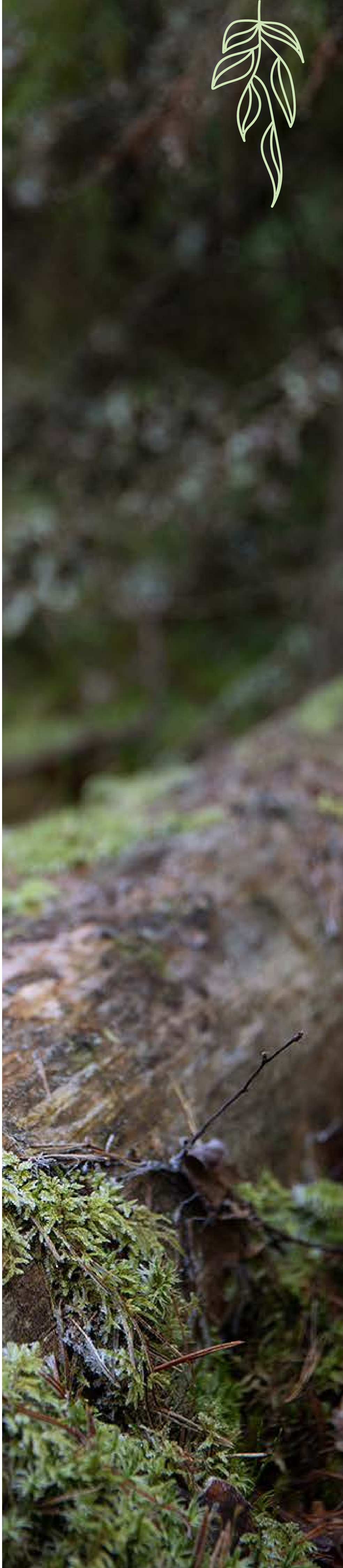
It is estimated that there are only 0.3 km² of coastal wooded swamps in Finland, of which 0.1–0.27 km² are protected. The guide to inventories of habitat types (SYKE & Metsähallitus 2020) includes wooded swamps with deciduous trees as defined in the Natura 2000 habitat type guide in this habitat type. They often have both deciduous and coniferous trees. The dominant tree species may be *Betula pubescens, Alnus glutinosa, Alnus incana* or trees in the genus *Salix*. Common alder woods under the Finnish Nature Conservation Act represent this habitat type. Forest compartments in their natural state with old trees are likely to be defined as old-growth forests, and the types at earlier stages of succession are also valuable from the point of view of species, climate and protection of waterways. This habitat type has also been determined at EU level as a priority habitat at risk of disappearance and which the Community has a particular responsibility to protect; such priority natural habitat types are indicated by an asterisk (*).

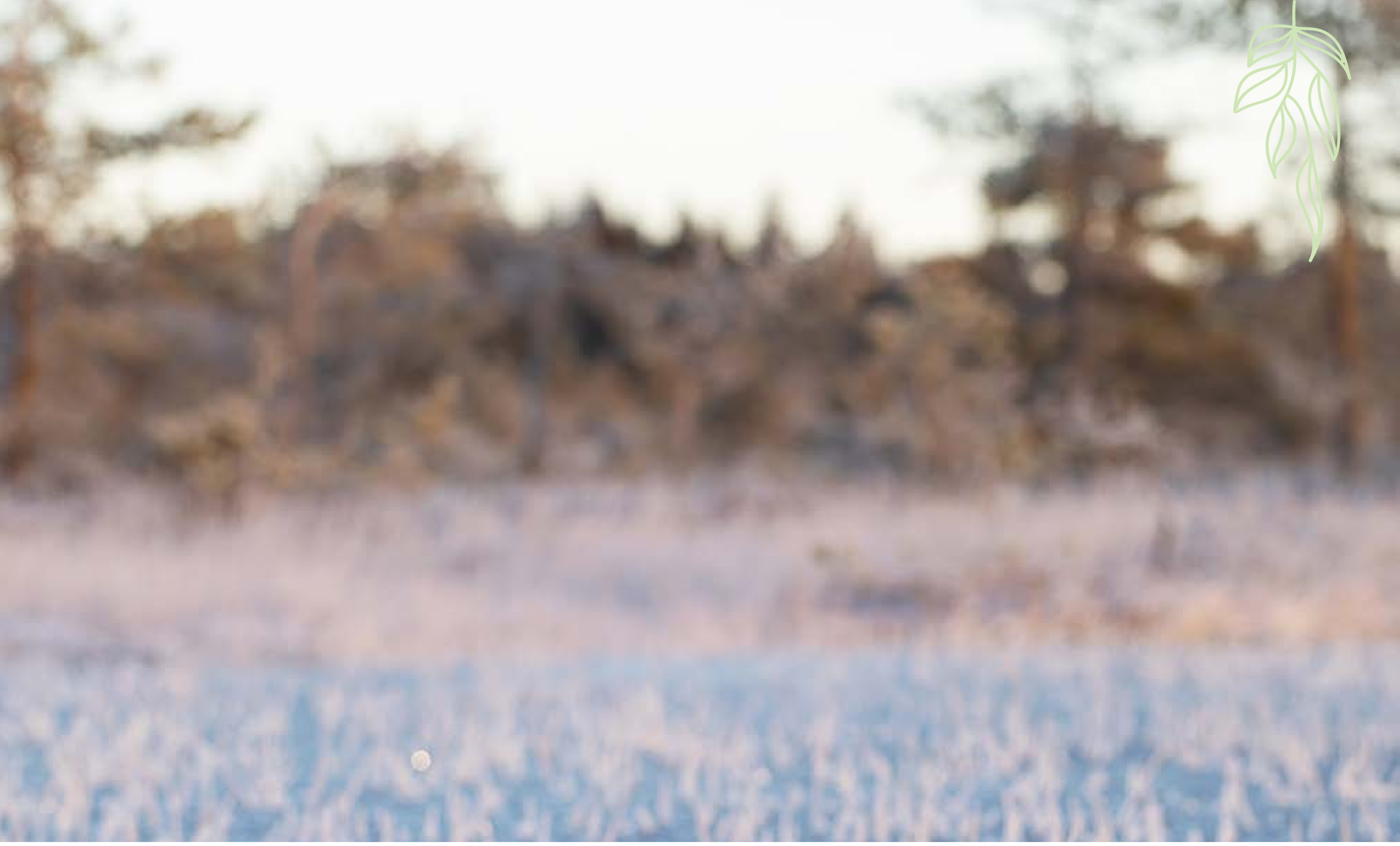
Alluvial forests (91E0*)

It is estimated that there are 11.5 km² of alluvial forests in Finland, most of which are protected. There are approximately 10 km² of alluvial forests in the boreal area, which are protected almost entirely, and 1.5 km² in the alpine area, of which 1.2–1.3 km² are protected. The guide to inventories of habitat types (SYKE & Metsähallitus 2020) includes alluvial forests on river banks, lake shores and estuaries and on islands (not on seashore) in this habitat type, as sediment accumulation is its essential characteristic. Alluvial forests are also found in the alpine region. Alluvial forests can also be dominated by coniferous trees (the flooding season is usually short). This habitat type has also been determined at EU level as a priority habitat at risk of disappearance and which the Community has a particular responsibility to protect; such priority natural habitat types are indicated by an asterisk (*).

Natural forests of primary succession stages of land upheaval coast (9030*)

It is estimated that there is a total of 180 km² of this habitat type in Finland, of which 106 km² is in protected areas, and 74 km² outside protected areas. This unique habitat type, which is found only in Finland and Sweden in the EU, requires a separate assessment in terms of conservation and protection management activities. Forests at earlier stages of succession are also important for biodiversity. This habitat type has also been determined at EU level as a priority habitat at risk of disappearance and which the Community has a particular responsibility to protect; such priority natural habitat types are indicated by an asterisk (*).





Annex 2:

Proposal 2: The conservation status of forest species in Finland

Annexes II and IV to the Habitats Directive list 29 forest species (Table 4) that are either threatened or near threatened in Finland and that have declined and become threatened or near threatened due to forestry (Hyvärinen et al. 2019). In Finland's 2019 report, only two of these had an overall conservation status assessed as favourable, for 21 species it was unfavourable-inadequate, and for five species it was unfavourable-bad (Table 4). Six of these species had a declining trend, 11 unknown, 10 stable, and for only one species the trend was improving (Table 4).

Species	Boreal 2019					Alpine 2019				
	Range	Population	Habitat for the species	Future prospects	Overall assessment	Range	Population	Habitat for the species	Future prospects	Overall assessment
Cinna latifolia	FV	FV	FV	U1	U1=					
Pulsatilla patens	FV	U2	U2	U2	U2-					
Cypripedium calceolus	FV	FV	FV	U1	U1=					
Calypso bulbosa	FV	FV	U1	U1	U1x					
Cephalozia macounii	U2	U2	U2	U2	U2-					
Plagiomnium drum-mondii	FV	U1	U1	U1	U1=					
Dicranum viride	FV	U1	FV	U1	U1=					
Herzogiella turfacea	FV	U1	U1	U1	U1=					
Scapania carinthiaca	U2	U2	U1	U2	U2=					
Buxbaumia viridis	FV	U1	U1	U1	U1=					
Pteromys volans	FV	U1	U1	U1	U1-					
Rangifer tarandus fennicus	FV	FV	FV	FV	FV+					
Triturus cristatus	FV	FV	U1	U1	U1x					
Vertigo geyeri	FV	XX	FV	FV	FVx	XX	XX	XX	XX	XX
Aradus angularis	U1	U1	U1	U1	U1x					
Cucujus cinnaberinus	U1	U2	U2	U2	U2-					
Osmoderma eremita	FV	FV	FV	U1	U1=					
Phryganophilus ruficollis	FV	U1	XX	XX	U1x					
Pytho kolwensis	U1	U1	U1	U1	U1x					
Xyletinus tremulicola	FV	U1	U1	XX	U1x					
Stephanopachys linearis	FV	FV	U1	U1	U1x					
Agathidium pulchellum	U1	XX	U1	XX	U1x					
Boros schneideri	U1	U1	U1	XX	U1x					
Stephanopachys sub-striatus	FV	FV	U1	U1	U1x					
Mesosa myops	U1	U1	FV	U1	U1=					
Xestia borealis	U1	U1	U1	U1	U1-					
Xestia brunneopicta	XX	XX	XX	XX	XX					
Lopinga achine	U1	U1	U1	U1	U1-					
Maculinea arion	U2	U2	U2	U2	U2=					

Table 4. Conservation status in the 2019 report of threatened and near threatened forest species under Annexes II and IV to the Habitats Directive (Hyvärinen et al. 2019) the status of which has declined or become threatened due to forest management activities. Extract from the report on the conservation status of habitat types in Finland under the EU Habitats Directive for the periods 2013–2018 (Ympäristöhallinto 2020).

Abbreviations:	
FV	Favourable
U1	Unfavourable-inadequate
U2	Unfavourable-bad
XX	Unknown, conservation status not assessed
=	stable trend
+	increasing trend
-	decreasing trend
x	trend unknown

Of the nine threatened and near threatened forest species listed in Annex I to the Birds Directive and similar migratory birds species the status of which has declined or become threatened due to forest management activities, four have an improving trend in both population size and distribution in the long term, five species have either declined in population size or distribution or both, and one has remained stable (Table 5).

Species	Population size		Distribution area	
	ST	LT	ST	LT
Milvus migrans	=	+	N/A	+
Aegolius funereus	-	-	N/A	-
Aquila clanga	=	=	N/A	-
Aquila chrysateos	+	+	X	+
Bonasa bonasia	-	-	N/A	-
Dendrocopos leucotos	+	+	X	+
Glaucidium passerinum	-	+	N/A	+
Buteo buteo	-	-	N/A	-
Emberiza rusticus	=	-	N/A	-

Table 5. Short-term and long-term changes in population size and short-term and long-term changes in the distribution area of threatened and near threatened bird species listed in Annex I to the Birds Directive and similar migratory birds the status of which has declined or become threatened due to forest management activities in Finland's 2019 report (Ympäristöhallinto 2020).

Key:	
Increasing	+
Stable	=
Decreasing	-
Unknown	X
N/A	
ST	short term
LT	long term

Annex 3:
The importance of structural characteristics in the Proposal 3 for the threat status of species and habitat types in Finland

Dead wood

The decreasing volume of dead wood is one of the causes of decline for 33% of threatened and near threatened forest species (523 of 1,587 species) and one of the future threats to 534 (34%) of these species in Finland (Hyvärinen et al. 2019). The decreasing volume of dead wood is also one of the causes of decline for 59 threatened and near threatened species in other habitats, such as rural habitats (31 species), shores (11 species) and mires (9 species), and it is one of the future threats for 53 species (Hyvärinen et al. 2019).

The decreasing volume of dead wood is the most significant cause of forest habitat types to have become threatened in Finland (one of the causes in 27 habitat types, i.e. in 79% of the forest habitat types), and it is also the most significant future threat (Kouki et al. 2018a).

Old-growth forests and large old trees

The decreasing number of old-growth forests and large trees is one of the causes of decline for 34% of threatened and near threatened forest species (542 of 1,587 species) and one of the future threats to 535 (34%) of these species in Finland (Hyvärinen et al. 2019). The decreasing number of old-growth forests and large old trees is also one of the causes of decline for 45 threatened and near threatened species in other habitats, such as rural habitats (14 species), mires (11 species), exposed bedrock (seven species) and shores (seven species), and it is one of the future threats for 40 species (Hyvärinen et al. 2019).

Similarly, the decreasing number of old-growth forests and old trees is also the second most significant cause for forest habitat types to become threatened (25 habitat types, i.e. 74% of forest habitat types), and their decline is also the second most significant future threat in Finland (Kouki et al. 2018a).