# Addendum to Latvia’s National Forestry accounting Plan (NFAP) and Forest Reference Level (FRL)

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# Modelling of living biomass

## Difference between the projections 'continuation of current forest management practices' and the LV FRL scenario for the period 2021-2025

Both projections provided in NFAP as alternative policy and FRL scenario are calculated using the same tools and activity data from the same sources *(National forest inventory as a primary activity data source, AGM model is used for projections of growth, mortality and harvest, and EPIM model is used for integration and transformation of different data into biomass and carbon pools)*; however, different modelling starting point and forest management assumptions are used in both scenarios. FRL scenario from 2010 follows to the forest management practices as they were in 2000-2009; alternative policy scenario considers continuous implementation of **good practices set by the most recent policies in the forest management**. FRL scenario is also significantly affected by windthrow in 2005 and economic crisis in 2009-2008 having continuous impact on structure of harvests, e.g. alternative policy scenario considers higher utilization rate of pre-mature forests and more intensive commercial thinnings.

The main methodology difference, besides the modelling starting point, between both scenarios is assumption on harvest rate – instead of intensities in the reference period (as in FRL) or demand driven assumptions the average intensities represented as area harvested in regenerative felling against the area available for regenerative felling during 5 previous years (2013-2017) is used in projections from 2018 to 2020. After 2020 different strategies are applied in modelling of harvests in state and other forests.

Regenerative felling in alternative policy scenario is calculated on the base of actual NFI data. The regenerative felling area is not considered as a constant according to the area felled at this moment, but in each 5 years cycle it is re-calculated according to changes in stand structure.

In the state forests *(managed by Joint stock company "Latvia's state forests")* regenerative felling area is calculated similar to that done at present in the company, namely, for coniferous species it is 2nd felling by age, for deciduous trees – 1st felling by age. This approach is introduced to ensure even age structure of forests in long term. The programme simulates that 79% of the estimated area will be felled in regenerative felling in pine, spruce and birch stands, and 62% for the other species. These percentages coincide with currently the proportion of stands felled in regenerative felling relative to the calculated maximum allowable.

In other forests it is modelled, that in final felling in pine, spruce and birch forests, 33% of area available for regenerative felling will be harvested, while for the other species this value is 25%. Here again, percentage have been selected according to past practices. Similarly, in other forests, it is modelled that in regenerative felling some of the pine, birch and spruce stands corresponding to the average diameter of trees of final felling but not yet reaching final felling age will be extracted in regenerative felling by diameter criteria. It is assumed that forest owners' behaviour will not change, and in each modelling cycle 15% of the stands that have reached the diameter threshold for regenerative felling will be harvested before they reach final felling age. In the FRL scenario harvesting by diameter threshold is not considered as regenerative harvesting method, as this practice was not common in the reference period.

In the alternative policy scenario the AGM model simulates that an additional area will be felled in the regeneration felling, according to average area that has been felled in sanitary (salvage) regenerative fellings in the last 5 years according to Stand wise forest inventory data.

Detailed description of stand selection of calculation of harvests outside regenerative felling in alternative policy scenario is provided in Annex 3 of NFAP. The threshold values for implementation of commercial thinning *(extraction of logs instead of leaving them in forests, as it is done in pre-commercial thinning)* are set in Table 12 of Annex 3 of NFAP. It is defined that at stand density of 0.85 *(actual basal area compared to normal basal area determined by legal restrictions),* commercial thinnings are simulated. In the NFI plots corresponding to the commercial thinning criteria (height, age, density), in the current 5 year period, thinning in all forests is simulated in 70% of the plots. After thinning, the residual basal area is simulated randomly, and it is at least 3 $m^2$ $ha^{-1}$ bigger in state forests in comparison to minimum basal area set by legal documents, but in other forests it is by 4 $m^2$ $ha^{-1}$ bigger in comparison to the legal restrictions. In both cases the minimum extracted basal area is 2 $m^2$ $ha^{-1}$; i.e. thinning is not planned if less than 2 $m^2$ $ha^{-1}$ can be extracted.

In alternative policy scenario it is considered that in state forests 4%, in other forests 3% of the area in stands older than 20 years and younger than the regulatory regenerative felling age is planned for sanitary felling where 17% of the stand basal area is extracted. The proportion of the area is corresponding to the felled area during the most recent 5 years in sanitary fellings according to Stand wise forest inventory data (LVMI Silava, 2019).

In the FRL scenario harvesting intensity approach is used to estimate harvest rate; respectively, certain percentage of growing stock available for regenerative felling by age at the beginning of the period is extracted in regenerative felling. The percentage of extracted timber or the intensity factor is determined as average proportion between resources available for regenerative felling at the beginning of 2000 and extracted between 2000 and 2004 and available for regenerative felling at the beginning of 2005 and extracted between 2005 and 2009. Harvest rate in commercial thinning is estimated as fixed proportion of timber volume extracted outside regenerative felling. This proportion is estimated according average values in 2000-2009 according to the Stand wise forest inventory data. This proportion is applied to the whole projection period to ensure that no assumptions based on policies implemented after 2009 affects the results of calculation. Available stock *(calculated according to difference between minimal basal area set by legal documents and actual basal area)* and species specific uncertainty range of the harvest rate outside regenerative felling are used to ensure that harvest projections do not exceed available resources and stays in a range determined by management intensities in 2000-2009. Considering practices in 2000-2009 thinnings or selective fellings are planned in mature and pre-mature forests, therefore actual volume available for thinning in practice includes also growing stock in mature forests. The applied intensities are provided in Table 1.

**Table 1: Assumptions for regenerative felling and commercial thinning in FRL scenario**

| No | Species | Intensity of regenerative felling, extracted volume against available volume | Proportion of harvests in commercial thinning from regenerative felling |
|---|---|---|---|
| 1. | Aspen | 2% | 6% |
| 2. | Grey alder | 2% | 11% |
| 3. | Birch | 5% | 23% |
| 4. | Spruce | 5% | 28% |
| 5. | Black alder | 2% | 18% |
| 6. | Ash, oak | 1% | 36% |
| 7. | Other species | 18% | 27% |
| 8. | Pine | 4% | 33% |

Comparison of harvest rate in FRL and alternative policy scenario is provided in Table 2 and 3. Total harvest rate, distribution by species, biomass, carbon stock and assortments structure are provided in these tables. The last column in Table 2 is results of *Ttest* analysis comparing both tables in time period between 2010 and 2030. For the most of the parameters, including total harvest and carbon in harvested biomass, *p* value is less than 0.05, which means that these values are statistically significantly different.

Modelled data in tables Table 2 and 3 are greyed out. Light greying means that only part of the data are modelled in a particular column, e.g. modelling is started from 2018 in Table 3. Here and in following tables periodic averages are provided in case if period is provided in table heading.

Total harvest projection in FRL scenario in the period between 2021 and 2025 is 82 mill. $m^3$ and in alternative policy scenario – 78 mill. $m^3$. The difference is associated with multiple reasons, mainly different initial conditions *(accessible resources for regenerative and commercial thinning by species)*, but also due to smaller *(in comparison to proposed)* harvesting intensity in state forests during recent years and increased proportion of commercial thinning. Growing stock in forests available for regenerative felling at the end of 2020 in alternative policy scenario corresponding to 'continuation of current forest management practices' scenario in NFAP is 331 mill. m3, while in FRL scenario – 336 mill. m3. The difference in growing stock in mature stands is associated with assumption of less intensive commercial thinning in FRL scenario in comparison to actual situation between 2010 and 2017, resulting in accumulation of growing stock in mature stands; however, the difference is not significant. According to the State Forest Register data, harvesting intensity in commercial thinning in the reference period was in average 21 $m^3$ $ha^{-1}$ and after the reference period (2010-2017) it nearly doubled reaching 41 $m^3$ $ha^{-1}$ (Figure 1), which significantly affected growth characteristics of forests. The NFI data demonstrates higher extraction rate in commercial thinning – 60-75 $m^3$ $ha^{-1}$ (over-bark including firewood) in the reference period (2000-2009); however, State forest register data better demonstrates trends.

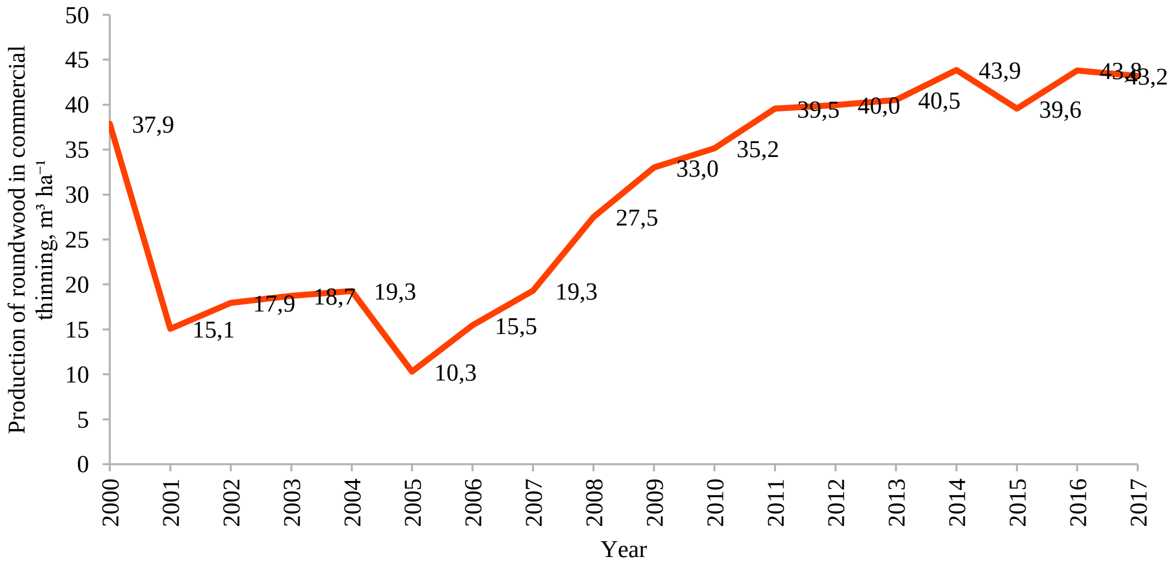


**Figure 1: Average extracted roundwood *(under bark volume, excluding firewood and harvesting residues)* in commercial thinning according to State forest register data.**

## Table 2: Characterization of harvesting stock in FRL scenario

| Year | 1990-1994 | 1995-1999 | 2000-2004 | 2005-2009 | 2010-2014 | 2015-2020 | FRL projections period | | | | | 2026-2030 | *Ttest* result[1] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 2021 | 2022 | 2023 | 2024 | 2025 | | |
| Harvest rate, mill. $m^3$ $yr^{-1}$ | | | | | | | | | | | | | |
| Total | 6.0 | 11.6 | 13.8 | 12.8 | 16.1 | 16.2 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.7 | 0.000177 |
| Aspen | 0.5 | 1.0 | 1.0 | 0.9 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.2 | 1.2 | 0.000008 |
| Grey alder | 0.4 | 0.7 | 0.9 | 0.9 | 1.2 | 1.2 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 0.009487 |
| Birch | 1.7 | 3.4 | 3.8 | 3.7 | 4.6 | 4.8 | 4.9 | 4.9 | 4.9 | 4.9 | 4.7 | 4.8 | 0.000000 |
| Spruce | 1.3 | 2.7 | 3.3 | 2.4 | 3.4 | 3.2 | 3.1 | 3.1 | 3.1 | 3.1 | 3.2 | 3.3 | 0.008789 |
| Black alder | 0.1 | 0.2 | 0.2 | 0.3 | 0.5 | 0.6 | 0.7 | 0.7 | 0.7 | 0.7 | 0.8 | 0.8 | 0.002858 |
| Ash. oak | 0.0 | 0.0 | 0.0 | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.000007 |
| Other species | 0.0 | 0.1 | 0.3 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.364147 |
| Pine | 1.9 | 3.6 | 4.3 | 4.2 | 5.0 | 4.9 | 5.0 | 5.0 | 5.0 | 5.0 | 4.9 | 5.0 | 0.000000 |
| Relative distribution of harvest rate by species | | | | | | | | | | | | | |
| Aspen | 9% | 9% | 7% | 7% | 7% | 7% | 7% | 7% | 7% | 7% | 7% | 7% | 0.000000 |
| Grey alder | 6% | 6% | 6% | 7% | 7% | 8% | 8% | 8% | 8% | 8% | 8% | 8% | 0.000432 |
| Birch | 29% | 29% | 27% | 29% | 29% | 30% | 30% | 30% | 30% | 30% | 29% | 29% | 0.000005 |
| Spruce | 22% | 23% | 24% | 19% | 21% | 20% | 19% | 19% | 19% | 19% | 20% | 20% | 0.359725 |
| Black alder | 2% | 2% | 2% | 2% | 3% | 4% | 4% | 4% | 4% | 4% | 5% | 5% | 0.000060 |
| Ash. oak | 0% | 0% | 0% | 1% | 1% | 1% | 1% | 1% | 1% | 1% | 1% | 1% | 0.000018 |
| Other species | 0% | 0% | 2% | 2% | 1% | 1% | 1% | 1% | 1% | 1% | 1% | 1% | 0.466307 |
| Pine | 32% | 31% | 31% | 33% | 31% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 0.000057 |
| Stem biomass, mill. tons $yr^{-1}$ | | | | | | | | | | | | | |
| Aspen | 0.2 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.000008 |
| Grey alder | 0.2 | 0.3 | 0.3 | 0.4 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.009487 |
| Birch | 0.9 | 1.7 | 1.9 | 1.8 | 2.3 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.3 | 2.4 | 0.000000 |
| Spruce | 0.5 | 1.1 | 1.3 | 0.9 | 1.3 | 1.3 | 1.2 | 1.2 | 1.2 | 1.2 | 1.3 | 1.3 | 0.008789 |
| Black alder | 0.1 | 0.1 | 0.1 | 0.1 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.4 | 0.4 | 0.002858 |
| Ash. oak | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.000007 |
| Other species | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.364147 |
| Pine | 0.8 | 1.6 | 1.9 | 1.8 | 2.2 | 2.1 | 2.2 | 2.2 | 2.2 | 2.2 | 2.1 | 2.2 | 0.000000 |
| Crown biomass, mill. tons $yr^{-1}$ | | | | | | | | | | | | | |
| Aspen | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.000008 |
| Grey alder | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.009487 |
| Birch | 0.2 | 0.3 | 0.4 | 0.4 | 0.4 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.4 | 0.5 | 0.000000 |
| Spruce | 0.2 | 0.4 | 0.5 | 0.4 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.008789 |

[1] Comparison of FRL and alternate scenario.

| Year | 1990-1994 | 1995-1999 | 2000-2004 | 2005-2009 | 2010-2014 | 2015-2020 | FRL projections period | | | | | 2026-2030 | *Ttest* result[1] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 2021 | 2022 | 2023 | 2024 | 2025 | | |
| Black alder | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.002858 |
| Ash. oak | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.000007 |
| Other species | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.364147 |
| Pine | 0.2 | 0.3 | 0.4 | 0.4 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.000000 |
| Below-ground biomass. mill. tons yr$^{-1}$ | | | | | | | | | | | | | |
| Aspen | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.000008 |
| Grey alder | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.009487 |
| Birch | 0.3 | 0.5 | 0.6 | 0.6 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.000000 |
| Spruce | 0.2 | 0.4 | 0.5 | 0.4 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.008789 |
| Black alder | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.002858 |
| Ash. oak | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.000007 |
| Other species | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.364147 |
| Pine | 0.2 | 0.5 | 0.5 | 0.5 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.000000 |
| Carbon stock, mill. tons C yr$^{-1}$ | | | | | | | | | | | | | |
| Stems | 1.4 | 2.7 | 3.2 | 3.0 | 3.7 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 3.9 | 0.000019 |
| Crown | 0.3 | 0.7 | 0.8 | 0.7 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.000014 |
| Below ground | 0.4 | 0.8 | 1.0 | 0.9 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 0.000005 |
| Carbon content. kg ton$^{-1}$ | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.000006 |
| Assortment structure, mill. m$^3$ yr$^{-1}$ | | | | | | | | | | | | | |
| Coniferous sawn wood | 2.3 | 4.4 | 5.2 | 4.8 | 6.0 | 5.9 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.1 | 0.000000 |
| Deciduous sawn wood | 0.5 | 1.0 | 1.2 | 1.1 | 1.4 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 0.303811 |
| Pulpwood | 2.3 | 4.4 | 5.2 | 4.8 | 6.1 | 6.1 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.3 | 0.000164 |
| Firewood | 1.0 | 1.9 | 2.2 | 2.1 | 2.7 | 2.7 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.9 | 0.279856 |
| Relative assortments structure | | | | | | | | | | | | | |
| Coniferous sawn wood | 38% | 38% | 38% | 37% | 37% | 37% | 36% | 36% | 36% | 36% | 36% | 36% | 0.000051 |
| Deciduous sawn wood | 9% | 9% | 8% | 9% | 9% | 9% | 9% | 9% | 9% | 9% | 9% | 9% | 0.000109 |
| Pulpwood | 38% | 38% | 38% | 38% | 38% | 38% | 38% | 38% | 38% | 38% | 38% | 38% | 0.089857 |
| Firewood | 16% | 16% | 16% | 16% | 17% | 17% | 17% | 17% | 17% | 17% | 17% | 17% | 0.000113 |

**Table 3: Characterization of harvesting stock in alternative policy scenario**

| Year | 1990-1994 | 1995-1999 | 2000-2004 | 2005-2009 | 2010-2014 | 2015-2020 | FRL projections period | | | | | 2026-2030 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 2021 | 2022 | 2023 | 2024 | 2025 | |
| Harvest rate, mill. m$^3$ yr$^{-1}$ | | | | | | | | | | | | |
| Total | 6.0 | 11.6 | 13.8 | 12.8 | 15.7 | 15.8 | 15.6 | 15.6 | 15.6 | 15.6 | 15.6 | 14.7 |
| Aspen | 0.4 | 0.8 | 1.0 | 0.9 | 2.1 | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 |
| Grey alder | 0.3 | 0.6 | 0.9 | 0.9 | 2.7 | 1.6 | 1.5 | 1.5 | 1.5 | 1.5 | 1.3 | 1.3 |
| Birch | 1.8 | 3.4 | 3.8 | 3.9 | 2.6 | 4.3 | 3.5 | 3.5 | 3.5 | 3.5 | 3.7 | 3.5 |

| Year | 1990-1994 | 1995-1999 | 2000-2004 | 2005-2009 | 2010-2014 | 2015-2020 | FRL projections period | | | | | 2026-2030 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 2021 | 2022 | 2023 | 2024 | 2025 | |
| Spruce | 1.7 | 3.2 | 3.3 | 2.2 | 2.5 | 3.0 | 3.4 | 3.4 | 3.4 | 3.4 | 3.2 | 3.0 |
| Black alder | 0.0 | 0.0 | 0.2 | 0.3 | 0.5 | 0.7 | 1.0 | 1.0 | 1.0 | 1.0 | 0.9 | 0.8 |
| Ash. oak | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 | 0.0 | 0.0 |
| Other species | 0.1 | 0.2 | 0.3 | 0.3 | 0.6 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 |
| Pine | 1.7 | 3.3 | 4.3 | 4.3 | 4.5 | 4.3 | 4.2 | 4.2 | 4.2 | 4.2 | 4.5 | 4.1 |
| Relative distribution of harvest rate | | | | | | | | | | | | |
| Aspen | 7% | 7% | 7% | 7% | 13% | 12% | 12% | 12% | 12% | 12% | 12% | 12% |
| Grey alder | 5% | 5% | 6% | 7% | 17% | 10% | 9% | 9% | 9% | 9% | 9% | 9% |
| Birch | 30% | 30% | 27% | 31% | 16% | 27% | 23% | 23% | 23% | 23% | 24% | 24% |
| Spruce | 28% | 28% | 24% | 17% | 16% | 19% | 22% | 22% | 22% | 22% | 20% | 20% |
| Black alder | 0% | 0% | 2% | 2% | 4% | 4% | 6% | 6% | 6% | 6% | 6% | 6% |
| Ash. oak | 0% | 0% | 0% | 0% | 1% | 0% | 1% | 1% | 1% | 1% | 0% | 0% |
| Other species | 2% | 2% | 2% | 2% | 4% | 0% | 0% | 0% | 0% | 0% | 1% | 1% |
| Pine | 28% | 28% | 31% | 33% | 29% | 27% | 27% | 27% | 27% | 27% | 29% | 28% |
| Stem biomass. mill. tons $yr^{-1}$ | | | | | | | | | | | | |
| Aspen | 0.2 | 0.3 | 0.4 | 0.4 | 0.8 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 |
| Grey alder | 0.1 | 0.2 | 0.3 | 0.4 | 1.1 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.5 | 0.5 |
| Birch | 0.9 | 1.7 | 1.9 | 1.9 | 1.3 | 2.1 | 1.7 | 1.7 | 1.7 | 1.7 | 1.8 | 1.7 |
| Spruce | 0.7 | 1.3 | 1.3 | 0.9 | 1.0 | 1.2 | 1.3 | 1.3 | 1.3 | 1.3 | 1.2 | 1.2 |
| Black alder | 0.0 | 0.0 | 0.1 | 0.1 | 0.3 | 0.3 | 0.5 | 0.5 | 0.5 | 0.5 | 0.4 | 0.4 |
| Ash. oak | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.0 | 0.0 |
| Other species | 0.1 | 0.1 | 0.1 | 0.1 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 |
| Pine | 0.7 | 1.4 | 1.9 | 1.9 | 2.0 | 1.9 | 1.8 | 1.8 | 1.8 | 1.8 | 2.0 | 1.8 |
| Crown biomass. mill, tons $yr^{-1}$ | | | | | | | | | | | | |
| Aspen | 0.0 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.1 |
| Grey alder | 0.0 | 0.0 | 0.1 | 0.1 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Birch | 0.2 | 0.3 | 0.4 | 0.4 | 0.2 | 0.4 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| Spruce | 0.3 | 0.5 | 0.5 | 0.4 | 0.4 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| Black alder | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Ash. oak | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Other species | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Pine | 0.2 | 0.3 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| Below-ground biomass, mill. tons $yr^{-1}$ | | | | | | | | | | | | |
| Aspen | 0.0 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| Grey alder | 0.0 | 0.1 | 0.1 | 0.1 | 0.3 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.1 | 0.1 |
| Birch | 0.3 | 0.5 | 0.6 | 0.6 | 0.4 | 0.6 | 0.5 | 0.5 | 0.5 | 0.5 | 0.6 | 0.5 |
| Spruce | 0.3 | 0.5 | 0.5 | 0.3 | 0.4 | 0.4 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |

| Year | 1990-1994 | 1995-1999 | 2000-2004 | 2005-2009 | 2010-2014 | 2015-2020 | FRL projections period | | | | | 2026-2030 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 2021 | 2022 | 2023 | 2024 | 2025 | |
| Black alder | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Ash. oak | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Other species | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Pine | 0.2 | 0.4 | 0.5 | 0.5 | 0.6 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.6 | 0.5 |
| Carbon stock, mill. tons C $yr^{-1}$ | | | | | | | | | | | | |
| Stems | 1.4 | 2.7 | 3.2 | 3.0 | 3.5 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 | 3.4 |
| Crown | 0.4 | 0.7 | 0.8 | 0.7 | 0.8 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.8 |
| Below ground | 0.4 | 0.8 | 1.0 | 0.9 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.0 |
| Carbon content. kg $ton^{-1}$ | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| Assortment structure, mill. $m^3$ $yr^{-1}$ | | | | | | | | | | | | |
| Coniferous sawn wood | 2.3 | 4.4 | 5.3 | 4.8 | 5.3 | 5.5 | 5.5 | 5.5 | 5.5 | 5.5 | 5.6 | 5.2 |
| Deciduous sawn wood | 0.5 | 1.0 | 1.2 | 1.1 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.4 |
| Pulpwood | 2.3 | 4.4 | 5.2 | 4.8 | 5.8 | 6.0 | 5.8 | 5.8 | 5.8 | 5.8 | 5.9 | 5.6 |
| Firewood | 0.9 | 1.8 | 2.2 | 2.1 | 3.1 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.7 | 2.6 |
| Relative assortments structure | | | | | | | | | | | | |
| Coniferous sawn wood | 38% | 38% | 38% | 37% | 33% | 35% | 35% | 35% | 35% | 35% | 36% | 35% |
| Deciduous sawn wood | 8% | 8% | 8% | 9% | 10% | 10% | 10% | 10% | 10% | 10% | 9% | 10% |
| Pulpwood | 38% | 38% | 38% | 38% | 37% | 38% | 37% | 37% | 37% | 37% | 38% | 38% |
| Firewood | 16% | 16% | 16% | 16% | 20% | 18% | 18% | 18% | 18% | 18% | 17% | 17% |

Total harvests, including regenerative and other fellings, in the **alternative policy scenario** in addition to Table 3 is provided in Table 4 as periodic averages of 5 years long period. Data on harvests outside regenerative felling are provided in Table 5 and harvests in regenerative felling in the alternative policy scenario – in Table 6. These and following tables are harmonized by design with the Table 15, 16, 18, 20, 21, 22, 23, 25 and 26 characterizing conditions in FRL scenario.

Growing stock in forest by dominant species[2] in the alternative policy scenario is represented in Table 7. Age structure (pre-mature and mature stands) of growing stock is provided in Table 8. Mature forests are forest stands, which reached legally permitted age threshold for regenerative fellings. Mature stands represents timber volume available for regenerative felling; however, harvesting by diameter, as described in above sections is also considered in modelling.

Growing stock available for commercial thinning in alternative policy scenario is provided in Table 9. This stock is calculated comparing legally binding minimal basal area and actual basal area in pre-mature forests. Volume of timber available for extraction is calculated as proportion between minimal and actual basal area multiplied by growing stock. However, thinning and selective felling in modelling is considered in different ages including mature forests, as described in sections above.

Forest area divided into age groups and dominant species at the end of every calculation period in the alternative policy scenario is provided in Table 10. Average gross annual increment divided by dominant species is provided in Table 11. Average natural mortality in alternative policy scenario divided by dominant species is provided in Table 12. Modelled data are greyed out in tables. Light greying means that part of represented in a column, e.g. 2015-2020 are partially modelled – situation till 2017 including it is based on actual data, but 2018, 2019 and 2020 are modelled.

[2] Dominant species at the end of the calculation period.

**Table 4: Total harvests in alternative policy scenario, mill. $m^3$ $yr^{-1}$**

| Species | 1990-1994 | 1995-1999 | 2000-2004 | 2005-2009 | 2010-2014 | 2015-2020 | 2021-2025 | 2026-2030 | 2031-2035 | 2036-2040 | 2041-2045 | 2046-2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aspen | 0.5 | 1.0 | 1.0 | 0.9 | 2.1 | 1.5 | 1.0 | 1.0 | 1.1 | 1.2 | 1.4 | 1.5 |
| Grey alder | 0.4 | 0.7 | 0.9 | 0.9 | 2.7 | 1.3 | 1.2 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 |
| Birch | 1.7 | 3.4 | 3.8 | 3.7 | 2.6 | 4.2 | 4.3 | 4.5 | 4.5 | 4.2 | 4.0 | 3.8 |
| Spruce | 1.3 | 2.7 | 3.3 | 2.4 | 2.5 | 3.0 | 2.8 | 2.8 | 2.8 | 3.1 | 3.4 | 3.5 |
| Black alder | 0.1 | 0.2 | 0.2 | 0.3 | 0.5 | 0.7 | 0.6 | 0.7 | 0.7 | 0.8 | 0.8 | 0.8 |
| Ash, oak | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Other species | 0.0 | 0.1 | 0.3 | 0.2 | 0.6 | 1.3 | 0.8 | 0.6 | 0.8 | 1.3 | 1.4 | 1.6 |
| Pine | 1.9 | 3.6 | 4.3 | 4.2 | 4.5 | 4.6 | 4.7 | 4.7 | 4.7 | 4.6 | 4.6 | 4.4 |
| Total | 6.0 | 11.6 | 13.8 | 12.8 | 15.7 | 16.6 | 15.6 | 15.8 | 16.1 | 16.8 | 17.1 | 17.1 |

**Table 5: Harvests outside regenerative felling in alternative policy scenario, mill. $m^3$ $yr^{-1}$**

| Species | 1990-1994 | 1995-1999 | 2000-2004 | 2005-2009 | 2010-2014 | 2015-2020 | 2021-2025 | 2026-2030 | 2031-2035 | 2036-2040 | 2041-2045 | 2046-2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aspen | 0.0 | 0.1 | 0.1 | 0.1 | 0.4 | 0.3 | 0.2 | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 |
| Grey alder | 0.0 | 0.1 | 0.1 | 0.1 | 0.3 | 0.3 | 0.3 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| Birch | 0.4 | 0.8 | 1.0 | 0.9 | 0.6 | 0.9 | 0.8 | 0.5 | 0.6 | 0.6 | 0.7 | 0.6 |
| Spruce | 0.4 | 0.8 | 0.8 | 0.6 | 0.7 | 0.9 | 0.8 | 0.5 | 0.5 | 0.6 | 0.6 | 0.6 |
| Black alder | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Ash, oak | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Other species | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.4 | 0.3 | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 |
| Pine | 0.6 | 1.2 | 1.3 | 1.4 | 1.5 | 1.4 | 1.3 | 0.8 | 0.7 | 0.8 | 0.8 | 0.8 |
| Total | 1.5 | 2.9 | 3.3 | 3.2 | 3.9 | 4.3 | 3.9 | 2.4 | 2.4 | 2.8 | 2.9 | 2.7 |

**Table 6: Harvests in regenerative felling in alternative policy scenario, mill. $m^3$ $yr^{-1}$**

| Species | 1990-1994 | 1995-1999 | 2000-2004 | 2005-2009 | 2010-2014 | 2015-2020 | 2021-2025 | 2026-2030 | 2031-2035 | 2036-2040 | 2041-2045 | 2046-2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aspen | 0.5 | 0.9 | 0.9 | 0.8 | 1.7 | 1.2 | 0.8 | 0.9 | 1.0 | 1.1 | 1.2 | 1.3 |

| Species | 1990-1994 | 1995-1999 | 2000-2004 | 2005-2009 | 2010-2014 | 2015-2020 | 2021-2025 | 2026-2030 | 2031-2035 | 2036-2040 | 2041-2045 | 2046-2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Grey alder | 0.3 | 0.6 | 0.8 | 0.8 | 2.4 | 1.1 | 0.9 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 |
| Birch | 1.3 | 2.6 | 2.8 | 2.8 | 2.0 | 3.3 | 3.5 | 3.9 | 3.9 | 3.6 | 3.4 | 3.2 |
| Spruce | 0.9 | 2.0 | 2.6 | 1.8 | 1.8 | 2.1 | 2.0 | 2.3 | 2.3 | 2.5 | 2.8 | 2.9 |
| Black alder | 0.1 | 0.2 | 0.2 | 0.3 | 0.4 | 0.5 | 0.5 | 0.6 | 0.6 | 0.7 | 0.7 | 0.7 |
| Ash, oak | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Other species | 0.0 | 0.0 | 0.3 | 0.2 | 0.4 | 0.8 | 0.5 | 0.5 | 0.6 | 1.1 | 1.2 | 1.5 |
| Pine | 1.3 | 2.4 | 3.0 | 2.9 | 3.0 | 3.2 | 3.4 | 4.0 | 4.0 | 3.8 | 3.7 | 3.6 |
| Total | 4.5 | 8.7 | 10.5 | 9.5 | 11.8 | 12.2 | 11.7 | 13.3 | 13.7 | 14.0 | 14.1 | 14.4 |

**Table 7: Development of growing stock in alternative policy scenario, mill. $m^3$**

| Species | 1990-1994 | 1995-1999 | 2000-2004 | 2005-2009 | 2010-2014 | 2015-2020 | 2021-2025 | 2026-2030 | 2031-2035 | 2036-2040 | 2041-2045 | 2046-2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aspen | 28.0 | 64.9 | 56.7 | 57.9 | 87.0 | 89.3 | 80.5 | 87.7 | 94.3 | 99.2 | 103.4 | 106.5 |
| Grey alder | 21.3 | 31.9 | 39.1 | 42.2 | 68.0 | 47.4 | 43.4 | 48.0 | 50.1 | 50.2 | 49.3 | 48.5 |
| Birch | 117.2 | 129.8 | 145.5 | 155.1 | 143.3 | 151.0 | 161.7 | 165.6 | 168.0 | 170.5 | 173.9 | 176.4 |
| Spruce | 102.2 | 105.9 | 113.5 | 120.2 | 114.2 | 122.4 | 132.9 | 137.6 | 140.9 | 142.0 | 142.4 | 141.9 |
| Black alder | 17.4 | 22.4 | 30.0 | 35.7 | 39.4 | 43.3 | 47.8 | 49.5 | 50.2 | 50.3 | 50.2 | 50.1 |
| Ash, oak | 7.9 | 8.2 | 9.1 | 9.7 | 7.5 | 6.4 | 6.0 | 6.6 | 7.0 | 6.9 | 6.9 | 7.5 |
| Other species | 3.6 | 4.8 | 6.2 | 6.8 | 12.9 | 16.2 | 10.4 | 4.9 | 5.7 | 10.2 | 11.2 | 11.6 |
| Pine | 206.7 | 208.8 | 221.0 | 226.7 | 201.0 | 202.7 | 206.1 | 202.2 | 197.5 | 192.4 | 188.8 | 186.4 |
| Total | 504.2 | 576.7 | 621.1 | 654.3 | 673.2 | 678.8 | 688.9 | 702.1 | 713.6 | 721.6 | 726.0 | 729.0 |

**Table 8: Development of growing stock by dominant species in different age groups in alternative policy scenario, mill. $m^3$**

| Species | 1990-1994 | 1995-1999 | 2000-2004 | 2005-2009 | 2010-2014 | 2015-2020 | 2021-2025 | 2026-2030 | 2031-2035 | 2036-2040 | 2041-2045 | 2046-2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mature stands | | | | | | | | | | | | |
| Aspen | 26.2 | 60.4 | 52.6 | 57.9 | 71.7 | 63.8 | 44.8 | 51.3 | 54.5 | 61.7 | 68.4 | 73.2 |
| Grey alder | 4.9 | 27.0 | 31.6 | 41.6 | 51.2 | 37.7 | 33.7 | 39.6 | 41.3 | 40.7 | 39.9 | 40.1 |

| Species | 1990-1994 | 1995-1999 | 2000-2004 | 2005-2009 | 2010-2014 | 2015-2020 | 2021-2025 | 2026-2030 | 2031-2035 | 2036-2040 | 2041-2045 | 2046-2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Birch | 43.6 | 50.1 | 54.5 | 69.7 | 58.2 | 59.3 | 63.2 | 70.6 | 71.1 | 65.1 | 60.5 | 58.3 |
| Spruce | 41.5 | 40.4 | 47.8 | 41.0 | 33.2 | 36.0 | 34.1 | 39.2 | 39.7 | 43.5 | 47.0 | 50.3 |
| Black alder | 5.9 | 7.7 | 10.7 | 14.8 | 14.4 | 17.7 | 20.6 | 25.6 | 27.8 | 28.9 | 29.6 | 30.2 |
| Ash, oak | 2.8 | 2.9 | 3.8 | 5.1 | 4.0 | 2.8 | 4.0 | 5.7 | 6.0 | 5.8 | 5.8 | 6.5 |
| Other species | 0.7 | 1.1 | 1.3 | 1.1 | 4.2 | 4.9 | 2.2 | 1.4 | 1.7 | 5.2 | 5.8 | 6.9 |
| Pine | 70.5 | 75.6 | 74.3 | 87.8 | 73.5 | 72.7 | 77.9 | 89.6 | 90.1 | 86.9 | 84.7 | 82.3 |
| Total | 196.2 | 265.1 | 276.5 | 319.1 | 310.4 | 294.8 | 280.5 | 323.0 | 332.3 | 337.8 | 341.7 | 347.8 |
| Pre-mature forests | | | | | | | | | | | | |
| Aspen | 1.7 | 4.4 | 4.2 | 5.9 | 15.3 | 25.5 | 35.7 | 36.4 | 39.7 | 37.6 | 34.9 | 33.3 |
| Grey alder | 16.4 | 4.9 | 7.5 | 8.0 | 16.7 | 9.7 | 9.7 | 8.4 | 8.8 | 9.5 | 9.3 | 8.4 |
| Birch | 73.6 | 79.8 | 91.0 | 82.3 | 85.1 | 91.8 | 98.5 | 95.0 | 96.9 | 105.4 | 113.5 | 118.1 |
| Spruce | 60.7 | 65.5 | 65.7 | 76.7 | 81.0 | 86.4 | 98.8 | 98.5 | 101.2 | 98.5 | 95.4 | 91.6 |
| Black alder | 11.4 | 14.7 | 19.3 | 20.2 | 25.0 | 25.6 | 27.1 | 23.8 | 22.5 | 21.3 | 20.7 | 19.9 |
| Ash, oak | 5.1 | 5.3 | 5.3 | 4.6 | 3.4 | 3.6 | 2.0 | 0.9 | 0.9 | 1.0 | 1.1 | 1.1 |
| Other species | 2.9 | 3.8 | 4.9 | 5.5 | 8.7 | 11.3 | 8.2 | 3.4 | 4.0 | 5.0 | 5.4 | 4.8 |
| Pine | 136.2 | 133.3 | 146.7 | 134.2 | 127.6 | 130.1 | 128.2 | 112.6 | 107.4 | 105.4 | 104.1 | 104.1 |
| Total | 308.0 | 311.6 | 344.6 | 337.3 | 362.8 | 384.0 | 408.4 | 379.1 | 381.3 | 383.8 | 384.3 | 381.2 |

**Table 9: Growing stock available for non-regenerative fellings in alternative policy scenario, mill. $m^3$**

| Species | 1990-1994 | 1995-1999 | 2000-2004 | 2005-2009 | 2010-2014 | 2015-2020 | 2021-2025 | 2026-2030 | 2031-2035 | 2036-2040 | 2041-2045 | 2046-2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aspen | 0.7 | 1.8 | 1.7 | 2.3 | 6.2 | 9.4 | 13.9 | 13.8 | 15.2 | 14.3 | 13.4 | 12.7 |
| Grey alder | 6.6 | 2.0 | 3.0 | 3.2 | 6.8 | 3.6 | 3.8 | 3.2 | 3.4 | 3.6 | 3.6 | 3.2 |
| Birch | 29.6 | 32.0 | 36.8 | 32.8 | 34.8 | 33.9 | 38.3 | 36.0 | 37.2 | 40.2 | 43.4 | 45.1 |
| Spruce | 24.4 | 26.3 | 26.5 | 30.6 | 33.1 | 31.9 | 38.4 | 37.3 | 38.8 | 37.5 | 36.5 | 35.0 |
| Black alder | 4.6 | 5.9 | 7.8 | 8.1 | 10.2 | 9.5 | 10.5 | 9.0 | 8.6 | 8.1 | 7.9 | 7.6 |
| Ash, oak | 2.1 | 2.1 | 2.1 | 1.8 | 1.4 | 1.3 | 0.8 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |

| Species | 1990-1994 | 1995-1999 | 2000-2004 | 2005-2009 | 2010-2014 | 2015-2020 | 2021-2025 | 2026-2030 | 2031-2035 | 2036-2040 | 2041-2045 | 2046-2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Other species | 1.2 | 1.5 | 2.0 | 2.2 | 3.5 | 4.2 | 3.2 | 1.3 | 1.5 | 1.9 | 2.0 | 1.8 |
| Pine | 54.8 | 53.5 | 59.2 | 53.5 | 52.2 | 48.0 | 49.8 | 42.7 | 41.2 | 40.2 | 39.8 | 39.7 |
| Total | 124.0 | 125.1 | 139.1 | 134.6 | 148.4 | 141.9 | 158.7 | 143.8 | 146.5 | 146.5 | 147.2 | 145.7 |

**Table 10: Forest area by age group and species in alternative policy scenario, 1000 ha**

| Period | 1995-1999 | 2000-2004 | 2005-2009 | 2010-2014 | 2015-2020 | 2021-2025 | 2026-2030 | 2031-2035 | 2036-2040 | 2041-2045 | 2046-2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Mature forest stands | | | | | | | | | | | |
| Aspen | 164.5 | 149.3 | 145.9 | 165.2 | 169.3 | 111.3 | 118.0 | 124.8 | 151.1 | 174.9 | 177.9 |
| Grey alder | 134.0 | 146.9 | 170.8 | 213.8 | 175.0 | 180.1 | 194.8 | 208.5 | 209.3 | 209.4 | 208.4 |
| Birch | 265.9 | 219.5 | 228.5 | 190.2 | 204.2 | 226.8 | 238.3 | 247.6 | 225.6 | 208.1 | 192.0 |
| Spruce | 140.9 | 176.2 | 137.2 | 120.0 | 96.7 | 99.1 | 98.7 | 98.7 | 117.0 | 130.4 | 139.8 |
| Black alder | 22.2 | 34.2 | 36.3 | 36.4 | 47.0 | 58.8 | 64.8 | 70.4 | 74.0 | 77.1 | 78.0 |
| Ash, oak | 10.3 | 13.2 | 16.2 | 13.6 | 9.3 | 10.1 | 11.8 | 13.5 | 13.9 | 14.3 | 14.8 |
| Other species | 3.6 | 3.5 | 4.4 | 14.5 | 19.6 | 7.7 | 4.4 | 4.0 | 12.4 | 13.3 | 16.5 |
| Pine | 215.0 | 225.9 | 241.6 | 236.6 | 222.0 | 237.7 | 246.7 | 254.8 | 252.0 | 249.0 | 238.2 |
| Total | 956.3 | 968.6 | 981.0 | 990.3 | 943.2 | 931.5 | 977.6 | 1022.3 | 1055.4 | 1076.5 | 1065.6 |
| Pre-mature forests | | | | | | | | | | | |
| Aspen | 56.4 | 74.0 | 82.4 | 79.5 | 131.9 | 136.2 | 128.0 | 120.3 | 92.9 | 67.2 | 66.1 |
| Birch | 597.8 | 574.3 | 552.2 | 515.1 | 508.0 | 505.0 | 474.0 | 445.0 | 466.4 | 485.5 | 514.3 |
| Spruce | 471.6 | 465.3 | 464.5 | 477.5 | 491.2 | 497.8 | 499.0 | 503.5 | 477.6 | 444.3 | 414.7 |
| Black alder | 311.2 | 286.4 | 261.8 | 232.3 | 203.6 | 200.7 | 197.2 | 193.9 | 191.8 | 193.4 | 211.3 |
| Ash, oak | 68.7 | 71.9 | 75.4 | 65.7 | 51.9 | 44.0 | 38.1 | 33.0 | 37.6 | 42.5 | 43.4 |
| Other species | 23.5 | 28.7 | 34.2 | 108.9 | 118.4 | 131.9 | 141.4 | 151.0 | 170.5 | 189.1 | 180.7 |
| Pine | 533.3 | 529.8 | 523.3 | 499.6 | 487.4 | 459.3 | 414.6 | 366.9 | 308.6 | 272.5 | 284.6 |
| Total | 1612.3 | 1540.3 | 1482.7 | 1428.5 | 1428.8 | 1446.7 | 1453.5 | 1462.5 | 1452.9 | 1451.2 | 1433.7 |

**Table 11: Gross increment by species[3] in alternative policy scenario, mill. $m^3$**

| Species | 1990-1994 | 1995-1999 | 2000-2004 | 2005-2009 | 2010-2014 | 2015-2020 | 2021-2025 | 2026-2030 | 2031-2035 | 2036-2040 | 2041-2045 | 2046-2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aspen | 3.2 | 3.7 | 3.2 | 2.8 | 4.2 | 3.7 | 3.1 | 3.1 | 3.2 | 3.1 | 3.0 | 2.9 |
| Grey alder | 2.0 | 2.3 | 2.3 | 2.1 | 2.1 | 2.4 | 2.4 | 2.4 | 2.4 | 2.3 | 2.3 | 2.3 |
| Birch | 7.4 | 7.5 | 7.1 | 5.9 | 5.2 | 6.1 | 6.3 | 6.3 | 6.4 | 6.3 | 6.3 | 6.4 |
| Spruce | 4.1 | 4.7 | 5.2 | 4.9 | 4.8 | 4.9 | 4.8 | 4.6 | 4.5 | 4.5 | 4.4 | 4.4 |
| Black alder | 1.3 | 1.8 | 1.7 | 1.5 | 2.0 | 1.8 | 1.5 | 1.4 | 1.4 | 1.3 | 1.3 | 1.3 |
| Ash, oak | 0.3 | 0.3 | 0.3 | 0.3 | 0.5 | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| Other species | 0.2 | 0.5 | 0.4 | 0.4 | 0.2 | 1.0 | 1.1 | 1.2 | 1.3 | 1.4 | 1.4 | 1.4 |
| Pine | 5.9 | 6.0 | 6.1 | 5.9 | 4.7 | 4.4 | 4.8 | 4.9 | 5.0 | 5.0 | 5.0 | 5.0 |
| Total | 24.5 | 26.8 | 26.4 | 23.7 | 23.7 | 24.4 | 24.1 | 24.1 | 24.2 | 24.1 | 23.9 | 23.9 |

**Table 12: Natural mortality by species in alternative policy scenario, mill. $m^3$**

| Species | 1990-1994 | 1995-1999 | 2000-2004 | 2005-2009 | 2010-2014 | 2015-2020 | 2021-2025 | 2026-2030 | 2031-2035 | 2036-2040 | 2041-2045 | 2046-2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aspen | 0.4 | 0.5 | 0.5 | 0.5 | 0.8 | 0.6 | 0.7 | 0.7 | 0.8 | 0.8 | 0.8 | 0.9 |
| Grey alder | 0.1 | 0.1 | 0.1 | 0.3 | 0.7 | 0.7 | 0.7 | 0.8 | 0.8 | 0.9 | 0.9 | 0.9 |
| Birch | 1.4 | 1.4 | 1.3 | 1.3 | 1.8 | 1.4 | 1.3 | 1.3 | 1.3 | 1.3 | 1.2 | 1.3 |
| Spruce | 0.9 | 1.0 | 1.0 | 1.2 | 1.5 | 1.1 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| Black alder | 0.2 | 0.2 | 0.2 | 0.3 | 0.5 | 0.4 | 0.4 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| Ash, oak | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| Other species | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.3 | 0.3 | 0.4 | 0.4 | 0.5 | 0.5 | 0.5 |
| Pine | 1.0 | 1.1 | 1.2 | 1.3 | 1.4 | 1.2 | 1.1 | 1.1 | 1.1 | 1.0 | 1.0 | 1.0 |
| Total | 4.1 | 4.4 | 4.5 | 5.0 | 6.9 | 5.8 | 5.7 | 5.8 | 6.0 | 6.1 | 6.2 | 6.3 |

[3] Gross increment is calculated by dominant species at the beginning of 5 year period, which may be changed at the end of period, e.g. due to commercial thinning, if other species has bigger remaining growing stock; respectively, dominant species are determined by growing stock of different forest elements.

## Harvest rates in the FRL is higher than in the alternative policy scenario

The assumptions on harvest intensities in 2021-2025 are fully compliant with requirement to exclude policy assumptions from calculation of the FRL scenario; respectively, the average intensities in 2000-2009 are applied and modelling is started from 2010.

Detailed description of difference between FRL and alternative policy scenario is already provided in previous section.

Figures 10 and 11 of NFAP in table format are provided in Table 13 and 14. Dark grey background in tables means that data are modelled. Light grey background means that data are partially modelled, e.g. in Table 13 in column representing period between 2005 and 2010 only data in 2010 are modelled. Similarly, in Table 14 in column representing period between 2015 and 2020 data characterizing 2018, 2019 and 2020 are modelled.

**Table 13: Structure of assortments in FRL scenario (Figure 10 in NFAP)**

| Assortment | 1970-1975 | 1975-1980 | 1980-1985 | 1985-1990 | 1990-1995 | 1995-2000 | 2000-2005 | 2005-2010 | 2010-2015 | 2015-2020 | 2020-2025 | 2025-2030 | 2030-2035 | 2035-2040 | 2040-2045 | 2045-2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Coniferous sawn wood | 3.1 | 2.1 | 2.2 | 2.5 | 2.5 | 4.8 | 5.3 | 4.9 | 6.0 | 5.9 | 6.0 | 6.1 | 6.1 | 6.1 | 6.0 | 5.9 |
| Deciduous sawn wood | 0.7 | 0.5 | 0.5 | 0.6 | 0.6 | 1.1 | 1.2 | 1.2 | 1.4 | 1.5 | 1.5 | 1.5 | 1.6 | 1.6 | 1.6 | 1.5 |
| Pulpwood | 3.2 | 2.1 | 2.3 | 2.5 | 2.5 | 4.8 | 5.2 | 5.0 | 6.1 | 6.1 | 6.2 | 6.3 | 6.4 | 6.4 | 6.3 | 6.2 |
| Firewood | 1.3 | 0.9 | 0.9 | 1.0 | 1.0 | 2.0 | 2.2 | 2.2 | 2.7 | 2.7 | 2.8 | 2.9 | 2.9 | 2.9 | 2.9 | 2.8 |
| Proportion of firewood from roundwood | 18.9% | 18.9% | 18.9% | 18.9% | 18.9% | 18.7% | 19.1% | 19.5% | 19.9% | 20.1% | 20.4% | 20.5% | 20.6% | 20.8% | 20.8% | 20.9% |

**Table 14: Structure of assortments in 'continuation of current forest management practices' scenario (Figure 11 in NFAP)**

| Assortment | 1970-1975 | 1975-1980 | 1980-1985 | 1985-1990 | 1990-1995 | 1995-2000 | 2000-2005 | 2005-2010 | 2010-2015 | 2015-2020 | 2020-2025 | 2025-2030 | 2030-2035 | 2035-2040 | 2040-2045 | 2045-2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Coniferous sawn wood | 3.1 | 2.1 | 2.2 | 2.5 | 2.5 | 4.8 | 5.3 | 5.0 | 5.0 | 5.8 | 5.6 | 5.6 | 5.7 | 5.8 | 5.9 | 5.8 |
| Deciduous sawn wood | 0.7 | 0.5 | 0.5 | 0.6 | 0.6 | 1.1 | 1.2 | 1.2 | 1.7 | 1.6 | 1.5 | 1.5 | 1.6 | 1.7 | 1.7 | 1.8 |
| Pulpwood | 3.2 | 2.1 | 2.3 | 2.5 | 2.5 | 4.8 | 5.2 | 5.0 | 5.9 | 6.3 | 5.9 | 6.0 | 6.1 | 6.4 | 6.5 | 6.5 |
| Firewood | 1.3 | 0.9 | 0.9 | 1.0 | 1.0 | 2.0 | 2.2 | 2.1 | 3.2 | 2.8 | 2.6 | 2.7 | 2.8 | 2.9 | 3.0 | 3.0 |
| Proportion of firewood from roundwood | 18.9% | 18.9% | 18.9% | 18.9% | 18.9% | 18.7% | 19.1% | 19.1% | 25.8% | 20.4% | 20.4% | 20.6% | 20.8% | 21.1% | 21.2% | 21.4% |

## Clarification when the modelling of the FRL starts, i.e. which year's results are the first modelled results

The model run is started with 2010; respectively, forest conditions at the end of 2009 are used as a starting point. Significant increase of harvest stock and reduction of net $CO_2$ removals in 2009 is associated with struggling against consequences of economic crisis; starting from 2010 average resource utilization intensities in 2000-2009 are applied, considering potentially available resources in this period. Similarly extraction rate in 2000-2009 is calculated.

## Information on the growing stock available for regenerative felling

Total harvests, including regenerative and other fellings, in the FRL scenario is provided in Table 15 as periodic averages of 5 years long period. Data on harvests outside regenerative felling are provided in Table 16 and 17 and harvests in regenerative felling – in Table 18 and 19. Both tables represent periodic average value.

Growing stock in forest by dominant species[4] in FRL scenario is represented in Table 20. Age structure (pre-mature and mature stands) of growing stock is provided in Table 21. Mature forests are forest stands, which reached legally permitted age threshold for regenerative fellings. Harvesting by diameter is not considered in the calculation, as it was not common practice during the reference period. Mature stands represents timber volume available for regenerative felling. For tree species without legally binding regenerative felling age, e.g. grey alder the most common harvesting age in 2000-2009 according to NFI data is considered as maturity age to estimate potentially available stock.

Growing stock and area available for commercial thinning is provided in Table 22 and 24. The growing stock in Table 22 is calculated comparing legally binding minimal basal area and actual basal area in pre-mature forests. Volume of timber available for extraction is calculated as proportion between minimal and actual basal area multiplied by growing stock. The area represented in Table 24 is total area of forests conforming legal criteria for commercial thinning in the reference period (2000-2009). However, mature forests, where non-regenerative felling can take place in practice and in the model, are not considered in these tables to avoid double accounting as they are already listed as accessible for regenerative felling.

Forest area divided into age groups and dominant species at the end of calculation period is provided in Table 23. Gross annual increment divided by dominant species is provided in Table 25. Natural mortality divided by dominant species is provided in Table 26. Modelled data are greyed out in tables.

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[4] Dominant species at the end of the calculation period.

**Table 15: Total harvests in FRL scenario, mill. $m^3$ $yr^{-1}$**

| Species | 1990-1994 | 1995-1999 | 2000-2004 | 2005-2009 | 2010-2014 | 2015-2020 | 2021-2025 | 2026-2030 | 2031-2035 | 2036-2040 | 2041-2045 | 2046-2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aspen | 0.5 | 1.0 | 1.0 | 0.9 | 1.1 | 1.1 | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 | 1.6 |
| Grey alder | 0.4 | 0.7 | 0.9 | 0.9 | 1.2 | 1.2 | 1.3 | 1.3 | 1.3 | 1.3 | 1.2 | 1.2 |
| Birch | 1.7 | 3.4 | 3.8 | 3.7 | 4.6 | 4.8 | 4.9 | 4.8 | 4.7 | 4.4 | 4.2 | 4.1 |
| Spruce | 1.3 | 2.7 | 3.3 | 2.4 | 3.4 | 3.2 | 3.2 | 3.3 | 3.4 | 3.6 | 3.7 | 3.7 |
| Black alder | 0.1 | 0.2 | 0.2 | 0.3 | 0.5 | 0.6 | 0.7 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 |
| Ash, oak | 0.0 | 0.0 | 0.0 | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| Other species | 0.0 | 0.1 | 0.3 | 0.2 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.3 | 0.3 | 0.3 |
| Pine | 1.9 | 3.6 | 4.3 | 4.2 | 5.0 | 4.9 | 5.0 | 5.0 | 5.0 | 4.8 | 4.7 | 4.5 |
| Total | 6.0 | 11.6 | 13.8 | 12.8 | 16.1 | 16.2 | 16.5 | 16.7 | 16.9 | 16.8 | 16.7 | 16.4 |

**Table 16: Harvests outside regenerative felling in FRL scenario, mill. $m^3$ $yr^{-1}$**

| Species | 1990-1994 | 1995-1999 | 2000-2004 | 2005-2009 | 2010-2014 | 2015-2020 | 2021-2025 | 2026-2030 | 2031-2035 | 2036-2040 | 2041-2045 | 2046-2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aspen | 0.0 | 0.1 | 0.1 | 0.1 | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.4 |
| Grey alder | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.3 | 0.4 | 0.4 | 0.4 | 0.4 | 0.3 | 0.3 |
| Birch | 0.4 | 0.8 | 1.0 | 0.9 | 1.1 | 1.2 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 |
| Spruce | 0.4 | 0.8 | 0.8 | 0.6 | 0.9 | 1.1 | 1.1 | 1.2 | 1.2 | 1.1 | 1.1 | 1.1 |
| Black alder | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| Ash, oak | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Other species | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Pine | 0.6 | 1.2 | 1.3 | 1.4 | 1.7 | 1.7 | 1.6 | 1.5 | 1.5 | 1.4 | 1.4 | 1.4 |
| Total | 1.5 | 2.9 | 3.3 | 3.2 | 4.2 | 5.0 | 5.0 | 4.9 | 4.8 | 4.7 | 4.7 | 4.6 |

**Table 17: Harvests outside regenerative felling in FRL scenario, 1000 ha $yr^{-1}$**

| Species | 1990-1994 | 1995-1999 | 2000-2004 | 2005-2009 | 2010-2014 | 2015-2020 | 2021-2025 | 2026-2030 | 2031-2035 | 2036-2040 | 2041-2045 | 2046-2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aspen | 0.8 | 1.5 | 7.2 | 5.7 | 6.0 | 5.4 | 4.0 | 3.4 | 4.1 | 4.6 | 5.2 | 5.1 |

| Species | 1990-1994 | 1995-1999 | 2000-2004 | 2005-2009 | 2010-2014 | 2015-2020 | 2021-2025 | 2026-2030 | 2031-2035 | 2036-2040 | 2041-2045 | 2046-2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Grey alder | 1.7 | 3.1 | 3.0 | 5.0 | 5.2 | 6.9 | 8.5 | 6.4 | 6.9 | 7.0 | 6.5 | 6.8 |
| Birch | 7.7 | 14.9 | 27.4 | 22.5 | 27.6 | 30.5 | 24.0 | 21.9 | 21.3 | 19.5 | 18.1 | 19.0 |
| Spruce | 6.2 | 13.1 | 21.5 | 10.4 | 18.5 | 16.6 | 15.4 | 13.4 | 14.6 | 14.1 | 14.8 | 13.4 |
| Black alder | 0.4 | 0.8 | 0.3 | 1.2 | 1.7 | 2.8 | 2.9 | 2.8 | 3.0 | 3.0 | 3.0 | 3.0 |
| Ash, oak | 0.2 | 0.4 | 0.1 | 2.3 | 4.9 | 4.3 | 3.8 | 3.3 | 3.3 | 3.2 | 3.1 | 3.2 |
| Other species | 0.0 | 0.3 | 0.3 | 0.8 | 0.6 | 0.8 | 1.0 | 0.9 | 1.3 | 1.3 | 1.9 | 2.1 |
| Pine | 6.8 | 12.7 | 22.6 | 18.6 | 24.1 | 23.5 | 21.3 | 19.0 | 20.3 | 20.0 | 20.0 | 20.0 |
| Total | 23.9 | 46.7 | 82.3 | 66.4 | 88.6 | 91.0 | 80.9 | 71.1 | 74.6 | 72.9 | 72.4 | 72.6 |

**Table 18: Harvests in regenerative felling in FRL scenario, mill. $m^3$ $yr^{-1}$**

| Species | 1990-1994 | 1995-1999 | 2000-2004 | 2005-2009 | 2010-2014 | 2015-2020 | 2021-2025 | 2026-2030 | 2031-2035 | 2036-2040 | 2041-2045 | 2046-2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aspen | 0.5 | 0.9 | 0.9 | 0.8 | 0.9 | 0.8 | 0.9 | 0.9 | 1.0 | 1.1 | 1.2 | 1.2 |
| Grey alder | 0.3 | 0.6 | 0.8 | 0.8 | 1.0 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 |
| Birch | 1.3 | 2.6 | 2.8 | 2.8 | 3.6 | 3.6 | 3.7 | 3.7 | 3.6 | 3.3 | 3.0 | 2.9 |
| Spruce | 0.9 | 2.0 | 2.6 | 1.8 | 2.4 | 2.1 | 2.0 | 2.1 | 2.2 | 2.5 | 2.6 | 2.7 |
| Black alder | 0.1 | 0.2 | 0.2 | 0.3 | 0.4 | 0.4 | 0.5 | 0.6 | 0.6 | 0.6 | 0.6 | 0.7 |
| Ash, oak | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Other species | 0.0 | 0.0 | 0.3 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.3 |
| Pine | 1.3 | 2.4 | 3.0 | 2.9 | 3.4 | 3.2 | 3.3 | 3.4 | 3.5 | 3.4 | 3.4 | 3.1 |
| Total | 4.5 | 8.7 | 10.5 | 9.5 | 11.9 | 11.2 | 11.5 | 11.9 | 12.1 | 12.1 | 12.1 | 11.8 |

**Table 19: Harvests in regenerative felling in FRL scenario, 1000 ha $yr^{-1}$**

| Species | 1990-1994 | 1995-1999 | 2000-2004 | 2005-2009 | 2010-2014 | 2015-2020 | 2021-2025 | 2026-2030 | 2031-2035 | 2036-2040 | 2041-2045 | 2046-2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aspen | 1.2 | 2.1 | 2.4 | 1.9 | 2.2 | 2.4 | 2.4 | 2.6 | 3.1 | 3.2 | 3.2 | 3.1 |
| Grey alder | 1.4 | 2.6 | 3.8 | 3.5 | 3.7 | 3.2 | 3.4 | 3.5 | 3.7 | 3.7 | 3.6 | 3.6 |
| Birch | 6.9 | 13.4 | 12.8 | 9.7 | 11.4 | 12.1 | 13.2 | 13.4 | 13.4 | 12.5 | 11.8 | 11.2 |

| Species | 1990-1994 | 1995-1999 | 2000-2004 | 2005-2009 | 2010-2014 | 2015-2020 | 2021-2025 | 2026-2030 | 2031-2035 | 2036-2040 | 2041-2045 | 2046-2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Spruce | 3.3 | 6.9 | 8.9 | 5.4 | 6.8 | 5.9 | 5.5 | 6.2 | 5.9 | 6.3 | 6.9 | 7.1 |
| Black alder | 0.2 | 0.4 | 0.7 | 0.5 | 0.9 | 1.0 | 1.2 | 1.3 | 1.5 | 1.5 | 1.6 | 1.6 |
| Ash, oak | 0.1 | 0.1 | 0.1 | 0.1 | 0.3 | 0.2 | 0.3 | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 |
| Other species | 0.0 | 0.1 | 0.7 | 1.1 | 0.5 | 0.4 | 0.3 | 0.4 | 0.3 | 0.7 | 0.6 | 0.7 |
| Pine | 3.6 | 6.7 | 8.4 | 8.0 | 8.8 | 9.0 | 9.7 | 9.4 | 9.5 | 9.2 | 9.1 | 8.6 |
| Total | 16.7 | 32.4 | 37.7 | 30.2 | 34.4 | 34.2 | 36.0 | 37.2 | 37.5 | 37.4 | 37.1 | 36.2 |

**Table 20: Development of growing stock in FRL scenario, mill. m$^3$**

| Species | 1990-1994 | 1995-1999 | 2000-2004 | 2005-2009 | 2010-2014 | 2015-2020 | 2021-2025 | 2026-2030 | 2031-2035 | 2036-2040 | 2041-2045 | 2046-2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aspen | 28.0 | 64.9 | 56.7 | 63.8 | 69.5 | 79.9 | 87.6 | 93.1 | 97.8 | 101.6 | 104.3 | 106.7 |
| Grey alder | 21.3 | 31.9 | 39.1 | 49.6 | 52.9 | 53.1 | 54.0 | 54.4 | 54.1 | 53.0 | 52.2 | 50.6 |
| Birch | 117.2 | 129.8 | 145.5 | 151.9 | 150.0 | 146.5 | 147.8 | 149.5 | 151.6 | 155.1 | 160.0 | 165.2 |
| Spruce | 102.2 | 105.9 | 113.5 | 117.7 | 120.3 | 122.9 | 127.3 | 131.1 | 134.5 | 137.1 | 138.6 | 140.3 |
| Black alder | 17.4 | 22.4 | 30.0 | 35.0 | 40.4 | 46.1 | 48.2 | 49.2 | 49.6 | 49.7 | 49.6 | 49.4 |
| Ash, oak | 7.9 | 8.2 | 9.1 | 9.7 | 10.9 | 7.7 | 8.4 | 9.4 | 10.2 | 10.6 | 11.0 | 11.1 |
| Other species | 3.6 | 4.8 | 6.2 | 6.7 | 7.0 | 7.3 | 7.3 | 7.2 | 7.0 | 6.4 | 5.6 | 4.6 |
| Pine | 206.7 | 208.8 | 221.0 | 222.0 | 217.2 | 210.4 | 204.5 | 199.3 | 194.2 | 190.0 | 186.5 | 184.8 |
| Total | 504.2 | 576.7 | 621.1 | 656.4 | 668.2 | 673.8 | 685.1 | 693.2 | 698.9 | 703.5 | 707.8 | 712.8 |

**Table 21: Development of growing stock by dominant species in different age groups in FRL scenario, mill. m$^3$**

| Species | 1990-1994 | 1995-1999 | 2000-2004 | 2005-2009 | 2010-2014 | 2015-2020 | 2021-2025 | 2026-2030 | 2031-2035 | 2036-2040 | 2041-2045 | 2046-2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mature stands | | | | | | | | | | | | |
| Aspen | 26.2 | 60.4 | 52.6 | 57.9 | 61.0 | 56.5 | 58.5 | 64.4 | 69.7 | 75.2 | 79.5 | 80.6 |
| Grey alder | 4.9 | 27.0 | 31.6 | 41.6 | 45.4 | 41.0 | 41.1 | 41.2 | 41.4 | 40.3 | 39.5 | 39.2 |
| Birch | 43.6 | 50.1 | 54.5 | 69.7 | 75.8 | 77.7 | 80.9 | 79.7 | 77.9 | 71.0 | 65.9 | 63.1 |
| Spruce | 41.5 | 40.4 | 47.8 | 41.0 | 48.8 | 43.0 | 41.2 | 43.5 | 45.7 | 50.3 | 53.5 | 54.4 |

| Species | 1990-1994 | 1995-1999 | 2000-2004 | 2005-2009 | 2010-2014 | 2015-2020 | 2021-2025 | 2026-2030 | 2031-2035 | 2036-2040 | 2041-2045 | 2046-2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Black alder | 5.9 | 7.7 | 10.7 | 14.8 | 21.7 | 22.5 | 25.7 | 28.7 | 31.4 | 32.7 | 33.8 | 34.0 |
| Ash, oak | 2.8 | 2.9 | 3.8 | 5.1 | 9.3 | 5.1 | 5.7 | 6.5 | 7.3 | 7.7 | 8.1 | 8.2 |
| Other species | 0.7 | 1.1 | 1.3 | 1.1 | 0.6 | 0.5 | 0.4 | 0.6 | 0.7 | 1.3 | 1.4 | 1.6 |
| Pine | 70.5 | 75.6 | 74.3 | 87.8 | 90.2 | 86.1 | 90.6 | 93.3 | 95.1 | 93.2 | 91.0 | 84.8 |
| Total | 196.2 | 265.1 | 276.5 | 319.1 | 352.8 | 332.5 | 343.9 | 358.0 | 369.2 | 371.6 | 372.6 | 365.8 |
| Pre-mature forests | | | | | | | | | | | | |
| Aspen | 1.7 | 4.4 | 4.2 | 5.9 | 8.5 | 23.4 | 29.1 | 28.7 | 28.0 | 26.4 | 24.9 | 26.1 |
| Grey alder | 16.4 | 4.9 | 7.5 | 8.0 | 7.5 | 12.0 | 12.9 | 13.2 | 12.8 | 12.7 | 12.7 | 11.5 |
| Birch | 73.6 | 79.8 | 91.0 | 82.3 | 74.2 | 68.7 | 67.0 | 69.8 | 73.7 | 84.2 | 94.1 | 102.2 |
| Spruce | 60.7 | 65.5 | 65.7 | 76.7 | 71.5 | 79.9 | 86.1 | 87.7 | 88.8 | 86.8 | 85.1 | 85.9 |
| Black alder | 11.4 | 14.7 | 19.3 | 20.2 | 18.7 | 23.5 | 22.5 | 20.4 | 18.2 | 17.1 | 15.8 | 15.4 |
| Ash, oak | 5.1 | 5.3 | 5.3 | 4.6 | 1.6 | 2.6 | 2.7 | 2.9 | 2.9 | 2.9 | 3.0 | 2.9 |
| Other species | 2.9 | 3.8 | 4.9 | 5.5 | 6.4 | 6.8 | 6.9 | 6.6 | 6.3 | 5.1 | 4.2 | 3.0 |
| Pine | 136.2 | 133.3 | 146.7 | 134.2 | 127.1 | 124.3 | 114.0 | 106.0 | 99.1 | 96.8 | 95.6 | 100.0 |
| Total | 308.0 | 311.6 | 344.6 | 337.3 | 315.5 | 341.3 | 341.2 | 335.2 | 329.7 | 331.9 | 335.2 | 347.0 |

**Table 22: Growing stock available for non-regenerative fellings in FRL scenario, mill. $m^3$**

| Species | 1990-1994 | 1995-1999 | 2000-2004 | 2005-2009 | 2010-2014 | 2015-2020 | 2021-2025 | 2026-2030 | 2031-2035 | 2036-2040 | 2041-2045 | 2046-2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aspen | 0.7 | 1.8 | 1.7 | 2.3 | 3.5 | 8.6 | 11.3 | 10.9 | 10.8 | 10.1 | 9.5 | 10.0 |
| Grey alder | 6.6 | 2.0 | 3.0 | 3.2 | 3.1 | 4.4 | 5.0 | 5.0 | 4.9 | 4.8 | 4.8 | 4.4 |
| Birch | 28.6 | 31.8 | 36.8 | 32.8 | 30.3 | 25.4 | 26.0 | 26.4 | 28.3 | 32.1 | 36.0 | 39.0 |
| Spruce | 24.4 | 26.3 | 26.5 | 30.6 | 29.2 | 29.5 | 33.5 | 33.2 | 34.1 | 33.1 | 32.5 | 32.8 |
| Black alder | 4.6 | 5.9 | 7.8 | 8.1 | 7.7 | 8.7 | 8.8 | 7.7 | 7.0 | 6.5 | 6.0 | 5.9 |
| Ash, oak | 2.1 | 2.1 | 2.1 | 1.8 | 0.6 | 1.0 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 |
| Other species | 1.2 | 1.5 | 2.0 | 2.2 | 2.6 | 2.5 | 2.7 | 2.5 | 2.4 | 1.9 | 1.6 | 1.1 |
| Pine | 54.8 | 53.5 | 59.2 | 53.5 | 52.0 | 45.9 | 44.3 | 40.1 | 38.0 | 36.9 | 36.6 | 38.2 |

| Species | 1990-1994 | 1995-1999 | 2000-2004 | 2005-2009 | 2010-2014 | 2015-2020 | 2021-2025 | 2026-2030 | 2031-2035 | 2036-2040 | 2041-2045 | 2046-2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total | 123.0 | 124.9 | 139.1 | 134.6 | 129.0 | 126.1 | 132.5 | 127.0 | 126.5 | 126.6 | 128.2 | 132.5 |

**Table 23: Forest area by dominant species and age group in FRL scenario, 1000 ha**

| Period | 1995-1999 | 2000-2004 | 2005-2009 | 2010-2014 | 2015-2020 | 2021-2025 | 2026-2030 | 2031-2035 | 2036-2040 | 2041-2045 | 2046-2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Mature forest stands | | | | | | | | | | | |
| Aspen | 164.5 | 149.3 | 145.9 | 144.7 | 166.6 | 169.6 | 189.2 | 227.5 | 228.5 | 228.3 | 218.0 |
| Grey alder | 134.0 | 146.9 | 170.8 | 156.4 | 140.5 | 150.6 | 155.1 | 160.0 | 159.3 | 158.3 | 158.7 |
| Birch | 265.9 | 219.5 | 228.5 | 247.8 | 265.1 | 281.1 | 286.5 | 274.0 | 259.4 | 254.6 | 244.6 |
| Spruce | 140.9 | 176.2 | 137.2 | 137.0 | 114.6 | 113.2 | 131.2 | 123.0 | 135.3 | 144.2 | 147.6 |
| Black alder | 22.2 | 34.2 | 36.3 | 49.5 | 55.2 | 66.3 | 72.5 | 78.3 | 80.6 | 82.4 | 82.8 |
| Ash, oak | 10.3 | 13.2 | 16.2 | 25.1 | 22.3 | 22.4 | 21.1 | 23.7 | 24.8 | 25.8 | 26.3 |
| Other species | 3.6 | 3.5 | 4.4 | 2.4 | 1.9 | 2.0 | 2.0 | 2.0 | 4.4 | 3.2 | 3.8 |
| Pine | 215.0 | 225.9 | 241.6 | 233.7 | 246.9 | 261.5 | 249.1 | 253.6 | 247.3 | 241.4 | 227.4 |
| Total | 956.3 | 968.6 | 981.0 | 996.6 | 1013.1 | 1066.5 | 1106.8 | 1142.0 | 1139.5 | 1138.1 | 1109.3 |
| Pre-mature forests | | | | | | | | | | | |
| Aspen | 56.4 | 74.0 | 82.4 | 103.3 | 195.3 | 163.0 | 148.0 | 143.4 | 137.1 | 131.3 | 125.0 |
| Birch | 597.8 | 574.3 | 552.2 | 505.2 | 483.1 | 449.6 | 455.8 | 445.4 | 466.2 | 504.7 | 510.5 |
| Spruce | 471.6 | 465.3 | 464.5 | 527.7 | 493.9 | 508.5 | 498.2 | 489.7 | 473.2 | 431.9 | 434.6 |
| Black alder | 311.2 | 286.4 | 261.8 | 237.8 | 224.2 | 231.4 | 230.1 | 231.6 | 231.9 | 234.8 | 242.6 |
| Ash, oak | 68.7 | 71.9 | 75.4 | 66.6 | 62.4 | 54.7 | 50.9 | 48.0 | 49.4 | 51.0 | 51.9 |
| Other species | 23.5 | 28.7 | 34.2 | 33.7 | 34.7 | 36.1 | 36.1 | 36.5 | 34.5 | 32.6 | 31.2 |
| Pine | 533.3 | 529.8 | 523.3 | 474.9 | 408.8 | 375.7 | 332.3 | 291.9 | 278.4 | 296.3 | 282.7 |
| Total | 1612.3 | 1540.3 | 1482.7 | 1491.8 | 1443.1 | 1414.4 | 1406.6 | 1377.3 | 1365.0 | 1401.2 | 1373.5 |

**Table 24: Forest area by dominant species available for commercial thinning in FRL scenario, 1000 ha**

| Species | 1990-1994 | 1995-1999 | 2000-2004 | 2005-2009 | 2010-2014 | 2015-2020 | 2021-2025 | 2026-2030 | 2031-2035 | 2036-2040 | 2041-2045 | 2046-2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aspen | 31.7 | 36.9 | 43.4 | 51.1 | 68.6 | 141.3 | 130.8 | 122.8 | 124.2 | 116.7 | 111.8 | 101.4 |
| Grey alder | 64.4 | 64.4 | 68.1 | 72.2 | 70.5 | 71.8 | 81.0 | 63.7 | 61.0 | 62.1 | 62.8 | 63.5 |
| Birch | 589.8 | 589.8 | 574.1 | 559.8 | 508.7 | 485.7 | 442.9 | 477.0 | 473.8 | 494.4 | 506.6 | 530.6 |
| Spruce | 400.7 | 400.7 | 359.1 | 321.7 | 392.5 | 354.3 | 364.9 | 350.6 | 339.3 | 322.9 | 336.2 | 304.8 |
| Black alder | 130.8 | 130.8 | 127.6 | 124.8 | 108.7 | 99.0 | 95.3 | 88.0 | 81.6 | 77.7 | 73.7 | 74.0 |
| Ash, oak | 46.0 | 46.0 | 43.3 | 40.6 | 37.1 | 35.4 | 33.4 | 30.7 | 28.4 | 27.2 | 25.9 | 25.6 |
| Other species | 23.5 | 23.5 | 25.8 | 28.3 | 28.6 | 29.3 | 31.2 | 31.4 | 32.0 | 30.3 | 31.1 | 28.0 |
| Pine | 563.7 | 563.7 | 563.4 | 560.4 | 525.9 | 476.5 | 460.3 | 432.9 | 409.0 | 404.3 | 411.6 | 416.5 |
| Total | 1 850.6 | 1 855.8 | 1 804.8 | 1 758.8 | 1 740.6 | 1 693.2 | 1 639.9 | 1 597.2 | 1 549.3 | 1 535.6 | 1 559.8 | 1 544.1 |

**Table 25: Gross increment by species[5] in FRL scenario, mill. $m^3$**

| Species | 1990-1994 | 1995-1999 | 2000-2004 | 2005-2009 | 2010-2014 | 2015-2020 | 2021-2025 | 2026-2030 | 2031-2035 | 2036-2040 | 2041-2045 | 2046-2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aspen | 3.2 | 3.7 | 3.2 | 2.8 | 4.3 | 3.7 | 3.2 | 3.1 | 3.0 | 3.0 | 2.9 | 2.8 |
| Grey alder | 2.0 | 2.3 | 2.3 | 2.1 | 2.0 | 2.2 | 2.3 | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 |
| Birch | 7.4 | 7.5 | 7.1 | 5.9 | 5.3 | 6.0 | 6.6 | 6.6 | 6.6 | 6.6 | 6.6 | 6.7 |
| Spruce | 4.1 | 4.7 | 5.2 | 4.9 | 4.9 | 5.0 | 5.2 | 5.2 | 5.2 | 5.2 | 5.1 | 5.1 |
| Black alder | 1.3 | 1.8 | 1.7 | 1.5 | 2.1 | 1.8 | 1.5 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 |
| Ash, oak | 0.3 | 0.3 | 0.3 | 0.2 | -0.1 | 0.1 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| Other species | 0.2 | 0.5 | 0.4 | 0.4 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| Pine | 5.9 | 6.0 | 6.1 | 5.9 | 4.7 | 4.9 | 5.1 | 5.1 | 5.1 | 5.1 | 5.1 | 5.2 |
| Total | 24.5 | 26.8 | 26.4 | 23.6 | 23.5 | 24.0 | 24.4 | 24.2 | 24.0 | 23.9 | 23.8 | 23.8 |

[5] Gross increment is calculated by dominant species at the beginning of 5 years period, which may be changed at the end of period, e.g. due to commercial thinning, if other species has bigger remaining growing stock; respectively, dominant species are determined by growing stock of different forest elements.

**Table 26: Natural mortality by species in FRL scenario, mill. $m^3$**

| Species | 1990-1994 | 1995-1999 | 2000-2004 | 2005-2009 | 2010-2014 | 2015-2020 | 2021-2025 | 2026-2030 | 2031-2035 | 2036-2040 | 2041-2045 | 2046-2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aspen | 0.4 | 0.5 | 0.5 | 0.5 | 0.8 | 0.7 | 0.8 | 0.8 | 0.8 | 0.9 | 0.9 | 0.9 |
| Grey alder | 0.1 | 0.1 | 0.1 | 0.3 | 0.7 | 0.7 | 0.8 | 0.8 | 0.8 | 0.9 | 0.9 | 0.9 |
| Birch | 1.4 | 1.4 | 1.3 | 1.3 | 1.8 | 1.5 | 1.4 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 |
| Spruce | 0.9 | 1.0 | 1.0 | 1.2 | 1.5 | 1.2 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 |
| Black alder | 0.2 | 0.2 | 0.2 | 0.3 | 0.5 | 0.4 | 0.5 | 0.5 | 0.5 | 0.6 | 0.6 | 0.6 |
| Ash, oak | 0.1 | 0.1 | 0.1 | 0.2 | 0.3 | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| Other species | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Pine | 1.0 | 1.1 | 1.2 | 1.3 | 1.4 | 1.2 | 1.2 | 1.1 | 1.1 | 1.1 | 1.0 | 1.0 |
| Total | 4.1 | 4.4 | 4.5 | 5.0 | 6.9 | 6.0 | 6.0 | 6.1 | 6.1 | 6.2 | 6.2 | 6.3 |

# Other carbon pools included in the NFAP

## Explanation if the values in Table 1 (in NFAP) provided as a sum over the five-year period, or average over 2021-2025

Values in Table 1 (in NFAP) are provided as a sum over the five-year period. Dead wood carbon pool is increasing over time according to FRL scenario. Slight decrease at the end of the projection period is compensated in following years. **If compared to situation in 2000 carbon stock in dead wood is nearly doubled in 2025**, and it continues to stay at this level during the second half of $21^{st}$ century (Figure 2).

Detailed description of parameters applied in calculation is provided in Annex 3 of NFAP, chapter 'Modelling of dead wood'. To ensure consistency with GHG inventory report 20 years decomposition period is used for all species and types of dead wood.

Total mortality (summarized figures from 2000 to 2100) is shown in Table 27. Modelled data in this and following tables are greyed out. Five years averages are provided in the table. Above and below ground biomass of dead wood is calculated using biomass equations published by Liepiņš et al. (2017), which are adopted to transfer volume to biomass (Liepiņš, 2019). Biomass (*summarized data are shown in* Table 29*)* then is transferred to carbon stock, using the same approach as in case of calculation of carbon stock in living biomass. Carbon content in wood is applied according to Muiznieks et al. (2015). Average stem volume above bark to the total biomass conversion factor in reference period is 0.69 and in the projections period (2021-2025) – 0.68. Difference is not statistically significant. Average carbon content in biomass trees dying during the reference period, as well as in the period between 2021 and 2025 is 524 g $kg^{-1}$.

Summarized mortality rates in FRL scenario are provided in Table 28, as well as in Table 26. Area of temporarily not regenerated clear-felling sites with no trees, which are not included in calculation of mortality in total is 2.9%, representing average value in the reference period (2000-2009). The same approach is used to calculate increment.

Losses in living biomass due to harvesting are calculated assuming instantaneous oxidation of stem wood, if it is not transferred into HWP, and 20 years decomposition period for crown and below ground biomass. Studies on improvement of calculation methodologies of carbon stock change in dead wood are under implementation and will be applied as technical corrections to the NFAP. Summary of losses in living biomass due to harvesting is provided in Table 30. Notably that $CO_2$ emissions due to on-site incineration of harvesting residues are accounted using instantaneous oxidation method and reported as losses in living biomass. The same approach is used to report carbon losses in living biomass due to production of biofuel from harvesting residues.

Annual biomass and carbon losses in living biomass due to harvesting are summarized in Table 31. A net loss of biomass in dead wood originated from harvesting residues is summarized in Table 32. The same approach as described above on carbon stock changes due to natural mortality is applied for calculation of biomass from volume above bark *(harvest stock)* and conversion of biomass to carbon stock.

Numeric values from Figure 21 of NFAP are provided in Table 34. The table clearly demonstrates that carbon stock in dead carbon pool is continuously increasing since the end of the reference period.

**Table 27: Natural mortality, mill $m^3$ $yr^{-1}$, 5 years average[6]**

| Species | 2000 | 2005 | 2010 | 2015 | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 | 2055 | 2060 | 2065 | 2070 | 2075 | 2080 | 2085 | 2090 | 2095 | 2100 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aspen | 0.46 | 0.45 | 0.59 | 0.75 | 0.68 | 0.76 | 0,80 | 0.83 | 0.86 | 0.88 | 0.91 | 0.93 | 0.95 | 0.97 | 0.99 | 1,00 | 1.01 | 1.02 | 1.03 | 1.04 | 1.05 |
| Grey alder | 0.10 | 0.12 | 0.36 | 0.69 | 0.68 | 0.78 | 0.82 | 0.85 | 0.88 | 0.91 | 0.93 | 0.96 | 0.98 | 1,00 | 1.02 | 1.04 | 1.05 | 1.06 | 1.07 | 1.08 | 1.09 |
| Birch | 1.38 | 1.28 | 1.43 | 1.73 | 1.52 | 1.36 | 1.34 | 1.33 | 1.32 | 1.31 | 1.32 | 1.33 | 1.34 | 1.35 | 1.36 | 1.37 | 1.37 | 1.38 | 1.37 | 1.37 | 1.37 |
| Spruce | 0.98 | 1.06 | 1.26 | 1.47 | 1.15 | 1.11 | 1.12 | 1.12 | 1.12 | 1.11 | 1,10 | 1.08 | 1.07 | 1.05 | 1.05 | 1.05 | 1.05 | 1.05 | 1.06 | 1.07 | 1.07 |
| Black alder | 0.22 | 0.23 | 0.33 | 0.45 | 0.45 | 0.48 | 0.51 | 0.53 | 0.55 | 0.57 | 0.58 | 0,60 | 0.61 | 0.62 | 0.63 | 0.64 | 0.64 | 0.65 | 0.65 | 0.66 | 0.66 |
| Ash, oak | 0.12 | 0.13 | 0.18 | 0.25 | 0.23 | 0.26 | 0.28 | 0.29 | 0.31 | 0.32 | 0.34 | 0.35 | 0.36 | 0.37 | 0.37 | 0.38 | 0.38 | 0.38 | 0.39 | 0.39 | 0.39 |
| Other species | 0.04 | 0.04 | 0.05 | 0.04 | 0.06 | 0.07 | 0.08 | 0.09 | 0.10 | 0.10 | 0.10 | 0.09 | 0.09 | 0.08 | 0.08 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.08 |
| Pine | 1.09 | 1.19 | 1.27 | 1.34 | 1.23 | 1.16 | 1.13 | 1.10 | 1.07 | 1.03 | 1,00 | 0.98 | 0.96 | 0.95 | 0.95 | 0.95 | 0.96 | 0.97 | 0.99 | 1.01 | 1.03 |
| Total mortality | 4,40 | 4,50 | 5.48 | 6.73 | 5.99 | 5.97 | 6.08 | 6.14 | 6.21 | 6.23 | 6.28 | 6.32 | 6.36 | 6.41 | 6.45 | 6,50 | 6.54 | 6.59 | 6.64 | 6.69 | 6.73 |

**Table 28: Summarized mortality rates, $m^3$ $ha^{-1}$ $yr^{-1}$**

| Year | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 | 2055 | 2060 | 2065 | 2070 | 2075 | 2080 | 2085 | 2090 | 2095 | 2100 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aspen | 1.6 | 1.8 | 2.0 | 2.0 | 2.5 | 3.1 | 2.8 | 3.1 | 3.3 | 3.4 | 3.5 | 3.6 | 3.7 | 3.8 | 3.9 | 4.0 | 4.1 | 4.1 | 4.2 | 4.2 | 4.3 | 4.3 | 4.3 |
| Grey alder | 0.3 | 0.3 | 0.3 | 0.4 | 1.3 | 2.4 | 2.3 | 2.7 | 2.8 | 2.9 | 3.0 | 3.1 | 3.2 | 3.3 | 3.4 | 3.4 | 3.5 | 3.6 | 3.6 | 3.7 | 3.7 | 3.7 | 3.7 |
| Birch | 1.6 | 1.6 | 1.6 | 1.5 | 1.7 | 2.1 | 1.8 | 1.6 | 1.6 | 1.6 | 1.6 | 1.5 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 |
| Spruce | 1.6 | 1.7 | 1.8 | 2.0 | 2.3 | 2.7 | 2.1 | 2.0 | 2.0 | 2.1 | 2.1 | 2.0 | 2.0 | 2.0 | 2.0 | 1.9 | 1.9 | 1.9 | 1.9 | 1.9 | 1.9 | 2.0 | 2.0 |
| Black alder | 1.3 | 1.3 | 1.4 | 1.5 | 2.1 | 2.6 | 2.6 | 2.8 | 3.0 | 3.1 | 3.2 | 3.3 | 3.4 | 3.5 | 3.6 | 3.6 | 3.7 | 3.7 | 3.7 | 3.8 | 3.8 | 3.8 | 3.8 |
| Oak, ash | 2.3 | 2.4 | 2.7 | 2.7 | 3.5 | 4.3 | 4.1 | 4.6 | 5.0 | 5.2 | 5.5 | 5.8 | 6.0 | 6.3 | 6.5 | 6.6 | 6.7 | 6.8 | 6.9 | 6.9 | 6.9 | 7.0 | 7.0 |
| Other species | 0.7 | 0.7 | 0.7 | 0.7 | 1.0 | 1.2 | 1.7 | 2.0 | 2.3 | 2.5 | 2.7 | 2.7 | 2.7 | 2.5 | 2.4 | 2.3 | 2.2 | 2.1 | 2.0 | 2.0 | 2.0 | 2.1 | 2.2 |

[6] Number in table heading means end of a period.

| Year | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 | 2055 | 2060 | 2065 | 2070 | 2075 | 2080 | 2085 | 2090 | 2095 | 2100 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pine | 1.2 | 1.2 | 1.3 | 1.4 | 1.6 | 1.7 | 1.6 | 1.5 | 1.4 | 1.4 | 1.4 | 1.3 | 1.3 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.3 | 1.3 | 1.3 |

**Table 29: Biomass of dying trees, mill tons yr$^{-1}$, 5 years average**

| Species | 2000 | 2005 | 2010 | 2015 | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 | 2055 | 2060 | 2065 | 2070 | 2075 | 2080 | 2085 | 2090 | 2095 | 2100 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aspen | 0.27 | 0.27 | 0.35 | 0.45 | 0,40 | 0.45 | 0.47 | 0.49 | 0.51 | 0.52 | 0.54 | 0.55 | 0.56 | 0.58 | 0.59 | 0.59 | 0,60 | 0.61 | 0.61 | 0.62 | 0.62 |
| Grey alder | 0.06 | 0.07 | 0.22 | 0.41 | 0,40 | 0.46 | 0.48 | 0,50 | 0.52 | 0.53 | 0.55 | 0.57 | 0.58 | 0.59 | 0,60 | 0.61 | 0.62 | 0.63 | 0.63 | 0.64 | 0.64 |
| Birch | 1.03 | 0.95 | 1.06 | 1.28 | 1.12 | 1,00 | 1,00 | 0.98 | 0.98 | 0.97 | 0.98 | 0.99 | 0.99 | 1,00 | 1.01 | 1.01 | 1.02 | 1.02 | 1.02 | 1.02 | 1.01 |
| Spruce | 0.69 | 0.74 | 0.88 | 1.03 | 0.81 | 0.78 | 0.78 | 0.79 | 0.79 | 0.78 | 0.77 | 0.76 | 0.75 | 0.74 | 0.74 | 0.73 | 0.74 | 0.74 | 0.74 | 0.75 | 0.75 |
| Black alder | 0.16 | 0.17 | 0.25 | 0.33 | 0.33 | 0.36 | 0.38 | 0.39 | 0.41 | 0.42 | 0.43 | 0.44 | 0.45 | 0.46 | 0.47 | 0.47 | 0.48 | 0.48 | 0.48 | 0.48 | 0.49 |
| Ash, oak | 0.09 | 0.09 | 0.13 | 0.18 | 0.17 | 0.19 | 0,20 | 0.22 | 0.23 | 0.24 | 0.25 | 0.26 | 0.27 | 0.27 | 0.28 | 0.28 | 0.28 | 0.28 | 0.29 | 0.29 | 0.29 |
| Other species | 0.03 | 0.03 | 0.03 | 0.03 | 0.04 | 0.05 | 0.06 | 0.06 | 0.07 | 0.07 | 0.07 | 0.06 | 0.06 | 0.06 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 |
| Pine | 0.72 | 0.79 | 0.84 | 0.89 | 0.81 | 0.77 | 0.75 | 0.73 | 0.71 | 0.68 | 0.66 | 0.65 | 0.64 | 0.63 | 0.63 | 0.63 | 0.63 | 0.64 | 0.65 | 0.67 | 0.68 |
| Total mortality | 3.05 | 3.11 | 3.76 | 4.61 | 4.09 | 4.06 | 4.13 | 4.16 | 4.21 | 4.22 | 4.25 | 4.28 | 4,30 | 4.33 | 4.36 | 4.39 | 4.42 | 4.45 | 4.48 | 4.51 | 4.54 |

**Table 30: Losses in living biomass due to harvesting, mill. tons**

| Biomass | 2000 | 2005 | 2010 | 2015 | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 | 2055 | 2060 | 2065 | 2070 | 2075 | 2080 | 2085 | 2090 | 2095 | 2100 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Stem | 5.56 | 6.08 | 5.82 | 7.11 | 7.16 | 7.29 | 7.41 | 7.47 | 7.41 | 7.34 | 7.21 | 7.07 | 6.94 | 6.82 | 6.71 | 6.63 | 6.59 | 6.57 | 6.59 | 6.63 | 6.69 |
| Crown | 1.39 | 1.51 | 1.41 | 1.74 | 1.73 | 1.76 | 1.79 | 1.81 | 1.82 | 1.82 | 1.79 | 1.75 | 1.71 | 1.67 | 1.64 | 1.62 | 1.6 | 1.6 | 1.6 | 1.61 | 1.63 |
| Crown without incinerated biomass | 0.96 | 1.27 | 1.33 | 1.59 | 1.59 | 1.55 | 1.49 | 1.67 | 1.67 | 1.67 | 1.64 | 1.61 | 1.57 | 1.54 | 1.51 | 1.48 | 1.47 | 1.47 | 1.47 | 1.48 | 1.49 |
| Below-ground biomass | 1.75 | 1.9 | 1.81 | 2.22 | 2.23 | 2.27 | 2.3 | 2.32 | 2.31 | 2.29 | 2.25 | 2.21 | 2.17 | 2.13 | 2.09 | 2.07 | 2.05 | 2.05 | 2.05 | 2.07 | 2.08 |

| Biomass | 2000 | 2005 | 2010 | 2015 | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 | 2055 | 2060 | 2065 | 2070 | 2075 | 2080 | 2085 | 2090 | 2095 | 2100 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total except incinerated biomass | 8.26 | 9.26 | 8.96 | 10.93 | 10.97 | 11.10 | 11.20 | 11.46 | 11.39 | 11.31 | 11.10 | 10.89 | 10.68 | 10.48 | 10.31 | 10.18 | 10.11 | 10.09 | 10.11 | 10.18 | 10.27 |

**Table 31: Biomass losses due to harvesting, mill tons yr$^{-1}$, 5 years average**

| Biomass | 2000 | 2005 | 2010 | 2015 | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 | 2055 | 2060 | 2065 | 2070 | 2075 | 2080 | 2085 | 2090 | 2095 | 2100 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Stem biomass | 5.56 | 6.08 | 5.82 | 7.11 | 7.16 | 7.29 | 7.41 | 7.47 | 7.41 | 7.34 | 7.21 | 7.07 | 6.94 | 6.82 | 6.71 | 6.63 | 6.59 | 6.57 | 6.59 | 6.63 | 6.69 |
| Crown biomass | 1.39 | 1.51 | 1.41 | 1.74 | 1.73 | 1.76 | 1.79 | 1.81 | 1.82 | 1.82 | 1.79 | 1.75 | 1.71 | 1.67 | 1.64 | 1.62 | 1.6 | 1.6 | 1.6 | 1.61 | 1.63 |
| Below-ground biomass | 1.75 | 1.9 | 1.81 | 2.22 | 2.23 | 2.27 | 2.3 | 2.32 | 2.31 | 2.29 | 2.25 | 2.21 | 2.17 | 2.13 | 2.09 | 2.07 | 2.05 | 2.05 | 2.05 | 2.07 | 2.08 |
| Total | 8.7 | 9.5 | 9.04 | 11.07 | 11.12 | 11.31 | 11.5 | 11.61 | 11.54 | 11.45 | 11.24 | 11.03 | 10.82 | 10.62 | 10.45 | 10.32 | 10.24 | 10.22 | 10.24 | 10.31 | 10.4 |
| Total carbon, mill. tons C | 4.56 | 4.99 | 4.74 | 5.81 | 5.83 | 5.94 | 6.03 | 6.09 | 6.05 | 6.01 | 5.9 | 5.78 | 5.67 | 5.56 | 5.47 | 5.4 | 5.36 | 5.35 | 5.36 | 5.4 | 5.45 |

**Table 32: Net changes in dead wood biomass and carbon stock in harvesting residues, mill tons yr$^{-1}$, 5 years average**

| Biomass | 2000 | 2005 | 2010 | 2015 | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 | 2055 | 2060 | 2065 | 2070 | 2075 | 2080 | 2085 | 2090 | 2095 | 2100 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Stem biomass | 5.56 | 6.08 | 5.82 | 7.11 | 7.16 | 7.29 | 7.41 | 7.47 | 7.41 | 7.34 | 7.21 | 7.07 | 6.94 | 6.82 | 6.71 | 6.63 | 6.59 | 6.57 | 6.59 | 6.63 | 6.69 |
| Crown biomass | 0.53 | 0.71 | 0.92 | 1.19 | 1,40 | 1.56 | 1,70 | 1.57 | 1.59 | 1.61 | 1.64 | 1.65 | 1.63 | 1,60 | 1.57 | 1.54 | 1.51 | 1.49 | 1.48 | 1.47 | 1.47 |
| Below-ground biomass | 0.96 | 1.24 | 1.48 | 1,80 | 2.01 | 2,10 | 2.22 | 2.27 | 2.29 | 2.31 | 2,30 | 2.28 | 2.25 | 2.21 | 2.17 | 2.13 | 2.10 | 2.07 | 2.06 | 2.06 | 2.06 |
| Total | 7.04 | 8.04 | 8.22 | 10,10 | 10.57 | 10.95 | 11.32 | 11.31 | 11.29 | 11.26 | 11.15 | 11,00 | 10.82 | 10.63 | 10.45 | 10,30 | 10.19 | 10.14 | 10.13 | 10.16 | 10.22 |
| Total carbon, mill. tons C | 3.70 | 4.22 | 4.32 | 5,30 | 5.55 | 5.75 | 5.94 | 5.93 | 5.92 | 5.91 | 5.85 | 5.77 | 5.67 | 5.57 | 5.47 | 5.39 | 5.34 | 5.31 | 5,30 | 5.32 | 5.35 |

**Table 33: Summary of carbon balance in dead wood**

| Year | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mortality (ktons $CO_2$ $yr^{-1}$): | | | | | | | | | | | | | | | | | | | | | | | | | | |
| removals | 5966 | 5954 | 5942 | 5930 | 6025 | 6012 | 6000 | 5999 | 5998 | 9052 | 9052 | 9052 | 9052 | 9052 | 9168 | 7796 | 8043 | 8325 | 7620 | 7620 | 7620 | 7783 | 7783 | 7783 | 7783 | 7783 |
| emissions | 5396 | 5452 | 5505 | 5554 | 5611 | 5658 | 5701 | 5742 | 5779 | 5950 | 6135 | 6320 | 6504 | 6689 | 6859 | 6960 | 7073 | 7201 | 7303 | 7385 | 7468 | 7560 | 7652 | 7745 | 7833 | 7922 |
| net removals | 571 | 502 | 437 | 376 | 413 | 354 | 298 | 257 | 219 | 3101 | 2917 | 2732 | 2547 | 2363 | 2309 | 836 | 970 | 1124 | 316 | 234 | 152 | 223 | 131 | 38 | -51 | -139 |
| Harvesting residues (ktons $CO_2$ $yr^{-1}$): | | | | | | | | | | | | | | | | | | | | | | | | | | |
| removals | 5708 | 5662 | 6052 | 6285 | 6109 | 6490 | 5660 | 5831 | 5135 | 6249 | 7338 | 7338 | 7338 | 7338 | 7338 | 7325 | 7351 | 7351 | 7351 | 7351 | 7297 | 7396 | 7364 | 7332 | 7300 | 7272 |
| emissions | 3228 | 3390 | 3575 | 3762 | 3951 | 4154 | 4304 | 4467 | 4590 | 4764 | 5003 | 5257 | 5521 | 5766 | 5987 | 6175 | 6369 | 6508 | 6619 | 6628 | 6739 | 6858 | 6956 | 7040 | 7132 | 7203 |
| net removals | 2480 | 2273 | 2477 | 2522 | 2158 | 2336 | 1356 | 1364 | 546 | 1485 | 2335 | 2081 | 1817 | 1572 | 1351 | 1150 | 981 | 842 | 732 | 722 | 558 | 538 | 408 | 292 | 167 | 69 |
| Total net removals in dead biomass: | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ktons $CO_2$ $yr^{-1}$ | 3050 | 2775 | 2915 | 2899 | 2572 | 2690 | 1654 | 1621 | 765 | 4587 | 5252 | 4813 | 4364 | 3934 | 3660 | 1986 | 1951 | 1966 | 1048 | 957 | 709 | 761 | 539 | 329 | 117 | -70 |
| ktons C $yr^{-1}$ | 832 | 757 | 795 | 791 | 701 | 734 | 451 | 442 | 209 | 1251 | 1432 | 1313 | 1190 | 1073 | 998 | 542 | 532 | 536 | 286 | 261 | 193 | 207 | 147 | 90 | 32 | -19 |
| Cumulative removals in dead biomass: | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ktons C $yr^{-1}$ | 5178 | 5935 | 6730 | 7520 | 8222 | 8955 | 9406 | 9849 | 10057 | 11308 | 12740 | 14053 | 15243 | 16316 | 17314 | 17856 | 18388 | 18924 | 19210 | 19471 | 19665 | 19872 | 20019 | 20109 | 20141 | 20121 |

**Table 34: Carbon stock in forest carbon pools except soil, mill. tons C**

| Carbon pool | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Living biomass | 215 | 218 | 222 | 225 | 228 | 230 | 232 | 234 | 237 | 235 | 235 | 235 | 236 | 236 | 236 | 236 | 237 | 237 | 240 | 241 | 242 | 243 | 244 | 244 | 245 | 246 | 246 | 247 | 247 | 248 | 248 |
| Dead wood | 25 | 27 | 28 | 30 | 31 | 33 | 34 | 35 | 36 | 37 | 39 | 41 | 43 | 44 | 46 | 47 | 48 | 49 | 51 | 52 | 53 | 54 | 54 | 55 | 55 | 56 | 56 | 56 | 55 | 55 | 54 |
| Litter | 38 | 38 | 38 | 38 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 |
| HWP | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |

| Carbon pool | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total | 281 | 286 | 291 | 296 | 301 | 304 | 307 | 311 | 315 | 315 | 317 | 319 | 321 | 323 | 325 | 327 | 329 | 330 | 335 | 337 | 339 | 341 | 342 | 344 | 345 | 347 | 347 | 348 | 348 | 348 | 348 |

## Explanation on meeting criteria (f) of Annex IV, section A regarding the conservation of biodiversity

Carbon stock changes in dead wood depends from initial carbon stock in dead wood *(determined by historical data on mortality and harvest rate)*, natural mortality in the projected period *(determined by species and site types composition, thinning intensity and regenerative felling)*, harvest rate and structure of harvest and utilization of harvesting residues *(incineration of residues, production of biofuel from branches and stumps)*.

The difference between carbon stock changes in dead wood in the projected period in NFAP and the national GHG inventory report is associated with changes in forest management after 2009, which are not considered in FRL to avoid impact of policies implemented after 2009, e.g. utilization of harvesting residues for biofuel production ("0" in 2000-2009 and 0.4 mill. tons $CO_2$ $yr^{-1}$ in 2018), more intensive thinnings, changed structure of regenerative harvests etc.

Dead wood carbon pool increases by 457 ktons C in the FRL projections scenario between 2021 and 2025. This is also noted in Table 1 of NFAP. Therefore, the FRL scenario is not associated with biodiversity risks due to reduction of carbon stock in dead wood. Carbon stock in dead wood is actually nearly doubling in the FRL scenario in 2025 in comparison to 2000 (Figure 2).

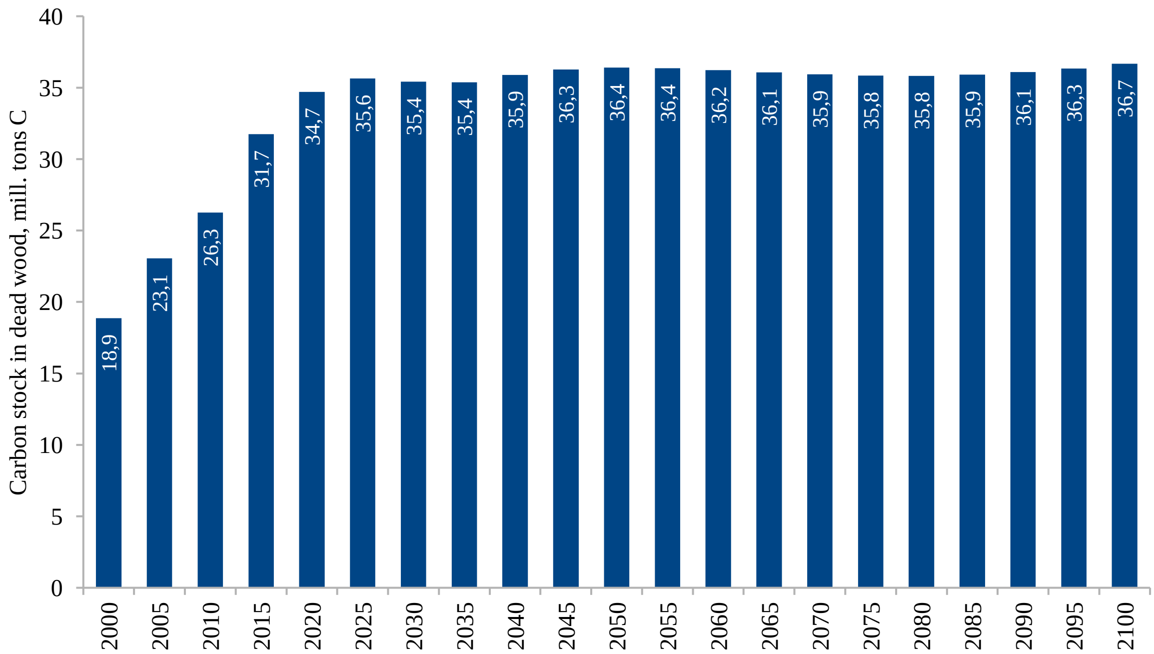


**Figure 2: Carbon stock in dead wood in FRL scenario.**

## Explanation on method to estimate emissions and removals from litter are consistent with GHG inventory

Carbon stock changes in litter are reported as not a source both in the national GHG inventory report and NFAP according to modelling results using Yasso soil carbon model (Bārdulis et al., 2017; Lupiķis & Lazdiņš, 2017).

Carbon stock changes in litter and mineral soils will be included into the national GHG inventory report and NFAP within the scope of technical corrections.

An exception is ameliorated and rewetted organic soils in forest land, where carbon stock changes in litter are considered in the default and country specific $CO_2$ emission factor.

However, carbon stock changes in litter reflected in Figure 21 of NFAP represents land use changes due to deforestation in 2000-2009. Carbon stock changes in litter in deforested areas are accounted as instant oxidation of this carbon pool; therefore, there is decrease of carbon stock in litter in the period between 2000 and 2009, but no carbon stock changes in litter in following years in Figure 21 in NFAP.

## Clarification on how the modelling of ameliorated organic soils was done

Forests with amelioration systems older than 30 years after regenerative felling, as well as forest stands, where NFI teams identifies stand type change from ameliorated to wet are accounted as rewetted. Rewetting in NFAP context means situation when drainage system in forest stand has stopped functioning and it is not related to wetlands. Usually the reason for stand type change is wearing of drainage systems or activity of beavers building dams on ditches and rivers. Considering that forest owner can implement measures to restore water regime, stand type (from ameliorated to wet) is changed with 5 years delay, if no measures are implemented. Transforming the stand type from wet to ameliorated is done instantly without 5 years delay. Figure 3 shows typical examples of identification of growth conditions using NFI data. Example I demonstrates a case, when changes of water regime *(increase of groundwater level due to depreciation of drainage systems or appearance of ground vegetation typical for wet forest site types without visible reason)* identified during the 2$^{nd}$ NFI cycle. Then in 3$^{rd}$ cycle growth conditions returns to initial status. In this case NFI plot is continuously reported as ameliorated. Example II demonstrates a case, when increase of groundwater level or other signs of rewetting are observed during 2$^{nd}$ and 3$^{rd}$ NFI cycle and return to initial conditions during 4$^{th}$ NFI cycle. In this case NFI plot is reported as rewetted during the periods represented by 2$^{nd}$ and 3$^{rd}$ NFI cycle. Example III demonstrates a case, when NFI plot is continuously reported as rewetted during the periods represented by 2$^{nd}$, 3$^{rd}$ and 4$^{th}$ NFI cycle. Similar approach is implemented in estimation of land use and land use change using the National forest inventory data (Krumšteds et al., 2019).

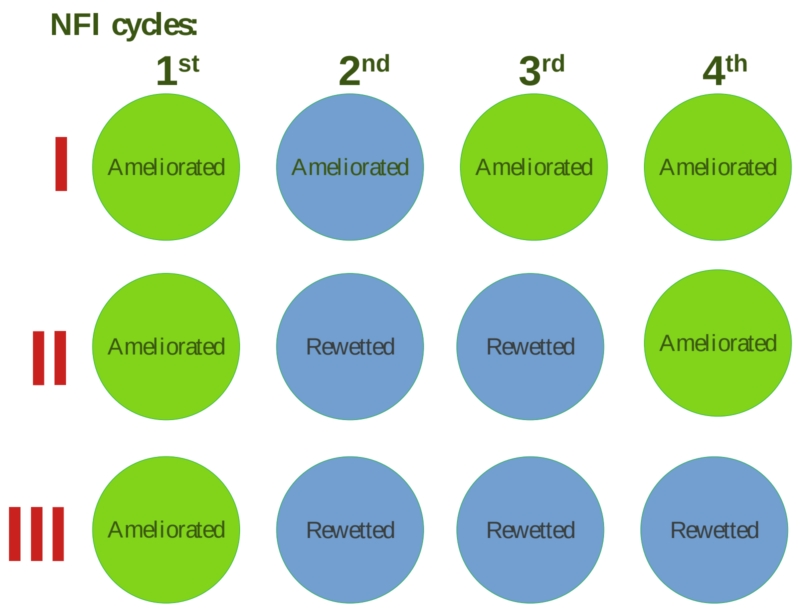

**Figure 3: Decision support system on reporting of growth conditions in ameliorated and rewetted soils.**

In case of regenerative felling, as well as in cases when basal area decreases below the critical threshold set by regulations of Cabinet of Ministers on harvest of trees in forest land (Cabinet of Ministers, 2012) growth conditions are changed to rewetted immediately, if age of drainage network or the period after it's reconstruction is more than 30 years. For elaboration of the FRL critical thresholds values of basal area from previous edition of the regulations of Cabinet of Ministers are applied. Calculation principle is incorporated in AGM forest growth model.

Restoration of drainage network is the main factor affecting returning of growth conditions to ameliorated status. Average area of drainage networks restored during reference period in state forests is 6.1 kha $yr^{-1}$. After the reference period (2000-2009) it increases to 15.3 kha $yr^{-1}$ (Figure 4). The state agency Real Estates of Ministry of Agriculture maintains database of drainage networks including information on the establishment and reconstruction year of drainage systems. No records on reconstruction of drainage networks in private forests during the reference period (2000-2009) are found in the database, which corresponds to actual situation in forest lands. Funding for reconstruction of drainage networks in private forests were available since 2013 within the scope of Rural Development Plan. Following to requirement to avoid impact of policies implemented after the reference period it is assumed in the calculation of the FRL that reconstruction of drainage networks in state forests corresponds to 6.1 kha $yr^{-1}$ and in other forests no reconstruction of drainage networks is done after the reference period.

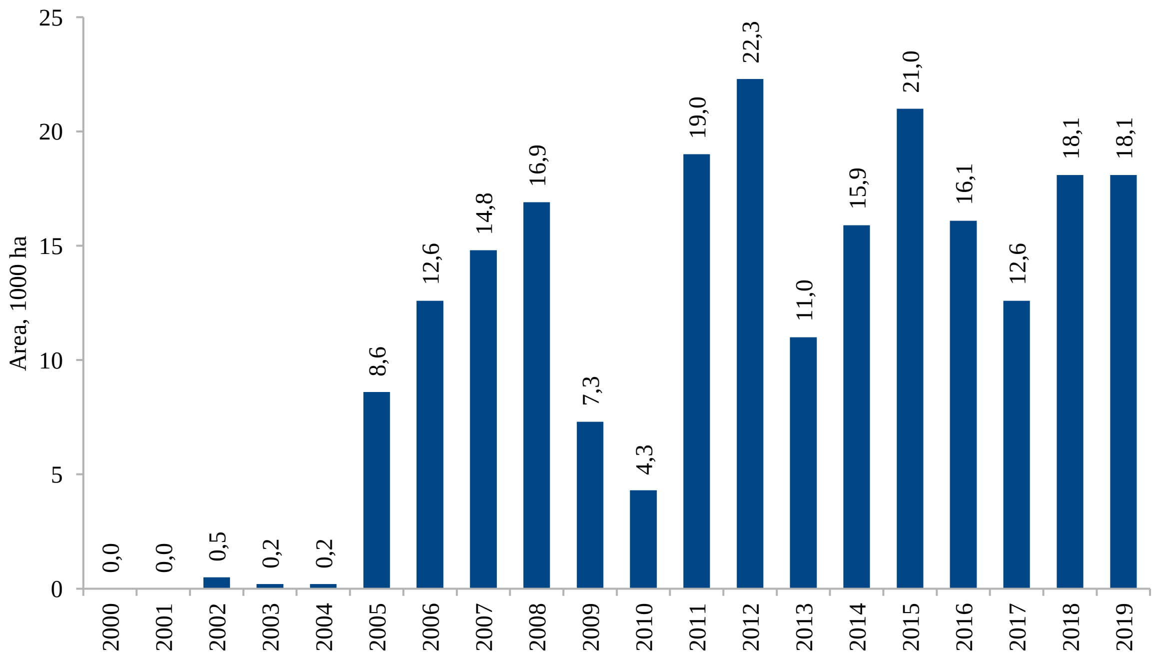


**Figure 4: Reconstruction of ditch networks in state forests.**

Application of the above mentioned assumptions leads to estimated 96 kha area of rewetted forest lands at the end of the projections period (in 2025). This area consists of 41 kha of regenerative fellings and 55 kha is area of forests where drainage network would not be restored if the forest management intensity remains as in 2000-2009.

Changes of growth rate as a result of changes in the forest site index is based on NFI data, transferred into growth functions (Donis, 2011; Donis, Šņepsts, & Šēnhofs, 2015; Donis, Šņepsts, Šēnhofs, et al., 2015; Lazdiņš et al., 2019). An example demonstrating difference of growth rate / growing stock in ameliorated and naturally wet or rewetted forests of different age is provided in Figure 5. The growing stock in ameliorated forests is significantly bigger than in naturally wet or rewetted forests – from 17% in young stands to 100% in mature stands. The difference is associated by multiple factors, but mainly by accessibility of nutrients in deeper soil layers in ameliorated forests.

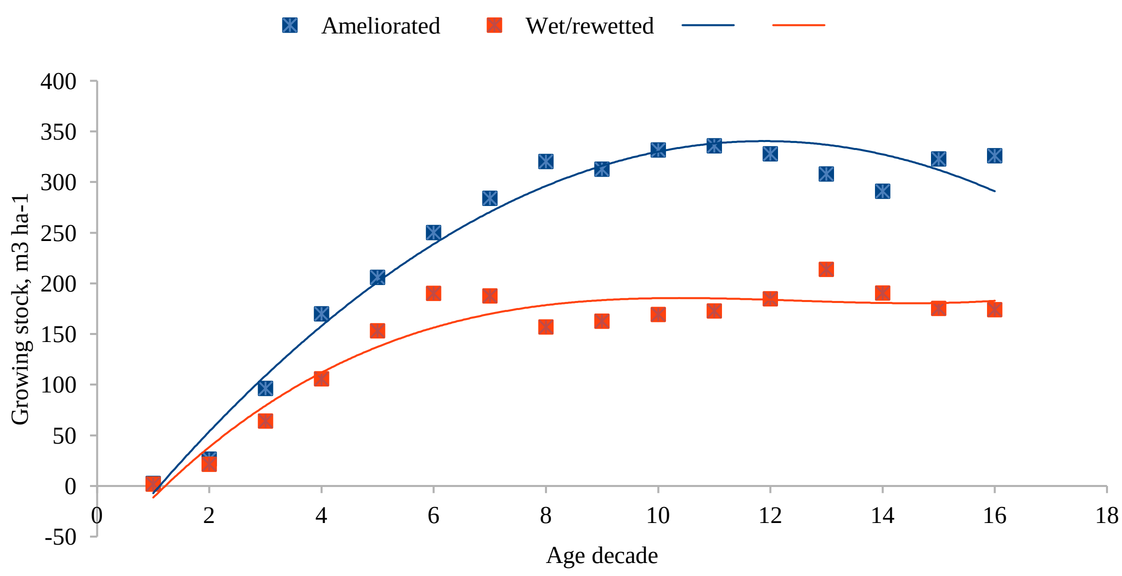


**Figure 5: Growing stock in forests with ameliorated and naturally wet or rewetted organic soils.**

## Explanation on increase in emissions from organic soils

GHG emissions from ameliorated and rewetted organic soils are accounted in the National GHG inventory report using the National forest inventory data and 30 years life-time assumption *(in case of regenerative felling)* of the amelioration systems. This principle is described more in details in previous section. $CO_2$ emissions from ameliorated organic soils in forest land are accounted using country specific emission factor (Table 37); $CO_2$ emissions from rewetted soil, as well as $CH_4$ and $N_2O$ emissions from ameliorated and rewetted organic forest soils are calculated using default emission factors (Table 36).

The default $CH_4$ emission factor for rewetted soils is significantly higher than the one for ameliorated soils; while the applied $CO_2$ emission factors are changing only by 0.02 tons $CO_2$-C $ha^{-1}$ $yr^{-1}$ in case of rewetting; therefore, rewetting is currently associated with increase of GHG emissions by 5.36 tons $CO_2$ eq. $ha^{-1}$ $yr^{-1}$ due to increase of emissions of $CH_4$.

Considering high uncertainty of the default emission factors, country specific GHG emission factors for rewetted soils are now under development and will be implemented as technical corrections. Preliminary summary of data, which will be implemented in the next GHG inventory report in 2021, is provided in Table 35. According to these findings $CH_4$ emission factor for rewetted organic forest soil is nearly 10 times smaller than the default emission factor according to the IPCC guidelines listed in Table 36. After implementation of new emission factors the whole time series will be recalculated within the scope of technical corrections.

**Table 35: GHG emissions from ameliorated and rewetted forests according to recent study results according to** Lazdiņš & Lupiķis (2019) and Lupiķis (2019)

| **Greenhouse gas** | **Emission factor, tons $CO_2$ eq. $ha^{-1}$ $yr^{-1}$** | |
|---|---|---|
| | **ameliorated forest with organic soil** | **rewetted or naturally wet forest with organic soil** |
| $CO_2$ | 4.21 | 6.78 |
| DOC | 1.14 | 0.88 |
| $CH_4$ | -0.03 | 0.71 |
| $CH_4$ from ditches | 0.14 | 0.00 |
| $N_2O$ | 0.29 | 0.02 |
| Net emissions | 5.74 | 8.39 |

## Explanation on how consistency with the GHG inventory report CRF Table 4.II is ensured

The methods applied to calculate area of ameliorated and rewetted organic soils in forest lands is described in previous sections.

GHG emissions due to rewetting of organic forest soils are accounted in the national GHG inventory report using default emission factors for nutrient-rich soils in cool temperate moist climate region (Table 36). The same approach is used in the NFAP for calculation of FRL. The area of rewetted organic soils in forest land according to the national GHG inventory used in elaboration of the NFAP and FRL is 18.1 kha in 2017; according to NFAP it is 50.2 kha due to application of forest management intensities *(restoration of drainage systems)* as in 2000-2009 to avoid impact of recently implemented policy assumptions in the projections period.

**Table 36: GHG emission factors in rewetted forest land with organic soil, according to Hiraishi et al. (2013)**

| **Greenhouse gas and measurement units** | **Emission factor** | **Source** |
|---|---|---|
| $CO_2$, tons $CO_2$-C $ha^{-1}$ $yr^{-1}$ | 0.50 | 2013 SUPPLEMENT, TABLE 3.1 DEFAULT EMISSION FACTORS (EF $CO_2$) FOR $CO_2$-C FROM REWETTED ORGANIC SOILS (temperate, rich) |
| $CH_4$, kg $CH_4$-C $ha^{-1}$ $yr^{-1}$ | 216.00 | 2013 SUPPLEMENT, TABLE 3.3 DEFAULT EMISSION FACTORS FOR $CH_4$ FROM REWETTED ORGANIC SOILS (temperate, rich) |

Area of ameliorated organic soils in forest land remaining forest at the end of reference period, considered in calculation of GHG emissions is 428 kha. Considering rewetting due to application of the management intensities as from 2000-2009, avoiding impact of policy assumptions, the area of ameliorated organic soils reduces to 356 kha in 2021.

The emissions from ameliorated organic soils are calculated using default emission factors for $CH_4$ and direct $N_2O$ emissions and country specific emission factor for $CO_2$ as provided in Table 37. The same emission factors are applied during the reference and projections period.

**Table 37: GHG emission factors in ameliorated forest land with organic soil, according to Hiraishi et al. (2013) and Lupiķis et al. (2017)**

| Greenhouse gas and measurement units | Emission factor | Source |
|---|---|---|
| $CO_2$, tons $CO_2$-C $ha^{-1}$ $yr^{-1}$ | 0.52 | Lupiķis, A., Lazdiņš, A., Okmanis, M., Butlers, A., Saule, Z., Saule, L., Martinsone, K., Saule, G., Purviņa, D., Bārdule, A., & Skranda, I. (2017). *Empīrisku datu ieguve meža meliorācijas ietekmes uz CO2 emisijām no organiskajām augsnēm novērtēšanai (Elaboration of measurement data for evaluation of impact of amelioration systems on GH emissions from organic soils)* (2015/13, līguma 1.13 punkts; p. 43). LVMI Silava. |
| $N_2O$, kg $N_2O$-N $ha^{-1}$ $yr^{-1}$ | 2.80 | 2013 SUPPLEMENT, TABLE 2.5 TIER 1 DIRECT $N_2O$ EMISSION/REMOVAL FACTORS FOR DRAINED ORGANIC SOILS IN ALL LAND-USE CATEGORIES (Forest land, drained, temperate forests) |
| $CH_4$, kg $CH_4$-C $ha^{-1}$ $yr^{-1}$ | 2.50 | 2013 SUPPLEMENT, TABLE 2.3 TIER 1 $CH_4$ EMISSION/REMOVAL FACTORS FOR DRAINED ORGANIC SOILS IN ALL LAND-USE CATEGORIES (forest land, drained, temperate) |
| $CH_4$, kg $CH_4$-C $ha^{-1}$ $yr^{-1}$ from ditches | 217.00 | 2013 SUPPLEMENT, TABLE 2.4 DEFAULT $CH_4$ EMISSION FACTORS FOR DRAINAGE DITCHES (boreal/temperate, drained forest land) |
| Proportion of area of ditches | 3% | |

CRF table 4.II of the National GHG inventory includes land converted to forest land at least 20 years ago, respectively, at the end of reference period (2009) of the FRL CRF table 4.II contains forest land remaining forest land at the beginning of 1990 and no land converted to forest land during the period between 1990 and 2009. **Rewetting or amelioration of forest land is not associated with land use changes.** The scope of amelioration is improvement of growth conditions in forest land; particularly, amelioration avoids floods and ensures continuous water flow in forest lands periodically or continuously suffering from exceeding water, which results of formation of anaerobic conditions in soil and decrease of growth rate.

## Explanation of difference between GHG reporting in CRF Table 4.V and data provided in the NFAP

GHG emissions due to biomass burning consist of GHG emissions due to forest fires and incineration of harvesting residues. According to methodology applied in the national GHG inventory GHG emissions from forest fires depends from average carbon stock in living biomass, dead wood and litter, therefore, using the same wildfire area assumptions *(average in 2000-2009, as it is noted in NFAP)*, GHG emissions due to forest fires may significantly differ in the reference (2000-2009) and projection period (2021-2025).

Average area of forest wildfires in 2000-2009 was 0.99 kha $yr^{-1}$. Average amount of biomass and dead organic matter including living biomass, dead wood and litter left for incineration in 2000-2009 was 178.0 ktons $yr^{-1}$ (184 tons $ha^{-1}$). The combustion factor used in calculation is 0.45 according to Table 67 of IPCC 2006 (Eggleston et al., 2006). Emission factors for wildfires in Table 38 are taken from Table 2.5[8] of IPCC 2006 guidelines (Eggleston et al., 2006).

**Table 38: GHG emission factors applied for wildfires in forest lands**

| No. | GHG and measurements unit | Emission factor |
|---|---|---|
| 1. | $CO_2$, g $kg^{-1}$ | 1550.00 |
| 2. | $CH_4$, g $kg^{-1}$ | 6.10 |
| 3. | $N_2O$, g $kg^{-1}$ | 0.06 |

Modelled stock of living and dead biomass available for incineration in wildfires increased to 210 tons $ha^{-1}$ in 2021-2025 (by 12% in comparison to the reference period). Continuous increase of carbon stock available for wildfire in the FRL scenario is demonstrated in Figure 6. The values shown in Figure 6 are multiplied with area of forest fires, combustion factor and emission factors in Table 26 to estimate GHG emissions due to forest fires.

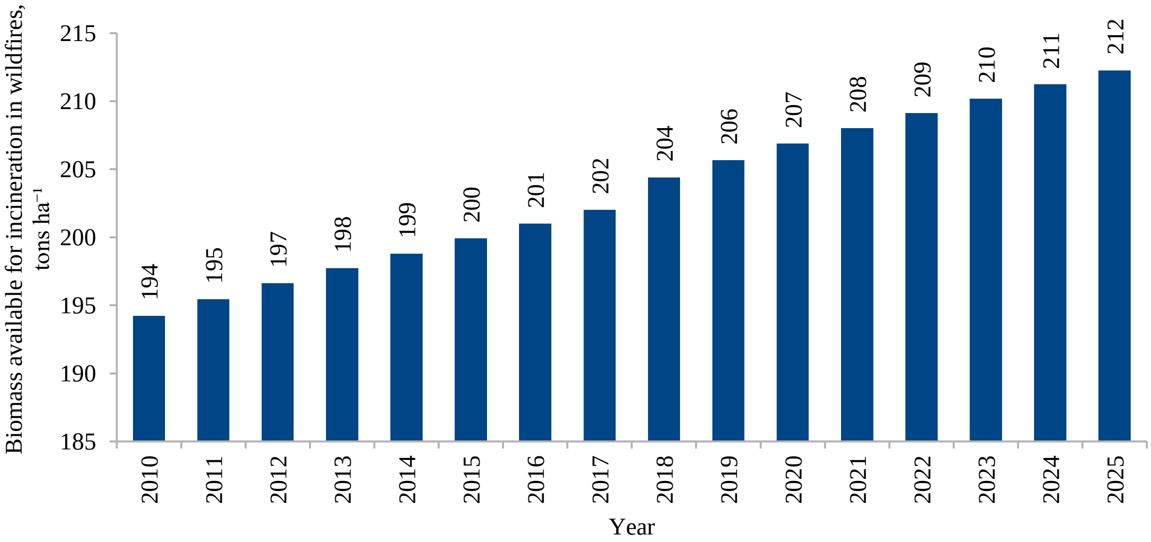


**Figure 6: Biomass and dead organic matter available for incineration of wildfires (modelled data).**

GHG emissions due to incineration of harvesting residues in 2021-2025 are calculated according to average amount of harvesting residues left for incineration in 2000-2009. Proportion of harvesting residues left for incineration and actually incinerated in 2021-2025 is estimated according to average values in 2000-2009 to avoid impact of policies implemented after the reference period. The share of harvesting residues left for incineration in 2000-2009 is 13% (it decreased from 50% in 2000 to 7% in 2009). Average share of actually incinerated harvesting residues in 2000-2009 is 67%. Combustion factor

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[7] IPCC 2006, TABLE 2.6, COMBUSTION FACTOR VALUES (PROPORTION OF PREFIRE FUEL BIOMASS CONSUMED) FOR FIRES IN A RANGE OF VEGETATION TYPES, combustion factor for all "other" temperate forests

[8] IPCC 2006, TABLE 2.5, EMISSION FACTORS (g $kg^{-1}$ DRY MATTER BURNT) FOR VARIOUS TYPES OF BURNING VALUES ARE MEANS ±SD AND ARE BASED ON THE COMPREHENSIVE REVIEW BY ANDREAE ANDMERLET (2001)

for harvesting residues considered in calculation is 0.62 according to Table 2.66 of IPCC 2006 (Eggleston et al., 2006). Actually incinerated harvesting residues in 2000-2009 is 268.8 ktons $yr^{-1}$; the average value of incinerated residues according to FRL scenario, according to estimated harvested rates and proportion of harvesting residues left for incineration and incinerated in 2021-2025 is 154.3 ktons $yr^{-1}$. Emission factors provided in Table 38 are used to transfer incinerated biomass into GHG emissions. $CO_2$ emissions due to incineration of harvesting residues are not included, as they are already reported as losses in living biomass carbon pool due to harvesting. The same approach is applied in the national 2019 GHG inventory9.

Detailed description of methodologies applied for calculation of GHG emissions due to wildfires and incineration of harvesting residues is provided in NFAP, pages 26-27. As explained earlier, the estimates in NFAP and national GHG inventory differs due to application of assumptions on forest management practices, as they were in 2000-2009, e.g. available biofuel (stock of living and dead biomass in forest) and considerably bigger proportion of incinerated harvesting residues in the reference period.

## Confirmation whether the values in Table 1 are provided as a sum over the five-year period, or average over 2021-2025

The values reported in Table 1 of NFAP are sum over the five-year period.

## Explanation on impact of change in living biomass on the estimates for HWP

Net removals in HWP depends from several factors, including historical harvest rate, species composition in the harvest stock, export of roundwood, proportion of energy wood and share of different HWP in output *(the last 2 parameters depends from species composition and historical data on efficiency of the roundwood utilization)*. The average values of these parameters in 2000-2009 were used in calculation to avoid impact of policies implemented after the reference period.

## Explanation on conformity forest are used in modelling with CRF Table 4.A row "forest land remaining forest land"

Forest area used in calculation of FRL is 3071 kha. It conforms with the area of forest land remaining forest land at the end of 2009 in the national GHG inventory report CRF Table 4.A, submission date 12.04.2019. Forest area mentioned in page 7 (Table 1), page 30 and page 37 is taken by accident from Land Transition Matrix, which includes afforested lands.

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[9] 2019 GHG inventory 1990 – 2017: https://unfccc.int/documents/194812

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