Norwegian Ministry
of Climate and Environment

Strategy on Land Use, Land Use Change and forestry sector

12 March 2020

Content

A. OVERVIEW AND PROCESS FOR DEVELOPING THE STRATEGIES

This strategy is submitted according to Protocol 31 Article 3 para 8(a) (iii), "*By 1 January 2020, each EFTA state shall prepare and submit to the EFTA Surveillance Authority its strategy for the land use, land use change and forestry sector with a perspective of at least 30 years".*

This strategy outlines how to fulfil Norway's commitments under the UNFCCC and the Paris Agreement to reduce anthropogenic greenhouse gas emissions and enhance removals by sinks of greenhouse gases in the second half of this century.
The purpose of the submission of this strategy is to fulfil the criteria to have access to the managed forest land flexibility given in Article 13 of the LULUCF-regulation[1].

This strategy is developed in collaboration between relevant Ministries and outlines existing Norwegian measures and policies as well as updated projections of emissions and removals until 2050. In 2020, the Government plans to present a White Paper on how to meet the 2030-commitments.

A1. Executive summary

Norway has several ongoing and planned measures to ensure the conservation and enhancement of forest sinks and reservoirs. The LULUCF sector in Norway was a large sink with net removals of 25 million tons of CO_2 including 29.1 million tons CO_2 in the managed forest land category, according to the National Inventory Report for 2017. The projections indicate that the carbon sink capacity of the forest has reached a peak and the net removals of the sector will be reduced to around 20 mill tons of CO_2 by 2050. By the second half of the century total removals of the LULUCF sector is projected to increase again. There are several factors driving this, such as the implementation of new forest management measures, a changed age class structure and better growing conditions due to global warming. There are large uncertainties in these projections, especially in the longer term. A wide range of measures, including legislation, taxation, economic support schemes, research, extension services and administrative procedures, support the implementation of forest policy and mitigation actions. In addition to ordinary support schemes for silviculture and forestry, the Government has introduced climate motivated support schemes for regeneration, increased seedling density on regeneration sites, enhanced breeding of forest seedlings and fertilization of forest stands to increase the forest sink capacity in the future. In addition, a pilot-project on afforestation has been carried out. Owing to the slow growth rate of boreal forests, fertilization is for the time being the only implemented measure in managed forests that can achieve a significant effect in the short term (2030), but all measures will give a substantial effect by 2050. To reduce emissions from deforestation LULUCF

[1] Regulation (EU) 2018/841 of the European Parlament and of the Council of 30 May 208 on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework.

calculation tools have been developed and made available for all municipalities to inform spatial planning decision making processes.

Measures in the LULUCF sector also need to be considered in light of other sectors' needs for biomass to reach their mitigation targets. There are ongoing and upcoming processes that will identify further emission reduction options and options for enhancement of sinks.

A2. Legal and policy context, including where appropriate, indicative milestones for 2040 and 2050.

Forest land cover 12 million hectares and constitutes 37.4 per cent of the land area in Norway. Approximately 12 per cent of the productive forest area is publicly owned (by the state, region, municipality).

Forestry in Norway is primarily characterized by small-scale farmers, combining forestry and agriculture. This is based on the Norwegian topography, varying production conditions and the ownership structure of Norwegian forests. In 2015, Norway had 128 000 forest owners with more than 2.5 hectares of forest. 97 per cent of these properties are privately owned. The average size of privately owned farms with forest resources is 45 hectares.

In Norway, the forest industry is important. An active and profitable forestry and a competitive forest industry is of importance for settlement, employment and business development in large parts of the country. Norway has an active forest policy, which aims to increase the yield potential and the use of forest resources in a sustainable manner. This policy will also strengthens the forest carbon sink and stocks. The forest also represents an important source of renewable energy. Norway has an ambitious policy on biofuels, and several industrial actors are planning to produce advanced biofuels on forest based materials. Further, the Norwegian forest contributes to production of wooden materials that can replace materials with a stronger carbon footprint. The forest as a renewable resource is strengthened through research, value creation, and long term sustainable management.

A.2.1 Overarching climate targets and commitments

Norway is committed to reduce its overall greenhouse gas emissions, in view of holding the increase in the global average temperature well below 2 degrees above pre-industrial levels, and to pursue efforts to limit the temperature increase to 1.5 degrees above pre-industrial levels. Norway is considering and implementing a variety of measures that are outlined in this strategy to achieve the goal in the Paris Agreement to achieve a balance between anthropogenic emissions by sources and removals by sinks of GHG gases in the second half of this century.

In Decision No 269/2019 of 25 October 2019, EU, Iceland and Norway formally agreed to extend the climate cooperation by including the Effort Sharing Regulation[2] and the

[2] Regulation (EU) 2018/842 of the European Parliament and of the Council of 30 May 2018 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to

Regulation on greenhouse gas emissions and removals from Land Use, Land Use Change and Forestry (the LULUCF-regulation)[3], into Protocol 31 of the EEA Agreement. By this decision, Iceland and Norway are taking action to fulfil our emission reductions of an at least 40 per cent reduction of greenhouse gas emissions by 2030 compared to 1990 levels.

According to the Agreement, Norway will fulfil our greenhouse gas emission reduction commitments for the period 1 January 2021 to 31 December 2030 in accordance with the LULUCF-Regulation and the Effort Sharing Regulation.

Under the Effort Sharing Regulation, Norway will have a commitment to reduce 40 percent of emission in the non-ETS-sectors in 2030 compared to 2005. Under the LULUCF-regulation, Norway shall ensure that emissions do not exceed removals, according to the accounting rules and flexibilities provided.

Norway has a target of becoming a low-emission society by 2050. In quantitative terms, the target is to achieve emissions reductions of the order of 80 - 95 percent from the level in the reference year 1990. The effect of Norway's participation in the EU ETS is to be taken into account in assessing progress towards this target.

The Government issued a low emission strategy for 2050 in October 2019[4], which states that in 2050; "Areas, forest and resources are managed in a sustainable manner that gives high removals and low emissions. Our land areas stores carbon and supplies materials, food and energy". The Government is planning to initiate a comprehensive assessment of low emission development aligned with the targets for 2050 within relevant sectors and policy areas.

Norway does not have any specific milestones for the year 2040, and therefore no such milestones will be described.

A.2.2 Legal frameworks

A wide range of measures, including legislation, taxation, economic support schemes, research, extension services and administrative procedures, support the implementation of land use and forest policy and mitigation actions.

A.2.2.1 The Forestry Act

The current Forestry Act was adopted by the Norwegian Parliament in 2005 and entered into force in 2006. Its main objectives are to promote sustainable management of forest resources with a view to promote local and national economic development, and to secure biological diversity, consideration for the landscape, outdoor recreation and the cultural values associated with the forest. The Forestry Act also contributes to the conservation of

climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No 525/2013

[3] Regulation (EU) 2018/841 of the European Parliament and of the Council of 30 May 2018 on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry

[4] Prop.1 2019-2020) Ministry of Climate and Environment

biodiversity and the sustainable use of natural resources. The Forestry Act requires the forest owner to regenerate areas within three years after harvesting.

A regulation under the Forestry Act states specific requirements for sustainable management of Norwegian forests. Another regulation requires forest owners to set aside between 4 and 40 per cent of the revenues from harvested timber into a Government administered fund, The Forest Trust Fund. A significant tax relief is granted through the Forest Trust Fund to secure long-term investment in sustainable forest management. The Forest Trust Fund is the property of the forest owners, but the use of the fund is regulated allowing only for specific purposes such as planting, road building, management planning, non-commercial thinning and other silvicultural activities.

A.2.2.2 The Land Act

The purpose of the Land Act is to provide suitable conditions to ensure that the land areas in the country including forests and mountains and everything pertaining thereto (land resources) may be used in the manner that is most beneficial to society and to those working in the agricultural sector.
Land resources should be disposed of in a way that ensures an appropriate, varied system of use with a view to the development of the local community and with emphasis on settlement, employment and effective solutions.

Ensuring that resources are used in a manner beneficial to society involves disposing the resources in a way that considers the needs of future generations. Land resource management shall be environmentally sound and, among other things, take into consideration protection of the soil as a production factor and preservation of land and cultural landscapes as a basis for life, health and well-being for human beings, animals and plants.

A.2.2.3 General legal framework for land use planning

The Planning and Building Act is the main legal instrument for the other land use categories. The purpose of the Planning and Building Act is to promote sustainable development, with an emphasis on long-term solutions. Land-use planning is a cross-sectoral activity, and land use and development patterns have a strong influence on transport needs and the choice of modes of transport. Thus, planning processes under the Act may influence greenhouse gas emissions for a long time to come, including emissions from important sources such as transport, stationary energy use, and land use, land-use change and forestry (the LULUCF sector).

Under the Act, decision makers have the primary responsibility for weighing up the importance to be given to various relevant considerations and interests. Reducing greenhouse gas emissions must be balanced towards other interests. To ensure that planning processes give sufficient weight to climate change concerns, the Government has adopted central government planning guidelines for coordinated housing, land-use and transport planning by municipalities and counties. There are also central government

planning guidelines on municipal and county climate and energy planning and climate adaptation. These guidelines requires municipalities to include measures to reduce greenhouse gas emission as well as implementing measures and policies to reduce deforestation and to increase carbon sinks in forest and other land use.

To inform spatial planning decision making processes, LULUCF-inventories have been developed and made available for all municipalities, as well as simple LULUCF calculation tools. This tool can calculate emissions or sinks related to land use and land use change.

A.2.2.3 Voluntary certification schemes

The timber value chain in Norway demand certified timber. Therefore, two voluntary certification schemes are present in Norway in addition to the laws and regulations. The schemes are the Program for the Endorsement of Forest Certification (PEFC) and the Forest Stewardship Council (FSC). Practically all forest properties in operation are covered by the PEFC certification. This amounts to a total of 7.3 million hectares of forest, of which 6,0 million hectares are productive forests. PEFC's Forest Standard applies to forest owners, contractors and other employees in the industry. The standard has a list of 27 requirements for managers' responsibility and planning, harvesting and forestry measures and specific environmental values.

About 100 forest properties are certified through both PEFC and FSC. This includes 0.44 million hectares of forest. The FSC certification applies to end consumer products, and the Norwegian FSC certification is under development. It has a list of requirements covering sustainability, social, managerial and environmental aspects. This means that almost all timber logs sold in Norway are certified.

A.2.3 Existing measures in forest land areas and carbon storage in harvested wood products

A.2.3.1 Support schemes for sustainable forest management

Tax relief and economic support is provided for a range of activities supporting sustainable forest management. Some of these activities also affect climate change mitigation. This funding is provided through the national budget to e.g. forest roads and tree planting, payments for ecosystem services and silviculture.

Three climate specific measures impacting increased removals of CO_2 in forest have received financial support over the last years, notably higher seedling density, forest tree breeding programme and fertilization of forests. The support schemes are subject to annual Parliamentary appropriations.

A.2.3.2 Higher seedling densities in existing areas of forest land

Higher seedling densities for forest regeneration increases the growing stock and CO_2 removals by forest. In 2016, a grant scheme was launched to increase the seedling density used for regeneration after harvesting. This measure forms part of ordinary planting after harvesting, and thus does not involve afforestation. Higher seedling densities have only a

modest effect in the short term. The total potential has been calculated to increase removals by 45 000 tons in 2030. In the longer term, however, it has greater potential, estimated at nearly 700 000 tonnes CO_2 in 2050, and the maximum increase in annual CO_2 removals of around 2 million tons of CO_2 in 2100. However, the total potential is not yet released. Based on statistics for 2017 and 2018, about 50 per cent of the total regeneration area has been covered by this scheme. This means that the accumulated effect of CO_2-removal will be equivalently less than the former calculated potential.

A.2.3.3 Forest tree breeding

Tree breeding involves making use of the genetic variation in forest trees to produce seeds that are more robust and give higher yields than non-improved seed from ordinary forest stands. High-quality seeds have been produced in seed orchards, making it possible to develop forest where tree survival rate is high, timber quality is better and growth in volume is 10–15 percent larger. If more effective tree breeding techniques are used, it may be possible to increase the growth in volume by 20 percent or more. Thus, tree breeding is a way of increasing CO_2 removals by forests. In addition, it is possible to ensure that forest reproductive material is resilient to future climate change. Given these assumptions, it is estimated that the present level of annual financial support gives an estimated increase in CO_2 removals of 232 000 tones CO_2 per year by 2050 and 1.4 million tonnes CO_2 annually per 2100. The most important tree species in Norwegian forestry is Norway spruce (≈50 percent of the growing stock and 93 percent of the planted seedlings). More than 90 percent of the spruce trees that are planted annually originate from improved seeds.

A.2.3.4 Fertilization of forest as a climate mitigation measure

On forest land where growth is limited by the availability of nitrogen, using nitrogen fertiliser will increase both diameter and height growth, and boost annual CO_2 removals over a ten-year period. A grant scheme for fertilisation of forest as a climate mitigation measure was started in 2016. It is designed to meet recommended environmental criteria and avoid unacceptable effects on biodiversity and the environment otherwise. It was estimated that fertilisation of 5 000-10 000 hectares of forest will give an additional CO_2 removals of 14 000 - 27 000 tonnes a year up to 2026. Assuming that 10 000 hectares is fertilised every year from 2018 onwards, the additional CO_2 removals will be 270 000 tonnes a year from 2027 onwards. The existing area for fertilisation has been between 5000 – 9000 ha per year. The decline is partly due to environmental criteria that set a cap for fertilization in South-eastern part of Norway, where it is assumed that excessive nitrogen can run-off and cause eutrophication in Skagerak Sea. If a level of 5000 ha will be pursued in the future, it gives a total removal of CO_2 for 50 per cent of the total potential calculated.

A.2.3.5 Following up obligations relating to regeneration after harvesting

Regeneration after harvesting is important to maintain or increase the long term carbon stock in forest and to ensure the availability of environmentally friendly raw materials and building materials in the future. After harvesting, forest owners are required to ensure satisfactory regeneration within three years.

The Norwegian Agriculture Agency has strengthened inspection routines to check compliance with regeneration obligations. Guidelines have been issued for the conversion of forest land to pasture to ensure that areas are not removed from the scope of the forestry legislation in order to evade regeneration obligations. This has resulted in an increased planting activity over the last few years. The Government will continue to improve routines for following up forest owners' obligations to regenerate areas after harvesting, to ensure that a high level of CO_2 removals is maintained in Norwegian forests.

A.2.3.6 Conservation of forest areas

The government has an aim of protecting 10 percent of the forests. This is important both for the conservation of reservoirs and protecting endangered species and biodiversity. The conservation is done at a voluntary basis both in privately-owned forests and state-owned forests. The Nature Diversity Act provides formal, long-term protection of forests as nature reserves. The 10 percent target is long-term, and as of October 2019, 4.9 percent of the total forest cover was protected, out of which 3.7 percent is productive forest area. If the current pace in the protection is continued, the aim of 10 percent protection will be reached by around 2035.

A.2.3.7 Carbon storage in harvested wood products (HWP)

Wooden building materials and paper and cardboard products store carbon throughout their lifetime. Norway has a long tradition of using wood in single-family homes and other smaller buildings, for example smaller commercial buildings and farm buildings. In recent years, the development of new technology has also made it possible to use timber in larger buildings and other structures. Using laminated and cross-laminated timber, makes it possible to build higher structures, and also long bridges. Problems relating to fire safety, durability and load-bearing capacity, which have previously limited the use of wood, have now largely been solved. Nevertheless, studies show that factors such as a lack of standardisation and industrialisation, a lack of expertise in the industry and a lack of pre-approved solutions are acting as barriers to greater use of wood in larger, urban buildings and other structures. However, these markets are develops quickly and an increase in tall and large wooden buildings are expected. Since the early 2000s the Government has developed support schemes to promote increased use of wooden materials in constructions.

B Content

B1. Land use, Land Use Change and Forestry (LULUCF)

B.1.1 Projected emission reductions and enhancement of removals by 2050

B.1.1.1 Historical trend and overarching numbers

According to the National Inventory Report to the UNFCCC, the LULUCF sector contributed in 2017 to net removals of 25 million tonnes of CO_2 equivalents, which correspond to almost half of the national GHG emissions that year. Forest land was the major contributor to the net sequestration of CO_2 in the sector. The total net removals from forest land were 29.1 million tons of CO_2 equivalents, an increase from 11.5 million tons CO_2 equivalents in 1990. Since 1990, the carbon stock in living biomass in the LULUCF-sector has increased by around 30 per cent. The steady increase in living carbon stock is the result of an active forest management policy over the last 60–70 years. The combination of the policy to re-build the country after the Second World War II and the demand for timber led to a great effort to invest in afforestation, as well as to replanting after harvest on existing forest land. A total accumulated area of 0.4 million hectares have been afforested since 1952, mainly along the West coast of Norway. These trees are now at their most productive age and contribute to the increase in living biomass, and hence the forest carbon stock.

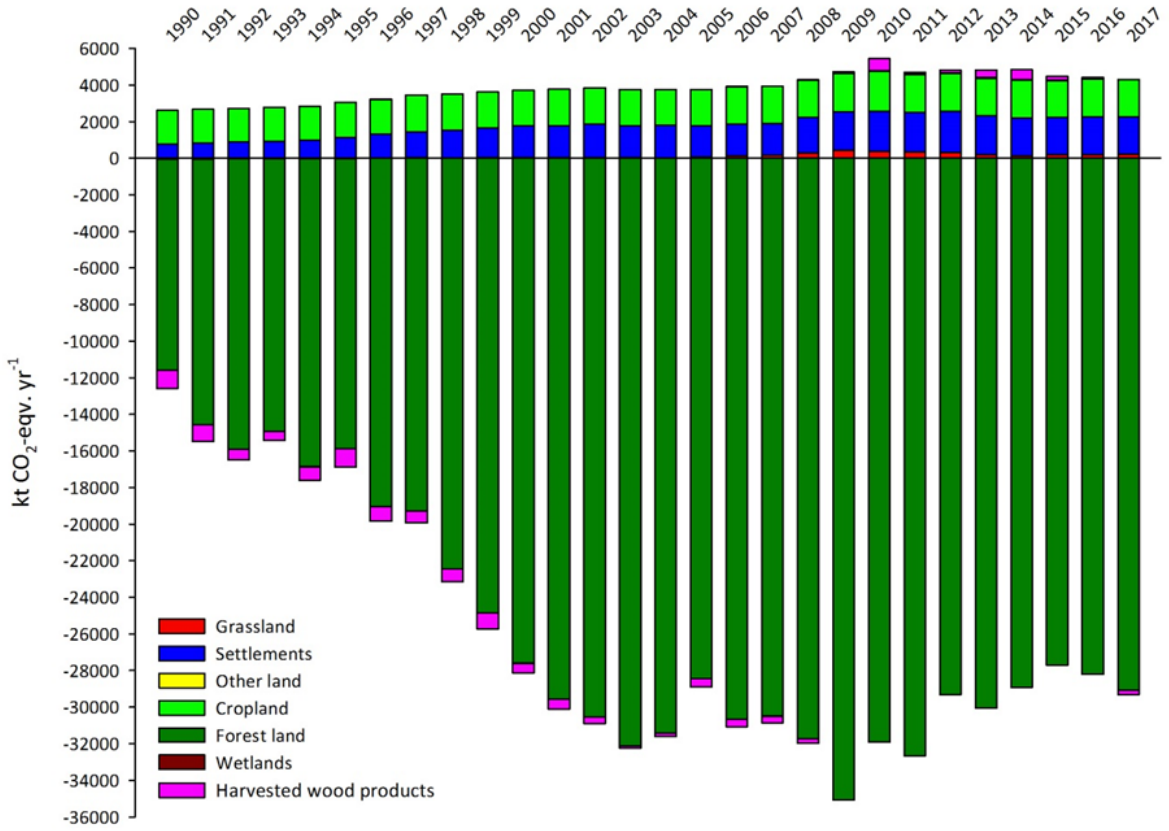


Figure 1: Net CO_2 emissions and removals (kt CO_2-equivalents per year) from the LULUCF sector by land-use category (forest land, cropland, grassland, wetlands, settlements, other land, and harvested wood products) from 1990 to 2017, including emissions of N_2O and and CH_4. Source: Norwegian Institute of Bioeconomy Research

Forest land is the category that constitutes the largest carbon sink, and emissions from settlements and cropland are the largest emission sources.

In the period 1990-2015 the annual deforestation area in Norway was an average of 58 km2 (NIBIO 152 / 2017). This gives an emission of approximately 2.4 million tonnes CO_2-

equivalents a year. Settlement was the main cause of deforestation, with a 68 per cent of the deforested area. Grassland accounted for 18 per cent and cropland accounted for 13 per cent of the deforested areal.

Norway's reporting to the UNFCCC has for many years shown net removals in the HWP sector. However, in the period 2009 to 2016 this situation changed, due to restructuring of the Norwegian pulp and paper industry and increasing exports of raw timber for pulp and paper production. Processing abroad is not included in the HWP accounts, and hence the carbon stocks in the HWP sector was reduced for some years between 2009-2016. Since paper has a short lifetime before oxidation, the carbon stocks in the HWP sector stabilize quickly, and from 2017 the sector show net removals again after the restructuring of the industry.

The figure below illustrates historical forest fellings, annual increment and total standing volume. The figure shows that the annual tree harvest has been at a lower level than the annual increment in Norwegian forests and that the standing volume has tripled over the last century.

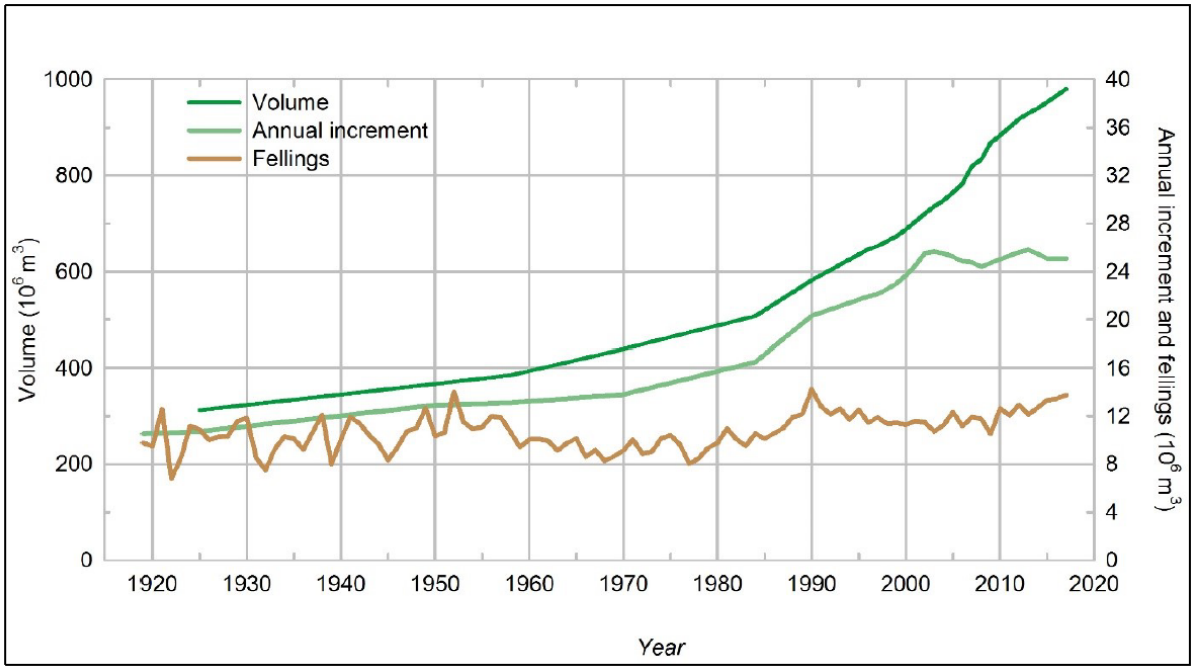


Figure 2: Forest fellings, annual increment and total standing volume, 1919–2016. The 2014 value is the middle year in the National Forest Inventory cycle (2012-2016) for volume (without bark) and annual increment. The values for the two last years are extrapolated. Source: NIR 2018, Norwegian Institute of Bioeconomy Research and Statistics Norway.

B.1.1.2 Projections for 2030 and 2050

New emission projections for the LULUCF sector was released from the Norwegian Institute of Bioeconomy Research (NIBIO) in December 2019[5]. The projections are based on the accounting rules of the climate convention, and calculate the projected emissions of all

[5] Søgaard, G.; Mohr, C. W.; Alfredssen, G.; Antón Fernández, C.; Astrup, R.; Breidenbach, J.; Eriksen, R.; Granhus, A.; Smith, A.. 2019. Framskrivninger for arealbrukssektoren – under FNs klimakonvensjon, Kyotoprotokollen og EUs rammeverk. NIBIO Rapport 5(114).

greenhouse gas emissions in the LULUCF sector from 2018 to 2100. The projections include all land categories, and take the following policy measures into account: Improved seedling density, use of improved seed material in regeneration after harvest, N-fertilization of forest and the establishment of 10 percent protected forest area.

The Norwegian Institute of Bioeconomy Research (NIBIO) based the projections on the best available and most updated data and models. Trends in land-use change and emission factors were established based on data from National Inventory Report 2019, using 2010 – 2017 as a reference period. The projections is based on the SiTree simulation tool, the most recent numbers from the The National Forest Inventory (NFI) database and the RCP 4.5 climate scenario. (NIBIO 2019). The methodology for the calculations of the projections is described in more detail in chapter B1.6.

Figure 3 shows development in net emissions for the LULUCF-sector by each land use category as reported under the UNFCCC, illustrated in CO_2-eqvivalents, covering the greenhouse gases CO_2, CH_4 and N_2O.

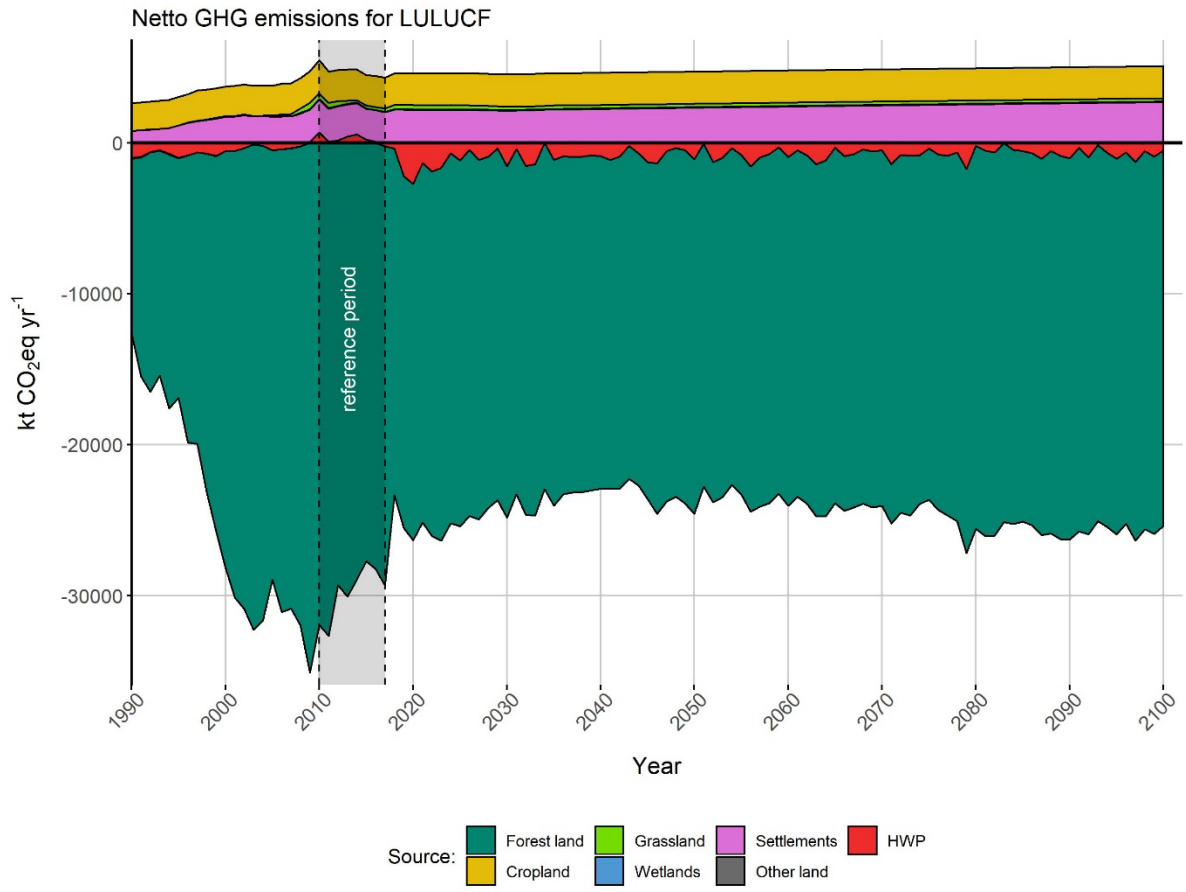


Figure 3: Total net emissions from all categories, including CO_2, N_2O and CH_4, expressed as CO_2-eqvivalents historical data (NIR 2019) and projections. The historical data is from National Inventory Report 2019. The figure shows emissions from areas in transition and areas remaining in their category (i.e. was the same category in 1990, or changed category more than 20 years ago). Source: Norwegian Institute of Bioeconomy Research.

	1990	2005	2010	2017	2020	2030	2050
LULUCF	-10,0	-25,1	-25,5	-25	-21,7	-20,3	-19,9

Table 1: The total net removals of the LULUCF-sector for the historic period 1990, 2005, 2010 and 2017 and projections for 2020, 2030 and 2050.

The projections indicate that the carbon sink capacity of the forest has reached a peak. A lower number of planted trees the last decades compared to the post-war decades, together with a changed age structure of the forest and increased harvest, may be some of the main reasons for the decrease in the carbon sequestration towards 2040-45. The projections from NIBIO, indicate that the forests' capacity to act as a forest sink is projected to increase again towards 2100. There are several factors driving this, such as the implementation of new forest management measures, a changed age class structure and better growing conditions due to global warming.

The projections also show that the largest land use change is from forest land to settlements. The settlements are expected to increase to approximately 70 000 hectares, or by 11 percent, by 2030 compared to the 2010-2017 baseline. By 2050, the increase may be 150 000 hectares or 22 percent. The corresponding emissions are illustrated in figure 5 in chapter B.1.2. Population growth may be a reason for this development.

There may also be a significant land use change from other land to forest land since the maximum altitude of the treeline will increase due to warmer climate, trees will grow in mountainous areas that previously have not been forest land. Thus, the projections show that the net change may be low.

In the following, the projections of each land use category according to the UNFCCC is given, and the individual gases are illustrated. The projections are based on the trends observed in 2010–2017 in the latest National Inventory Report. The same land-use changes serve as a basis for further calculation of the accounting categories in the EU LULUCF Regulation.

B.1.2 To the extent feasible, expected emissions by sources and by individual GHGs

The figures below are based on UNFCCC categories in order for them to correspond with the reported historic development. However, the projection report (NIBIO 2019) includes also the projected removals and emissions for the land use categories under the LULUCF-regulation[6].

[6] For a description of the land use categories in the LULUCF-regulation, please see the EU Regulation 2018/841 of the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework.

There are large uncertainties in these projections, especially in the longer term. More details regarding these uncertainties are described in chapter B.1.7.

Forest land

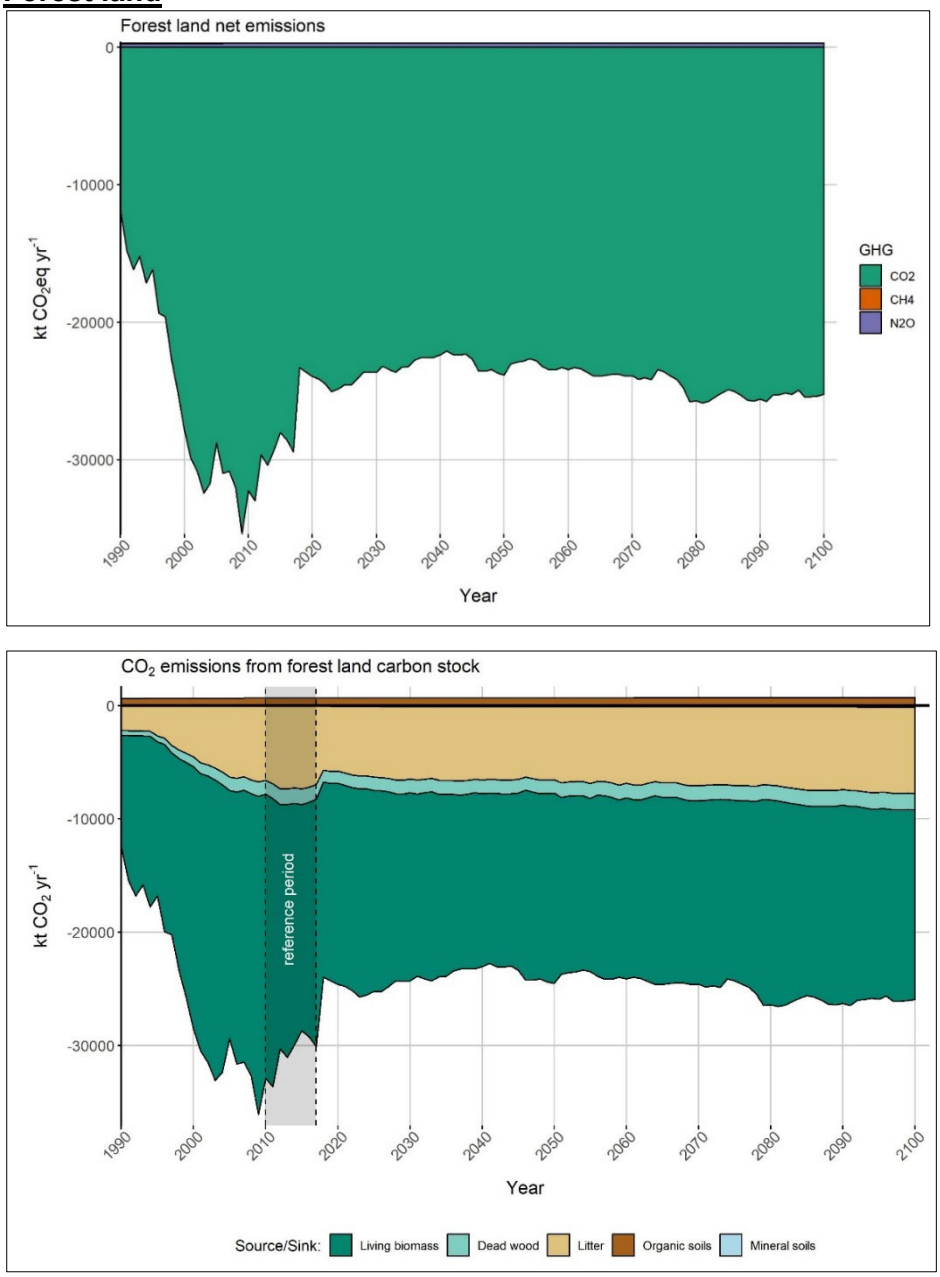


Figure 4: Forest land: The top figure shows projections of removals and emission of forest land by the individual greenhouse gases, and the bottom figure gives the net emissions by each source. Source: Norwegian Institute of Bioeconomy Research.

The figure includes removals and emissions from areas in transition (i.e. from cropland, grassland, settlement, wetlands and other lands) as well as forest land remaining forest land.

In forest land, living biomass, dead wood and litter contributes with a net removal of CO_2, whereas drained organic soils contribute with net emissions. The emissions from drained organic soils is expected not to increase due to a ban of drainage of forest land.

Emissions of N_2O come mainly from the fertilization of forests and CH4 mainly come from forest fires.

Settlements

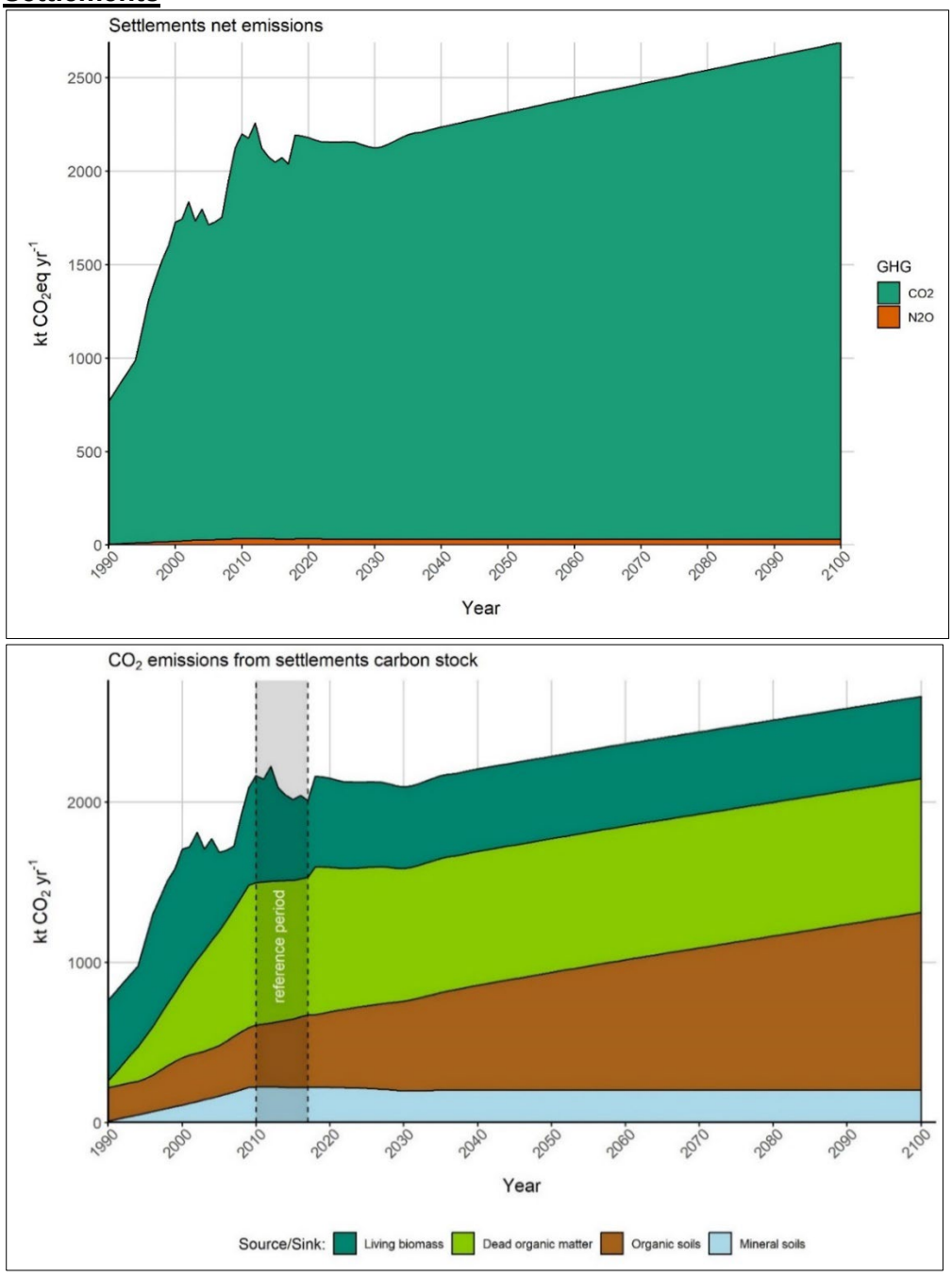


Figure 5: Settlements: The top figure shows projections of net emission of settlements by the individual greenhouse gases, and the bottom figure shows the net emissions by each source. Source: Norwegian Institute of Bioeconomy Research.

The figure includes emission and removals from areas in transition (i.e. from forest land, cropland, grassland, wetlands and other land) and settlement remaining settlement.

The main emission sources from settlements comes from moving or drainage of organic soils and removal of living biomass and dead wood.

The total area of settlements has increased since 1990, and is estimated to continue to grow based on the observed trend in 2010 - 2017. According to the projections it is assumed that forest area in the future will be the largest source of area converted to settlements (73 percent), followed by cropland (11 percent).

Cropland

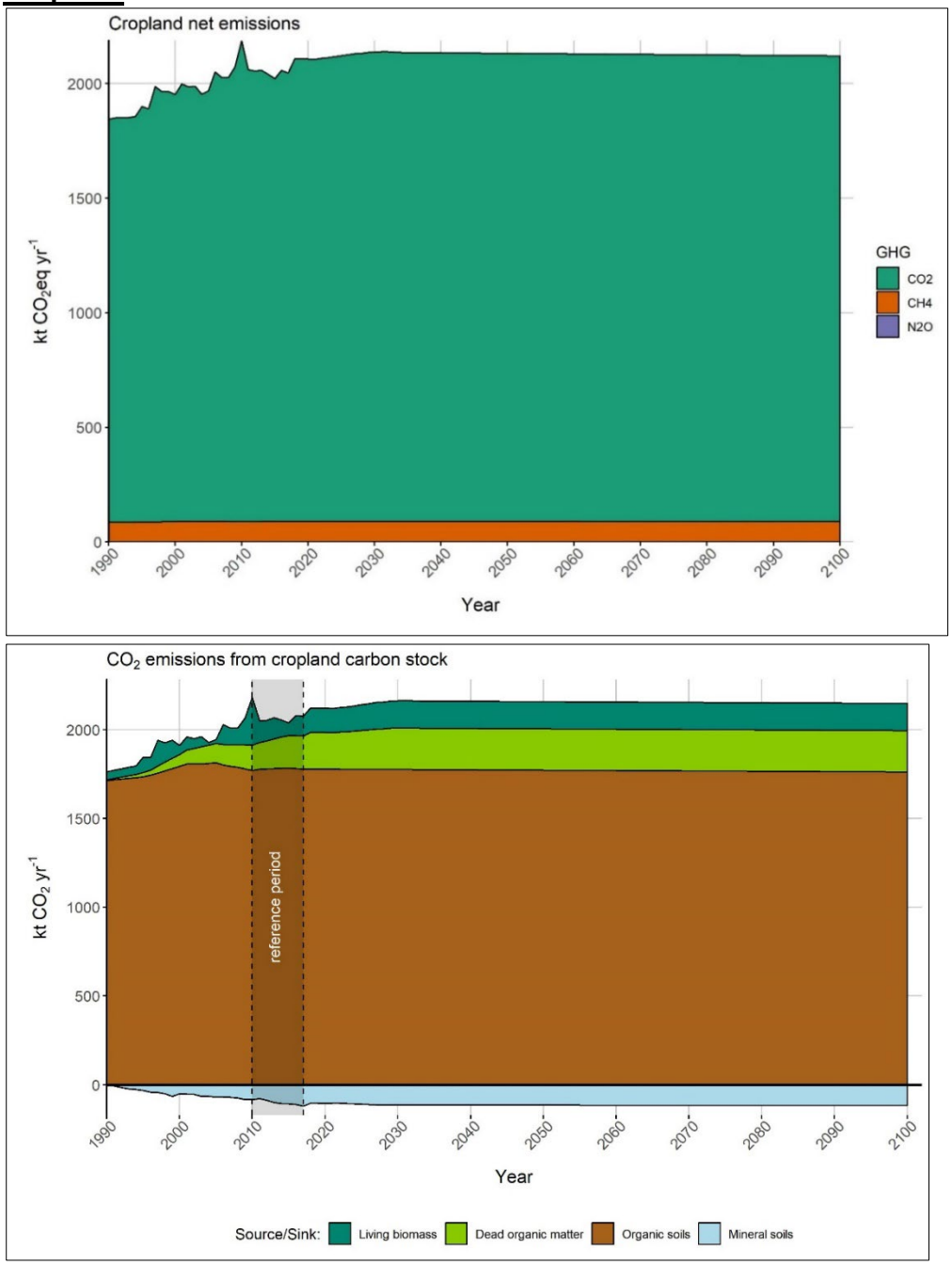


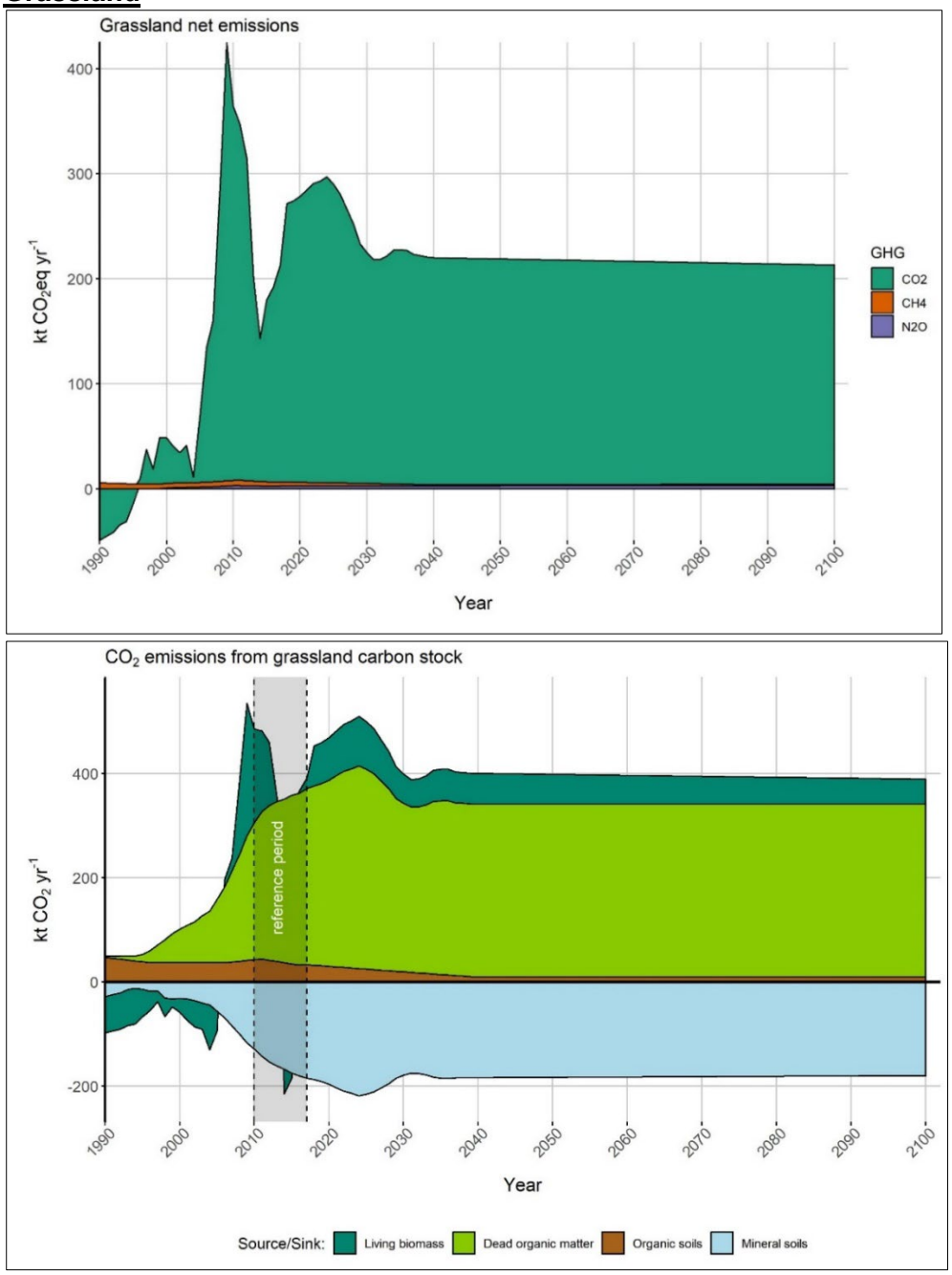
Figure 6: Cropland: The top figure gives the net emission of cropland by the individual greenhouse gases (in CO_2-eq.), and the bottom figure gives the net emissions of CO_2 by each source. Source: Norwegian Institute of Bioeconomy Research.

The figure includes emissions and removals from areas in transition (i.e. from forest land, grassland, settlements and wetlands) and cropland remaining cropland.

According to the projections, net emissions from cropland is assumed to stabilize on the same level from 2020 onwards. The main emission source is drained organic soils. Mineral soils contribute with a small net removal. In addition to the CO_2 emissions shown in Figure 6, there is methane emissions from drained organic soils.

Emissions of nitrous oxide from cropland soils is reported for in the agricultural sector and are therefore not shown here.

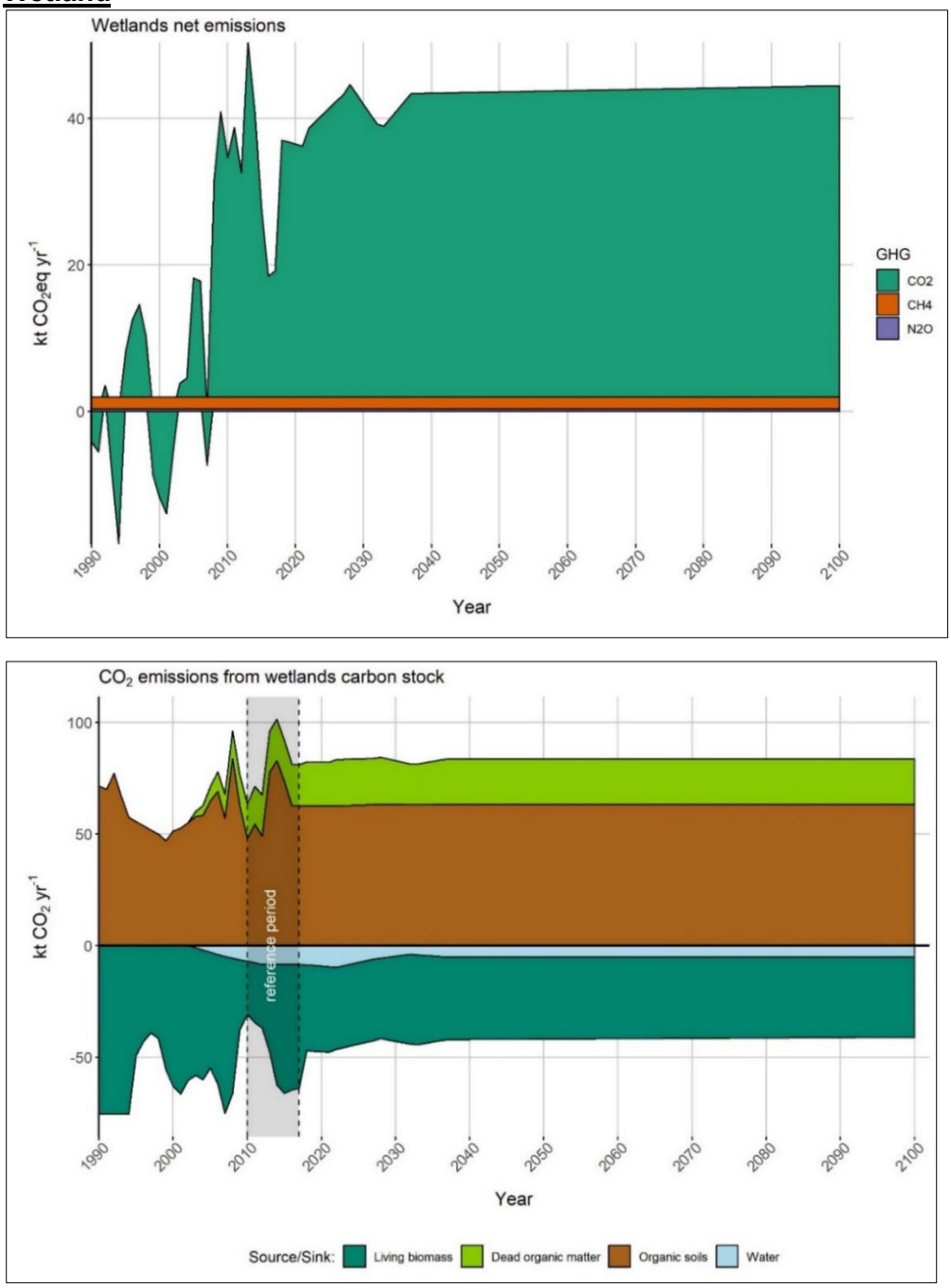
Grassland



Figur 6: Grassland. The top figure gives the net emission of Grassland by the individual greenhouse gases (in CO2-eqv.), and the bottom figure gives the net emissions of CO2 by each source. Source: Norwegian Institute of Bioeconomy Research.

The figure includes emissions and removals from areas in transition (i.e. from forest land, wetland, settlements) and grassland remaining grassland.
The figure illustrate that the net emissions have varied historically; i.e. resulting in both net removal and net emissions. According to the projections, mineral soils is expected to give net removals. Dead organic materials, organic soils and living biomass is expected to give a net emission in the future. It is expected a total net emission from this source.
The emissions of methane and N_2O comes from organic soils

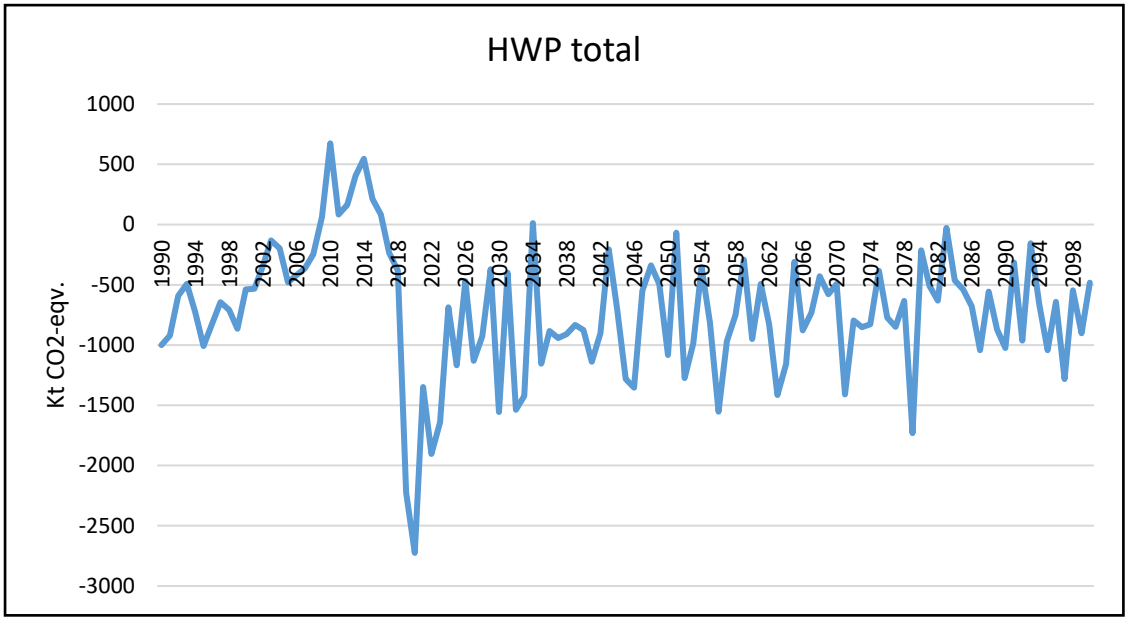
Wetland



Figur 7: Wetlands. The top figure gives the net emission of wetlands by the individual greenhouse gases (in CO_2-eq.), and the bottom figure gives the net emissions of CO_2 by each source. Source: Norwegian Institute of Bioeconomy Research.

The figure includes emissions and removals from areas in transition (i.e. from forest land, other land) and wetlands remaining wetlands. The wetland category has small net emissions and removals, and the balance between emissions and removals has varied in the past. There are large annual variations in the volume of peat extracted (off-site emissions). According to the projections, living biomass is expected to give net removals also in the future, whereas organic soils and dead organic matter is a net emission.
Methane and N2O emissions comes from drained organic soils utilized for peat extraction.

HWP



Figur 8: Annual change in the carbon pool of HWP based on convention (production approach). Source: Norwegian Institute of Bioeconomy Research.

The projections indicate that there will be a net removal from the HWP categories from 2020 onwards. Only harvested wood products produced domestically are accounted for. The peak in 2020 is also due to higher harvesting rates and stabilization of the carbon stocks after a major restructuring of the paper and pulp pr industry 2006-2013. When timberlogs are exported, the domestic HWP carbon stocks are diminished for some years determined by the halftime and the different products.

B.1.4 Emission reduction options and options for enhancement of sinks envisaged

There are ongoing and upcoming processes that will identify further emission reduction options and options for enhancement of sinks.

In 2020 the Government plans to present a White Paper on how to fulfil Norway's 2030 commitments in the non-ETS sectors. To develop a knowledge base for the 2030-plan, the Government has requested the Norwegian Environment Agency to lead a study on possible measures and policy instruments for further emission cuts in the effort sharing sector in Norway before 2030 (so-called Climate Cure 2030, or *Klimakur 2030* in Norwegian). These sectors include transport, buildings, agriculture, non-ETS industry and waste. The LULUCF sector is also encompassed by this study. Relevant agencies and institutions, such as Statistics Norway, the Norwegian Public Road Administration, the Norwegian Water Resources and Energy Directorate, the Norwegian Agricultural Agency and Enova, take part. The mandate is to assess possible measures and policies to reduce the climate emissions with at least 50 per cent in the effort sharing sectors within 2030. For long-term measures within the LULUCF sector, the effects need to be assessed beyond 2030. Measures in the LULUCF sector also need to be considered in light of other sectors' needs for biomass to reach their mitigation targets. The purpose of the assessment is to develop the knowledge base on possible measures and instruments to comply with the 2030 commitments. LULUCF-relevant measures assessed includes silvicultural activities like climate optimal tending of juvenile stands, measures to reduce forest disturbances and calamities (forest fire preparedness, damage from insects and fungi etc), maintenance of ditches and measures to prevent root rot. Earlier assessments complement the upcoming assessment, such as exploring gains and barriers of a possible reintroduction of a former ban of clear cutting juvenile stands.

Below follows a description of other LULUCF measures that are assessed in other processes.

B.1.4.1 Afforestation

In the period 2015-2018, the government asked the Norwegian Environment Agency in close cooperation with the Norwegian Agriculture Agency, to carry out a pilot project for planting trees on new areas. Former calculations indicated a potential increased annual removals of 1.8 mill. tonnes of CO_2 in 2050 within acceptable environmental limits based on an afforestation of 5000 ha/year for 20 years. (100 000 ha total). Afforestation on new areas must be based on thorough assessments to find a balance between climate, environmental and commercial interests. The pilot project has helped identify challenges and opportunities, potential scoping of area and climate effect, as well as updated environmental criteria for planting trees as a climate solution. The governmental platform (Granavolden platform) states that the government will continue the work on planting forests with native tree species, and the next steps for the initiative is currently being assessed by the government.

B.1.4.2 Potential measures related to other land categories

Peatland bogs and mires are important carbon stocks, and three measures are under consideration.

The Government is in the process of implementing restrictions on the cultivation of peatlands in order to reduce the amount of GHG emissions associated with this practice. The agricultural sector cultivates approximately 200 hectares of peatland bogs and mires annually as land-use conversion to agricultural land. The projected effect of the restrictions on national emissions is estimated to 360 000 tons of $CO_2$for the whole period 2021 – 2030, based on the prevention of cultivation of 200 hectares per year. The effect of the restrictions are increasing over time because the emissions from each hectare of drained peatlands continue for decades after the drainage have happened. The projected effect is therefore estimated to be 152 000 tons of CO_2per year around 2050 (based on the prevention of cultivation of 200 ha per year).

Peat extraction caused emissions of 63 000 tons CO_2 equivalents per year in the period 1990-2015, from extraction of approximately 220 000 m^3 peat. The last five years, the extraction has been higher – about 330 000 m^3 per year, causing emissions of 83 000 tons CO_2 equivalents per year. A plan proposal to reduce and eventually phase out the use of peat among gardeners and professional plant producers will be completed by the Norwegian Environment Agency by March 2020. The plan proposal shall describe possible measures in order to phase put the use of peat given there are other relevant products with less negative climate- and environment effects available.

In the period 2016-2020, Norway is implementing a plan to restore wetlands (organic soils) as a climate measure to reduce GHG-emissions and improve the ecosystem functions of such areas.

The reduction of greenhouse gas emissions will be distributed over several decades and is uncertain. The effect in the short term is therefore not estimated. In a long-term perspective the purpose is to turn these degraded peatlands from CO_2 emission sources to sinks. By now, more than 60 peatlands have been restored. An updated plan for restoration 2021-2025 will be developed and implemented.

B.1.5 To the extent it is relevant for the conservation or enhancement, as appropriate, of forest sinks and reservoirs, adaptation policies and measures

Many of the policies and measures mentioned above are relevant for the conservation and enhancement of forest sinks and reservoirs.

Norway has decided to conserve 10 percent of the forest area and is also in a process to reduce emissions from peatland bogs and mires.

For forests and forestry, climate change means both increased risks and new opportunities. The rapid rate of climate change may overcome the natural ability of forest ecosystems to adapt. Climate change increases the pressure on the land sector. It leads to increased risk of disturbances through storms, fire, pests and diseases with implications for forest growth and production. The economic viability of forests will be affected, as well as the capacity of forests to provide environmental services, including changes in the carbon sinks and reservoirs. Actions to maintain and enhance forest resilience and adaptive capacity are among the measures identified to ensure sustainable forest management.

Norway has several preparedness plans in place to address events like forest fires, storm fellings and bark- beetle outbreaks. For instance, the forest fire preparedness plans includes forest fire troops and equipment at the local level, and governmental financed aerial support and incident commander support to assist the local chief fire officer. The Norwegian Civil Defense has 8000 men and women that can support local municipalities with troops and gear, and there are obligations for the municipalities to have sufficient preparedness plans to prevent forest fires.

Norway has also preparedness plans to prevent bark- beetle outbreaks. Salvage logging and removal of infested spruce timber before hatching of new bark-beetle generations are important actions. These plans will be carried out after storm fellings or drought in order to reduce the risk of following insect attacks on remaining forests. The bark-beetle populations in Norwegian forests are monitored continuously and reported to relevant stakeholders.

B.1.6 Aspects related to market demand for forest biomass and impacts on harvest

The Government's bioeconomy policy (2016) includes sustainable, efficient and profitable production, extraction and use of renewable biological resources for food, feed, ingredients, health products, energy, materials, chemicals, paper, textiles and other products. The bioenergy policy has pledged to utilise the potential for increased, profitable and more efficient production, extraction and use of renewable biomass from agriculture, forestry, fisheries and aquaculture within sustainable boundaries.

The Government will promote more use of wood in buildings and consider measures that can play a part in increasing the carbon stock in long-lived wood products. Innovative use of wood is a strategic prioritized area of opportunities in the development of a national bioeconomy scheme.

A wood based Innovation Programme is included in this scheme. This program shall as far as possible encourage synergies across established sectors, industries and disciplines, and have a holistic approach to different stages in the value chain. Currently, the government is assessing the use of low-emission materials in Norway, to evaluate how to reduce barriers and develop possible measures for increased use of low-emission materials in construction projects.

Bioenergy and advanced biofuels in particular, will increase the demand for forest biomass. The government has introduced a quota obligation for biofuels in road traffic with a sub-target for advanced biofuels. The quota obligation was introduced in 2009, committing the economic operators to sell at least 2.5 percent biofuels as a share of the total yearly amount of fuel sold for road transport. This share was increased to 12 per cent from 1 January 2019, and 20 percent from 1 January 2020, including double counting of advanced biofuels. The Parliament has decided to increase the quota obligation from 1 July 2020 to a level that is not below the level of biofuels sold in 2019.

A sub-target was introduced in the quota obligation on 1 January 2017, requiring at least 0.75 percentage points of the quota obligation (without double counting) to be met by the use of advanced biofuels. This sub target increased to 4 percent from 1 January 2020. In the quota obligation, 'advanced biofuels' means biofuels that are produced from the feedstock listed in Part A and part B of Annex IX in the EU ILUC-directive (Directive (EU) 2015/1513). As of 1 January 2014, sustainability criteria must be met by all biofuels and bioliquids included in renewable energy obligations or government support schemes. The sustainability criteria are the same as the EU criteria implemented in the Fuel Quality

A quota obligation to sell at least 0.5 percent advanced biofuels for aviation will enter into force from 1 January 2020. Advanced biofuels can be made of forest-based feedstock and several companies have research activities, pilot plant activities as well as plans for investments in biofuel plants in Norway.

Bio4Fuels is one of eight centres for Environment-friendly Energy Research, and is funded by the Research Council of Norway and through a number of its industry partners. Bio4Fuels aims to develop viable technologies that are relevant for the sustainable commercial conversion of biomass feedstocks to biofuels and other products.

The Government has claimed to improve the incentives for enhanced use of bio-energy derived from woody biomass, with particular emphasis on utilization of forest residues (slash). To use the forest residue for energy will improve the total efficiency of the use of forest resources and is thus an important climate measure. Increased utilization of forest residues (slash) will temporarily reduce the forest carbon stocks and end up as instant emission from forestry, but will supply products that can substitute fossil energy in other sectors.

Severe bark-beetle outbreaks in parts of Europe cause large-scale salvage logging that affect timber markets and disrupt timber supply. Timber prices have already been affected in a manner that will influence the harvest level in adjacent areas in the marked, -both in the short and longer term. Such incidents can cause fluctuations in the harvest levels in Norway. Despite preparedness plans as described previously, severe bark beetle outbreaks, storms and other damages can also affect the harvest level in Norway and impact the timber market.

Marked demand for forest biomass must also be considered in light of other sectors' needs for biomass to reach their mitigation targets. This demand will be analysed and summarised in the Climate Cure 2030 process.

B.1.7 As necessary, details on modelling (including assumptions) and/or analysis, indicators etc.

The main source for activity data in the national greenhouse gas inventory is the National Forest Inventory (NFI) which is documented and described in detail in the national greenhouse gas inventory. The NFI utilizes a 5-year cycle based on re-sampling of permanent plots. The same plots are distributed across the country in order to reduce the periodic variation between years, and each year 1/5 of the plots are inventoried. The current system with permanent plots was put in place between 1986 and 1993, and made fully operational for the cycle covering the years 1994 to 1998.

The latest projections (NIBIO, 2019) are based on the SiTree model, updated numbers from the National Forestry Inventory and the RCP 4.5 climate scenario.

In the National Forestry Accounting Plan, the general approach for constructing the forest reference level was to forecast the development and management of the NFI plots and then apply the same methods for estimating emissions of the different pools as in the national greenhouse gas inventory. The last projection is based on similar methodology and assumptions as the forest reference level (FRL) in the national forest accounting plan (NFAP), but some changes have been implemented to reflect the latest updated information on the Norwegian forest. The main differences between the FRL and the last projection are different reference periods, current measures adopted and not accounted for in the FRL, including fertilization, improved genetic material, and higher density in plantations, as well as an increase in protected areas.

Climate data is used in forecasting both the individual tree development. Climate data for the simulations follow the IPCC scenario RCP 4.5 downscaled to a 1 by 1 km grid for Norway.[7]

For HWP the ratios between the different product categories are calculated based on data from FAOSTAT.

The SiTree model is an individual growth simulator, and imputation methods to project the future growth, mortality, ingrowth, and natural regeneration. The emissions and removals of total soil organic C (dead wood, litter, and soil pools) from forest land on mineral soil are estimated using the decomposition model Yasso07 (NIBIO 2019).

The method applied to run both the FRL and the last projections is chosen to produce the most accurate results for short term simulations. This method results in higher uncertainties for long term simulations.

[7] The utilized downscaled climate data is freely available at www.senorge.no/aboutSeNorge.html?show=on

There are two types of uncertainty related to the projections. Firstly, there are uncertainties related to the activity data and calculation methodologies, and secondly, there are uncertainties related to methodologies used for the projections, for instance choice of reference period. The projections are based on existing policies, and are exclusively based on trends in historical data. They do not take developments within other sectors into account. Changes in policies, such as an introduction of a ban against peat production, or changes in the grant schemes for forestry, may have a direct effect on the emission levels from the LULUCF sector. Other changes, such as economic fluctuations, increased demand for biomass from other sectors may have indirect effects by increasing demand for wood products or increasing pressure on new land for settlements.