

Greenhouse gases

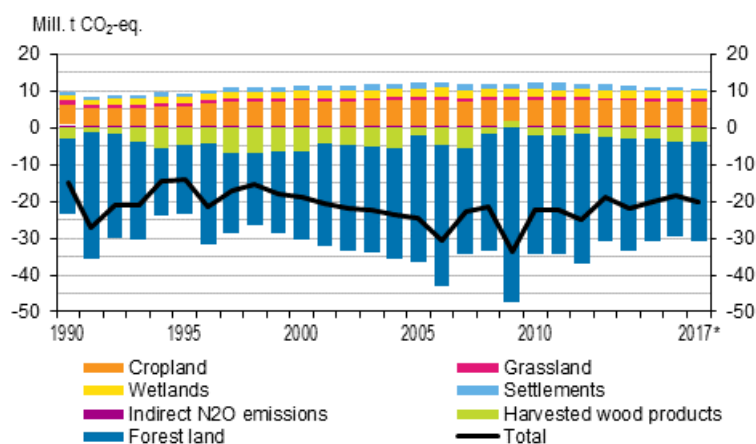
2017, land use, land use change and forestry, preliminary

Sink of the land use, land use change and forestry sector 20 million tonnes of carbon dioxide

Corrected on 15 January 2019. The corrected number is indicated in red.

According to Statistics Finland's preliminary data, the net sink of greenhouse gases in the land use, land use change and forestry sector (LULUCF) was 20.4 million tonnes of carbon dioxide equivalent (CO₂ eq.) in 2017, which was 5.6 million tonnes or 38 per cent more than in the comparison year 1990. The net sink of this sector increased by 10 per cent from the previous year. Fellings and the increase in the growing stock on forest land determine the size of the sector's net sink, which varies yearly particularly by the volumes of fellings. The introduction of the latest National Forest Inventory data decreased the net sink of forest land in the last few years compared to previous releases. In addition, the described methodological changes decreased the level of the net sink of forest land throughout the time series. Other land use categories than forest land mainly produce emissions, and they vary by year less than removals and emissions from forest land. The data in this release supplement the release of 11 December of other sectors' emission data and are part of the preliminary report to be submitted by Statistics Finland to the European Commission on 15 January 2019 concerning emissions in 2017.

Figure 1. Sum of greenhouse gas emissions and removals in the land use, land use change and forestry sector (LULUCF sector) in 1990 to 2017 (million tonnes of CO₂ eq.) Negative figures indicate removals from the atmosphere, that is, the sector acts as the net sink of carbon.



* Preliminary data. Emissions are positive and removals negative figures.

The land use, land use change and forestry sector (LULUCF) comprises six land use categories, that is, forest land, cropland, grassland, wetlands, settlements and other land (Table 1). Forest land is the most significant net sink of the sector, that is, its removals from the atmosphere exceed emissions. Removals refer to removals of greenhouse gas emissions from the atmosphere, for example, being bound to vegetation. Outside forest land, the most significant emissions come from fields on organic soil, i.e. peat, in cropland, while the contribution of other land use categories to the emissions and removals of the LULUCF sector is small.

According to preliminary data, the net sink of land use, land use change and forestry sector (LULUCF), that is, the sum of emissions (positive figures in Table 1) and removals (negative figures) of greenhouse gases grew by 10 per cent from the previous year. The variation between years in net sinks has been 1 to 23 per cent in the 2010s. Fellings and the increase in the growing stock on forest land determine the size of the whole sector's net removals, which varies yearly particularly by the volume of fellings. The combined emissions and removals of forest land were **-27.0** million tonnes of carbon dioxide equivalent (CO₂ eq.) in 2017, that is, the net sink was five per cent greater than in the year before and 33 per cent greater than in 1990. Net removals by harvested wood products were -4.0 million tonnes of carbon dioxide in 2017. Other land use categories of the LULUCF sector, especially cropland, mainly generated emissions but they vary less by year (Figure 1).

Table 1. Sums of emissions and removals in the land use, land use change and forestry sector (LULUCF) sector (+, net emission to the atmosphere, -net removal from the atmosphere) by land use category in 1990, 1995, 2000, 2005, 2010, 2015, 2016, 2017 (million t CO2 eq.)

		1990	1995	2000	2005	2010	2015	2016	2017 ¹⁾
		million tonnes of CO2 equivalent							
Forest land		-20.3	-18.4	-23.6	-34.6	-32.2	-28.3	-25.7	-27.0
Biomass									
	mineral soils	-16.7	-10.7	-12.0	-22.7	-22.0	-13.7	-10.4	-10.6
	organic soils	-11.2	-12.5	-15.2	-17.4	-15.4	-13.4	-13.3	-13.6
Soil, litter and dead wood									
	mineral soils	-8.8	-9.5	-8.9	-6.4	-4.9	-9.2	-9.4	-10.0
	organic soils	12.8	10.8	9.1	8.6	7.3	5.1	4.7	4.3
CH4 and N2O emissions from drained forest land		3.5	3.4	3.3	3.1	2.9	2.8	2.8	2.8
Other		0.03	0.02	0.02	0.02	0.03	0.02	0.02	0.04
Cropland		5.4	5.6	7.4	7.5	7.7	7.1	7.2	7.3
Soil and litter									
	mineral soils	0.1	0.2	1.3	0.7	0.7	0.4	0.4	0.5
	organic soils	5.2	5.1	5.3	5.8	6.0	6.3	6.3	6.4
Other		0.2	0.3	0.9	1.0	0.9	0.4	0.5	0.4
Grassland		0.9	0.8	0.7	0.8	0.7	0.7	0.7	0.6
Wetlands		1.3	1.7	1.9	2.2	2.1	2.2	2.2	2.0
Settlements		0.9	1.1	1.3	1.7	1.7	1.0	0.7	0.7
Harvested wood products		-3.0	-4.9	-6.6	-2.0	-2.2	-2.7	-3.6	-4.0
Indirect N2O emissions		0.002	0.001	0.001	0.002	0.002	0.002	0.002	0.002
Total		-14.8	-14.0	-18.9	-24.4	-22.1	-20.1	-18.5	-20.4

1) Preliminary data

Changes in the estimation of the emissions and removals of the LULUCF sector

According to the Climate Convention, the calculation of the sum of emissions and removals in the LULUCF sector, or the net sink becomes revised yearly for the penultimate years. This is caused by the utilisation of new data derived from the National Forest Inventory on such as surface areas, increase in the growing stock and allocation of fellings. Revisions of surface areas in land use changes are also made with the help of various other sources. In addition, the calculation methods may change along with new research and other data.

The now released preliminary data differ from the previous instant preliminary data released in spring 2018 for several reasons.

The introduction of the latest estimate of the increase in the growing stock based on four-year measurements of the 12th National Forest Inventory reduced the sink of tree biomass on forest land. The change decreased the net sinks of forest land by 3.8 million tonnes of carbon dioxide per year in 2013-2016, on average.

The methodological change reduced the removals (sink) of soils of forest land and cropland because of a change in how the average weather affecting the decomposition of forest litter and other organic matter is taken into consideration in the calculation. The change had most effect on the reduction of removals by soil and dead organic matter in the last few years, by nearly four million tonnes of carbon dioxide in 2013 to 2016.

In the second methodological change, N₂O emissions increased in drained forested peatlands, when the previously used emission coefficient was corrected. The previous emission coefficient was based on measurement data, part of which were produced with an erroneously functioning analyser. The correction in question increased emissions in 2016 by 0.8 million tonnes of carbon dioxide equivalent.

The emission and removal estimates of the LULUCF sector will become revised in future as well, particularly for the latest years, as new inventory data are obtained for the calculation of emissions and removals.

Monitoring of the commitments under the Kyoto Protocol

Statistics Finland's [review of the release \(in Finnish\)](#) of 11 December concerning greenhouse gas emissions described the emission reduction targets of the EU's burden-sharing decision and the second commitment period of the Kyoto Protocol and their implementation based on the published preliminary data. Emissions in the LULUCF sector influence only the monitoring of the obligations under the Kyoto Protocol, which the data below supplement as concerns LULUCF activities. The LULUCF activities under the Kyoto Protocol, afforestation and reforestation, deforestation and forest management, cover only part of the emissions and sinks of the above-described LULUCF sector.

In 2017, the combined annual net sinks of Article 3.3 of the Kyoto Protocol, that is, afforestation, reforestation and deforestation amounted to 2.7 million tonnes of CO₂ eq. and totalled 15.1 million tonnes of CO₂ eq. from the beginning of the second commitment period (Table 2). The emissions in question have an effect as such on Finland's reduction burden in the second commitment period of the Kyoto Protocol.

Removals of forest management activities of Article 3.4 of the Kyoto Protocol were -393 million tonnes of CO₂ eq. in 2017. Forest management activities under the Kyoto Protocol differ from total removals of forest land reported under the Climate Convention mostly because the calculation of the changes in the stock of harvested wood products is started from zero at the beginning of the second commitment period, while under the Climate Convention, the calculation of the stock of harvested wood products is started from 1900 and the stock is not included in the carbon stock of forest land.

In the second commitment period of the Kyoto Protocol, 2013 to 2020, the effect of the emissions and removals of forest management on the emission reduction obligation is assessed by comparing the removals or emissions of forest management to the reference level. The forest management reference level is corrected correspondingly, when methodological changes are made to the calculation of emissions and removals. Removals exceeding the reference level corrected according to the methodological changes can be calculated as credits for Finland in meeting the emission reduction commitment at most until 3.5 per cent of the country's total emissions in 1990 multiplied by the number of years of the commitment period. Finland's forest management cap is 19.978 mil. t CO₂ eq. (Table 2).

Changes and their effect on the calculation of LULUCF activities under the Kyoto Protocol

In addition to area revisions, the new National Forest Inventory data changed the allocation of fellings to afforestation areas, which changed afforestation in 2015 from emission into removal, for example. According to the changes, the annual net emissions of afforestation, reforestation and deforestation in 2013 to 2016 were, on average, over eight per cent lower than the previously released average emissions of the period 2013 to 2016. Net emissions of afforestation, reforestation and deforestation have a direct effect on the commitment of the second commitment period of the Kyoto Protocol.

The above-described changes in the increase in the growing stock as well as the methodological changes in estimates of soil carbon stock change and N₂O emissions from drained forested peatlands are visible as a clear reduction in net removals of forest management compared to the previously reported level. The effect is of the same size as for forest land reported under the Climate Convention. The forest management reference level was also corrected according to recommendations of the inventory review. The total methodological changes in the reference level reduce its sink with 3.6 million tonnes CO₂ eq. The changes do not impact the amount of net removals from forest management that can be accounted for in meeting the commitment (Table 2).

The emission and removal estimates of LULUCF activities also become revised yearly.

Further information about the inventory calculation of the LULUCF sector is available from the Greenhouse Gas Inventory at the Natural Resources Institute Finland (Luke).

Table 2. Accounting of emissions and removals of the LULUCF activities during the second commitment period of the Kyoto Protocol

		2013	2014	2015	2016	2017 ¹⁾	Total
		tonnes of CO2 equivalent					
Article 3.3 net emissions and removals²⁾		3 682 105	3 055 332	3 084 486	2 537 605	2 668 180	15 027 709
	Afforestation and reforestation	-271 964	-555 640	-98 367	-514 032	-254 809	
	Deforestation	3 954 069	3 610 973	3 182 854	3 051 637	2 922 988	
Article 3.4 net emissions and removals		-48 130 319	-47 010 638	-42 679 901	-38 776 249	-39 316 498	
	Finland's Forest Management Reference Level (FMRL)	-20 466 000	-20 466 000	-20 466 000	-20 466 000	-20 466 000	
	Technical correction to the FMRL	-10 939 000	-10 939 000	-10 939 000	-10 939 000	-10 939 000	
	FM net removals minus the FMRL and the technical correction	-16 725 319	-15 605 638	-11 274 901	-7 371 249	-7 911 498	
	FM cap ³⁾						-19 978 041
Estimate of net addition to the assigned amount from Article 3.4							-19 978 041³⁾

1) Preliminary data

2) Net emissions from activities under Article 3.3 will be subtracted from the assigned amount at the end of the second commitment period.

3) FM cap is -19,978,041 tonnes CO2 eq. for the whole second commitment period. It is presented as a negative number because its effect in accounting is opposite to that of emissions.

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Revision of Finland's greenhouse gas removals. Removals expressed in million tonnes CO2 equivalent

	Statistical reference year	Previous release	Latest release	Change ¹⁾
		24 May 2018	15 January 2019	
		Mill. t CO2-eq.		%
LULUCF sector	1990	-14.0	-14.8	5.4
	2005	-27.7	-24.4	-11.8
	2010	-27.5	-22.1	-19.5
	2013	-27.3	-19.0	-30.3
	2014	-30.9	-21.8	-29.5
	2015	-28.8	-20.1	-30.2
	2016	-27.1	-18.5	-31.5
	2017	-27.1 ²⁾	-20.4 ³⁾	-24.7

1) Change between the latest and previous releases

2) Proxy estimate

3) Preliminary data

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Source: Greenhouse gas inventory unit. Statistics Finland