

 **Federal Ministry**
Republic of Austria
Climate Action, Environment,
Energy, Mobility,
Innovation and Technology

Progress Report on LULUCF Actions

Austria

In accordance with Article 10 (4) of Decision 529/2013/EU

Vienna, 2020

Legal notice

Media owner, publisher, editor:

Federal Ministry of Climate Action, Environment, Energy, Mobility, Innovation and Technology, Radetzkystraße 2, 1030 Vienna, Austria

Vienna, 2020.

Copyright and Liability:

Copies may only be made of extracts where there is a reference to the source; all other rights reserved. Reference is made to the fact that despite careful processing all information provided in this publication is subject to correction and liability on the part of the Federal Ministry and the author is excluded. The legal opinions expressed represent the non-binding opinions of the author and in no way anticipate the jurisdiction of independent courts.

Table of Contents

1 Introduction	5
2 Description of past trends of emissions and removals	6
2.1 Forest land (Category 4.A)	9
2.2 Other Subcategories	10
2.3 Activities subject to Article 3, Paragraph 3 and 4 of the Kyoto Protocol	12
3 Projections for emissions and removals from the LULUCF sector for the respective accounting period	13
3.1 GHG Projections.....	13
3.2 LULUCF	13
3.2.1 Forest land (4.A).....	14
3.2.2 Harvested Wood Products (4.G).....	17
3.2.3 Cropland (4.B)	17
3.2.4 Grassland (4.C)	18
3.2.5 Wetlands (4.D)	19
3.2.6 Settlements (4.E).....	19
3.2.7 Other Land (4.F)	20
4 List of measures to be implemented in order to pursue the mitigation potential, including policies and timetable foreseen for their implementation	21
4.1 Energy related Policies and Measures.....	21
PAM 1 – Emissions trading Scheme	21
PAM 2 – Environmental Support Scheme.....	22
PAM 3 – Climate and Energy Fund (KLI.EN)	23
PAM 4 – Promotion of Green Electricity.....	25
PAM 6 – Klima:aktiv – Consumer awareness.....	26
PAM 7 – Action Programme Timber Flow.....	27
4.2 Policies and Measures in the Agriculture and Forestry Sector.....	27
PAM 8 – Austrian Rural Development Programme	27
PAM 9 – Transport Target of the Climate and Energy Package.....	44
PAM 10 – Guiding Principles of Forest Management.....	44
PAMs 11 to 17 – Relevant Provisions of the Forest Act.....	46
PAM 18 – Austrian Forest Dialogue	46
PAM 19 – Forest Cooperatives.....	47
PAM 20 – Task Force Renewable Energy	48
PAM 21 – Protection of Wetlands.....	48

Annex – Summary of policies and measures by sectors.....49
References.....51

1 Introduction

According to Article 10 (1) of Decision 529/2013/EU of the European Parliament and of the Council on accounting rules on greenhouse gas emissions and removals resulting from activities relating to land use, land-use change and forestry and on information concerning actions relating to those activities Member States (LULUCF decision, European Union 2013) shall transmit information on their current and future LULUCF actions.

Austria has submitted its report by mid-2014, which can be downloaded at bmk.gv.at/themen/klima_umwelt/klimaschutz/nat_klimapolitik/landnutzung.html.

According to Article 10 (4) of the LULUCF decision, Member States shall submit to the Commission, by the date halfway through and at the end of each accounting period a report describing the progress in the implementation of their LULUCF actions.

Austria has submitted its mid-term progress report by end of 2016.

Austria welcomes the opportunity to submit up to date information; this report is structured in accordance with Article 10 of the LULUCF Decision.

2 Description of past trends of emissions and removals

The information is based on Austria's greenhouse gas inventory, submitted to the UNFCCC on 15 April 2020 (Umweltbundesamt 2020). Chapter 6.1 summarises the net emissions and net removals from the sector land use, land use change and forestry (LULUCF) as follows:

LULUCF is a net sink in Austria. For the years after 2002 a significant increase in biomass drain in forest land causes a clear decrease in the net sink of the biomass pool of the subcategory forest land remaining forest land (4.A.1) with subsequent impacts on the totals of the LULUCF sector.

Table 1 Net emissions and net removals of the LULUCF categories 1990 to 2018;
Table 224 of Austria's National Inventory Report 2020 [Gg CO₂-e]

Year	Greenhouse gas emissions and removals [Gg CO ₂ -e]								[Gg CH ₄]	[Gg N ₂ O]
	4 Total	A Forest land	B Crop land	C Grass land	D Wet lands ₁₎	E Settle ments ₁₎	F Other land ₁₎	G Harvested Wood Products	Total CH ₄	Total N ₂ O (direct and indirect)
1990	-12,157	-10,892	176	626	42	570	444	-3,122	0.97	0.48
1991	-16,860	-16,620	169	621	42	574	454	-2,098	0.96	0.49
1992	-11,835	-11,856	161	616	42	577	463	-1,840	0.96	0.50
1993	-12,132	-12,327	154	611	42	581	473	-1,667	0.96	0.51
1994	-12,003	-11,264	159	611	42	579	473	-2,604	0.96	0.50
1995	-13,308	-12,246	133	444	30	524	375	-2,569	0.95	0.49
1996	-10,716	-9,229	104	446	36	520	372	-2,964	0.95	0.48
1997	-19,225	-17,982	77	447	36	516	368	-2,686	0.95	0.47
1998	-17,350	-16,169	54	449	36	511	364	-2,595	0.96	0.46
1999	-19,653	-19,088	18	449	36	510	365	-1,943	0.95	0.46

Year	Greenhouse gas emissions and removals [Gg CO ₂ -e]								[Gg CH ₄]	[Gg N ₂ O]
	4 Total	A Forest land	B Crop land	C Grass land	D Wet lands ¹⁾	E Settle ments ¹⁾	F Other land ¹⁾	G Harvested Wood Products	Total CH ₄	Total N ₂ O (direct and indirect)
2000	-16,551	-15,999	-22	448	36	509	366	-1,889	0.96	0.45
2001	-19,393	-17,951	-98	448	36	507	367	-2,701	0.95	0.45
2002	-14,386	-12,257	-122	656	47	590	335	-3,635	0.97	0.45
2003	-4,993	-2,264	-132	652	47	592	336	-4,223	0.97	0.45
2004	-9,309	-7,345	-135	653	47	591	328	-3,448	0.95	0.45
2005	-10,778	-8,797	-131	655	47	589	320	-3,461	0.95	0.44
2006	-5,315	-2,982	-120	654	37	587	312	-3,803	0.96	0.44
2007	-5,554	-1,954	-116	653	39	565	304	-5,045	0.95	0.45
2008	-4,316	-1,060	-95	648	51	599	296	-4,755	0.96	0.45
2009	-4,607	-4,498	-121	354	68	504	211	-1,126	0.96	0.45
2010	-5,936	-4,465	-123	353	69	479	204	-2,452	0.96	0.45
2011	-6,163	-4,432	-125	352	73	460	196	-2,687	0.96	0.45
2012	-5,506	-4,399	-132	351	70	470	188	-2,055	0.96	0.45
2013	-4,554	-4,366	-115	352	101	430	181	-1,138	0.96	0.45
2014	-4,761	-4,333	-87	354	71	433	173	-1,372	0.96	0.45
2015	-4,599	-4,326	-3	351	59	406	170	-1,254	0.96	0.46
2016	-4,431	-4,320	56	334	77	394	166	-1,137	0.95	0.46
2017	-5,011	-4,313	82	322	67	389	162	-1,722	0.95	0.45
2018	-5,311	-4,306	105	291	66	375	159	-2,001	0.96	0.45
1990- 2018	-56%	-60%	-40%	-54%	57%	-34%	-64%	-36%	-1%	-6%

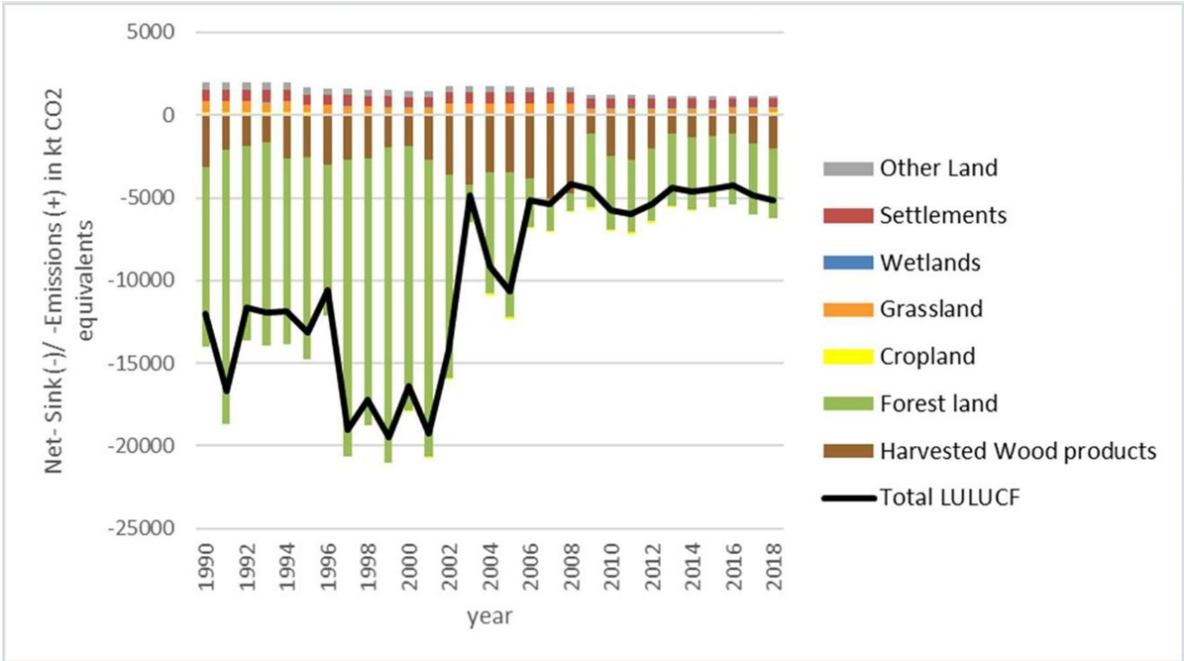
1) Only land use conversions are reported

The most important subcategory is forest land, in particular its subcategory forest land remaining forest land which is a net sink for CO₂. In the years 2007 and 2008 also the subcategory forest land remaining forest land represented a net source. Harvested wood products (HWPs) are the second largest net sink. Since 2000, the cropland subcategory generally constitutes a net sink; however, the net sink decreased in recent years and since 2016 the subcategory has been estimated as a small net source. The other subcategories are net sources of Greenhouse gas (GHG) emissions.

In 2018, net removals from sector LULUCF amounted to 5,311 gigagrams (Gg) CO₂-equivalent, which correspond to 6.5 % of national total GHG emissions (without LULUCF), compared to 15 % in the base year.

The most important subcategory is forest land (4.A) with net removals of 4,306 Gg CO₂-equivalent in 2018 (including indirect emissions). Harvested wood products (4.G) is the second largest net sink and contributed 2,001 Gg CO₂-equivalent. In 2018, CH₄ and N₂O emissions together amounted to 159 Gg CO₂-equivalent (including indirect emissions). Total net emissions arising from the other non-forest subcategories (excluding HWPs) amounted to 1,126 Gg CO₂-equivalent in 2018 (including indirect emissions).

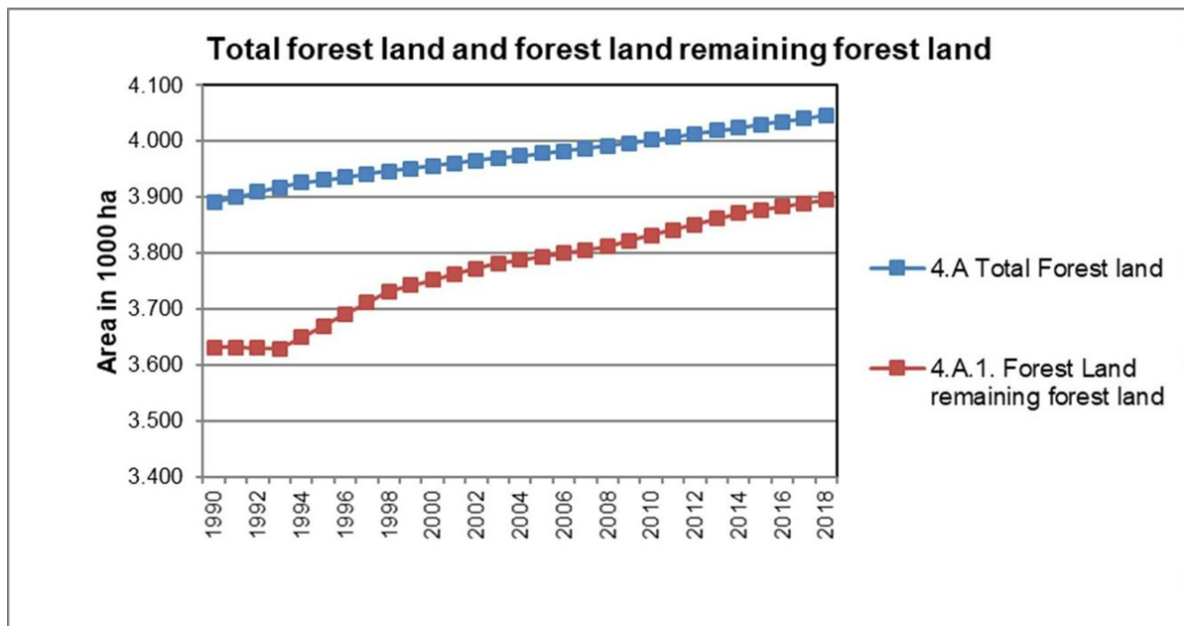
Graph 1 Net emissions and net removals of the LULUCF categories [Gg CO₂-e]



2.1 Forest land (Category 4.A)

In Austria, the area of forest land has been constantly increasing in the past (Graph 2). The Land converted to forest land subcategories (4.A.2) show a decreasing trend with exception of other land converted to forest land, which is stagnating.

Graph 2 Total forest land and forest land remaining forest land [1,000 ha]



The annual net removals in sector 4.A of the period 1990 to 2018¹ range from 1,060 Gg CO₂ to 19,088 Gg CO₂ (mean: 8,691 Gg CO₂). The most important subcategory is forest land remaining forest land (4.A.1), but also land use changes to forests (4.A.2) and from forests (4.B.2 to 4.F.2) contribute significantly to the net CO₂ balance.

The year 2008 is the median year of the last national forest inventory period, which was carried out between 2007 and 2009. For the years since 2008 the means (for example total forest area, land use changes, increment or drain) from the last period (2007 to

¹ For the years since 2009 the means for the last period (2007/2009) of the National Forest Inventory (NFI) have been reported.

2009) of the National Forest Inventory (NFI) have been reported (except for the land use changes to and from forests for which the ARD NFI 2011/2013 provided accurate figures for the last years up to 2013).

As already reported in previous submissions, changes in the Austrian forest biomass also resulted in a net sink in the years before 1990. In the period 1961 to 1989 the mean annual net sink amounted to 11,081 Gg CO₂ (from 4,324 Gg CO₂ to 16,385 Gg CO₂).

Between 1990 and 2018 the net sink of the forest land subcategory ranges between 1 % and 32 % of the total CO₂-equivalent emissions without LULUCF of the greenhouse gases CO₂, CH₄ and N₂O in this period.

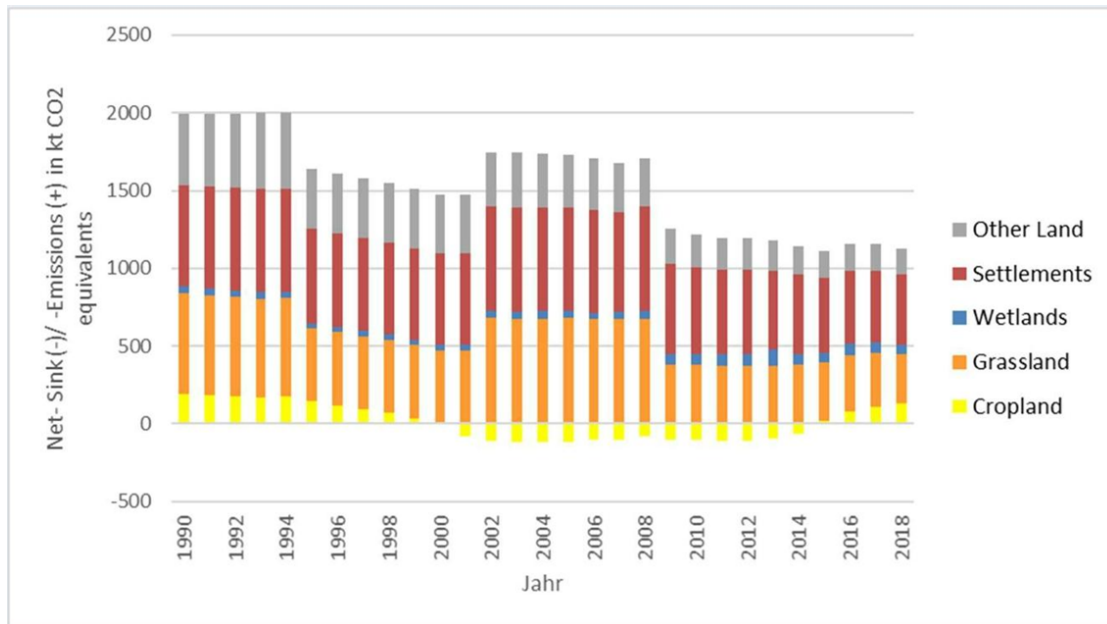
For the reported period 1990 to 2018 the total annual net removals from land use changes to forest range from about 1,729 Gg CO₂ to 3,370 Gg CO₂. The total annual emissions from land use changes from forests (conversion of forest land) vary between 509 and 1,210 Gg CO₂-equivalent.

The net carbon stock changes of subcategory 4.A vary considerably between single years and outliers exist. The reason is that the figures for annual growth and for annual harvest differ significantly year by year due to variations of influencing factors on growth and harvest like weather conditions, timber demand and prices or wind throws (for example very low increment in 2003, very high harvest rates in 2007 and 2008). The forest biomass changes in subcategory 4.A.1 have a major impact on the overall results in subcategory 4.A (and sector 4 as a whole). Therefore, such reasons for different growth and different harvest in single years explain the high annual variations as well as single outlier years in the net removals of this sector. The rather constant values from 2009 on are due the use of average values of the last NFI (2007/2009) for the estimates of the years after 2008.

2.2 Other Subcategories

Total net emissions arising from the other non-forest subcategories (excluding HWPs) amounted to 1,126 Gg CO₂-equivalent in 2018 (including indirect emissions) and decreased by 77 % since 1990 (Graph 3).

Graph 3 Net emissions and net removals of the LULUCF categories, excluding forest land and harvested wood products [Gg CO₂-e]



The trends for the subcategories 4.C grassland, 4.D wetlands, 4.E settlements and 4.F other land are generally quite stable with the exception of the discontinuities in the years 1995/1996, 2001/2002 and 2008/2009 for 4.C grassland. Net-emissions of these categories are highly dependent on the corresponding land use changes. For grassland emissions from organic soil represent also an important contribution to the net emissions of this subcategory. The land use changes from forest land to other land uses are derived from the NFIs. Due to the fact that the land use change rates are kept constant during the observation period of a NFI, the emission trends are quite constant during those years as well. Discontinuities occur in years, where observation periods change from one NFI to the next such as 1995/1996, 2001/2002 and 2008/2009.

Total net emissions and net removals of cropland range between minus 135 and 176 Gg CO₂-equivalent, with net emissions reported during the 1990s, net removals since 2000, and again net emissions since 2016. The net CO₂ emissions during the 1990s were mainly caused by the loss in soil carbon caused by conversion from grassland to annual cropland and from forest land to cropland. The net CO₂ removals since 2000 are largely due to the increase of soil carbon in cropland remaining cropland, due to specific management measures implemented by the Austrian Agri-Environmental Programme ÖPUL. This programme was introduced in 1995, when Austria joined the EU. Net CO₂ removals from this subcategory have however been decreasing since 2015. The reason is that increases in

soil carbon stocks are a consequence of the programme ÖPUL, which were mainly responsible for these net removals in past years, are starting to level off due to the reaching of the new equilibrium soil carbon stocks. Graph 3 shows discontinuities in the historic time series for the subcategory 4.B cropland every 6 years corresponding with the starting point of the different Rural Development programmes, in particular the respective programmes, which ran from 1995 to 2000, 1998 to 2000, 2000/2001 to 2007, 2007/2008 to 2013/2014 and 2015 to 2020. The shift from one programming period to the other quite often resulted in changes of the areas under management by the respective measures and hence in the corresponding emissions profile, as a result of changes in EU provisions or further improvement of the measures.

2.3 Activities subject to Article 3, Paragraph 3 and 4 of the Kyoto Protocol

Austria's greenhouse gas inventory contains estimates for the activities afforestation, reforestation, deforestation and forest management under Article 3, Paragraph 3 and 4 of the Kyoto Protocol. In addition, the emissions and removals of the activities cropland and grassland management for the time period since 2013 are reported under the LULUCF Decision.

Since 2013 net removals from afforestation and reforestation activities were quite stable with 2,018 to 2,182 Gg CO₂-equivalent per year and a trend of increase in net removals was observed. The average net emissions from deforestation since 2013 are between 536 and 499 Gg CO₂-equivalent per year with a trend of decreasing net emissions.

For forest management the data since 2013 show net-removals between 3,478 and 4,128 Gg CO₂-equivalent per year. However, it should be noted that for the years since 2009 the means for the last NFI period 2007/2009 have been reported. This information will be updated as soon as the results from the next NFI are available.

The Cropland Management net removals or net emissions from 2013 to 2018 range between minus 127 and 102 Gg CO₂-equivalent per year with a change from net removals to net emissions across the time series.

Net emissions from grassland Management range from 245 and 179 Gg CO₂-equivalent per year in the period 2013 and 2018, with a decreasing trend.

3 Projections for emissions and removals from the LULUCF sector for the respective accounting period

Austria has submitted “GHG projections and assessment of policies and measures in Austria” in accordance the EU Monitoring Mechanism Regulation (EU) No. 525/2013 on 15 March 2019 (Umweltbundesamt 2019). This report included projections for the complete LULUCF sector, which are consistent with the data reported in Austria’s GHG inventory submitted in 2020 under the UNFCCC.

3.1 GHG Projections

The projections for national GHG emissions include a scenario “with existing measures” (WEM) for the sector LULUCF. The share of energetic wood use from domestic harvest of the WEM scenario for LULUCF is consistent to those of the WEM energy scenario.

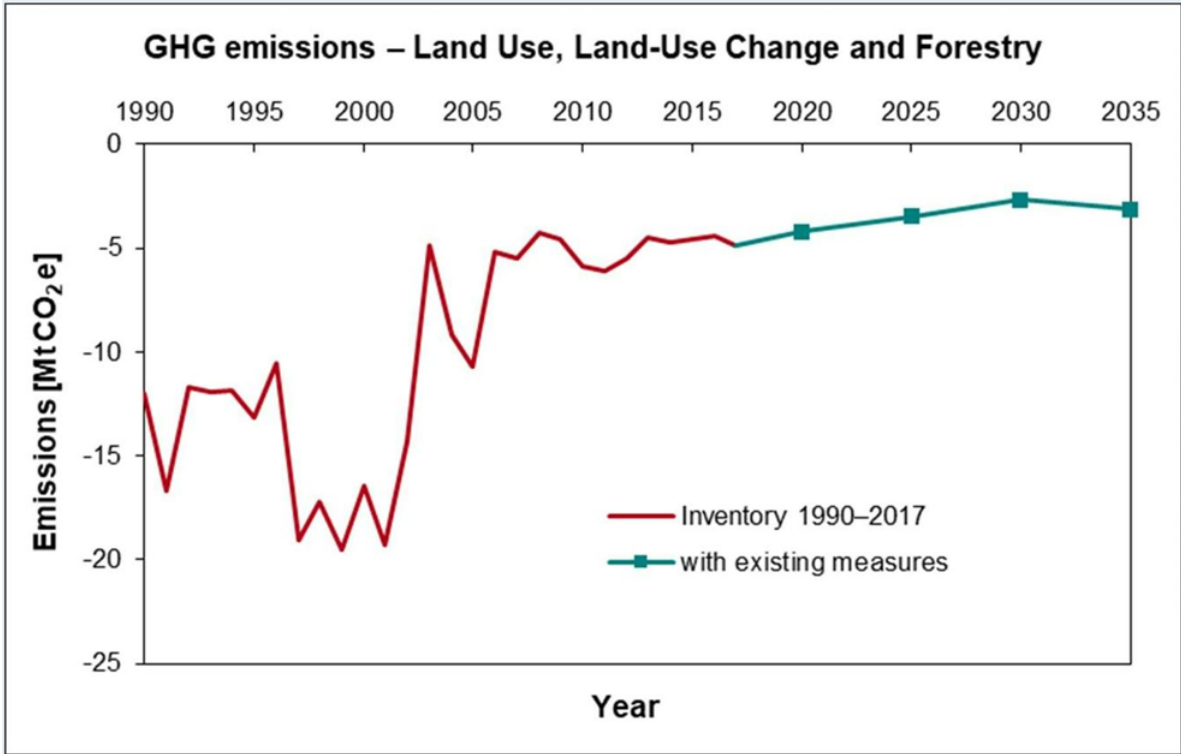
3.2 LULUCF

Category 4 LULUCF has been a net sink in the past and is projected to remain a net-sink in the period until 2035. Between 2017 and 2030 net removals are expected to decrease by approximately 2,200 Gg CO₂-equivalent. This will be strongly influenced by the decrease in removals on forest land caused by a decreasing trend in biomass growth. Biomass use also shows a decreasing trend but at a lower rate. From 2030 to 2035 onwards, this trend is expected to change and the net sink expected to increase, which can also be explained by a lower level of forest biomass use and by a slightly increasing biomass growth. However, it should be noted that the variations between the single years are significant due to the annual variations of climate scenarios and other parameters. The second largest subcategory, harvested wood products, is projected to remain a net sink on a stable level (about minus 2,100 Gg CO₂ on average) during the period 2017 to 2035. On the other hand, the non-forest sectors (cropland, grassland, wetlands, settlements and other land)

are net sources for the projected time series, amounting to approximately 1,200 Gg CO₂-equivalent per year (Graph 4).

The projection assumes no changes in policies and that the wood demand in terms of quantity and composition corresponds with the trend in the past years. Likewise, market participants do not change behaviour.

Graph 4 Historic and projected net emissions and net removals from LULUCF [Gg CO₂-e]



Detailed information on the respective subcategories can be found in the following chapters.

3.2.1 Forest land (4.A)

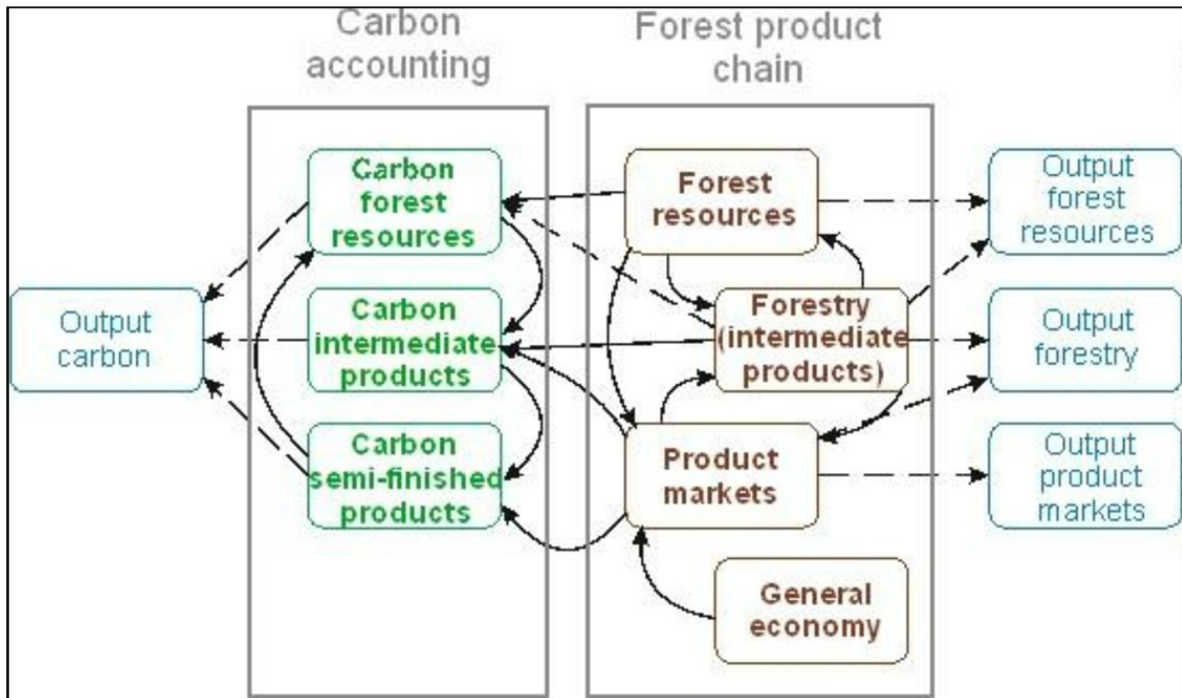
Emission projections for sector 4.A are based on a study on the GHG balance of the Austrian Forests and their value chain “CareForParis: Adaptation for carbon efficient forests and the entire wood value chain – pathways supporting the Paris Agreement” which was finalized end of 2019 (klimafonds.gv.at/wp-content/uploads/sites/6/B670274-ACRP9-CareforParis-KR16AC0K13154-EB.pdf), conducted by the Austrian Research Centre

for Forests (BFW), the University of Natural Resources and Applied Life Sciences, Vienna (BOKU), Kompetenzzentrum Holz (Wood K Plus) and Umweltbundesamt. The study includes several scenarios, with a Reference Scenario (R) which corresponds to the existing measures scenario (WEM).

The reference scenario was established based on historical field data from the Austrian National Forest Inventory (NFI) 2007 to 2009 which served as input to the CALDIS model. CALDIS is a climate-sensitive single individual-tree based forest growth model (Kindermann 2010; Gschwantner et al. 2010; Ledermann, 2002) that simulates forest development on the basis of the increment of single trees. It is based on a derivative of the PROGNAUS model. The model applies a set of tree species-specific, mathematical-statistical equations which describe the growth of diameter and the height of single individual trees. Temperature and precipitation data was fed into the model to simulate climatic conditions (on the basis of a regionalised RCP 4.5 climate scenario). Models for salvage cutting and incidental felling were integrated as well. An in-growth model estimated the renewal of forest stands. On this basis, above- and below-ground biomass was calculated on a single tree level. For estimating soil organic carbon the YASSO 07 model (LISKI et al. 2009, 2005) was applied.

To ensure consistency between subcategory 4.A Forest land and 4.G HWPs, the harvested timber volumes and increment were estimated and calibrated iteratively based on the CALDIS model (conducted by the Austrian Research Centre for Forests) and the Forest Sector Model FOHOW2 (conducted by the University of Natural Resources and Applied Life Sciences, Vienna), which has been used for projections of HWP and fuelwood production as well as for wood demand. FOHOW2 is a partial equilibrium dynamic forest sector model simulating Austria's wood product supply chain.

Graph 5 General structure of the FOHOW2 model, Source: Braun et altera 2015



Based on this, the model simulates all carbon fluxes of harvested wood products (sawn wood, wood panels and paper) in Austria and calculates the carbon stocks and fluxes in accordance with the 2006 IPCC guidelines for GHG inventories.

The projection shows that the subcategory Forest land will be a net-sink of around 2,400 Gg CO₂-equivalent in 2035. These are lower net-removals from this subcategory as compared to those of the last years, which is mainly caused by decreases of biomass growth (Table 2).

Table 2 Historic and projected net emissions and net removals from Forest land

Gg CO ₂ -e	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035
Forest land	-10,858	-12,212	-15,972	-8,771	-4,438	-4,299	-2,942	-2,538	-1,956	-2,437

3.2.2 Harvested Wood Products (4.G)

The FOHOW2 model was used to simulate the domestic production of harvested wood products, consistent with the projections for subcategory 4.A above. Historic production data starting from 1961 has been taken from FAO statistics (sawn wood, wood-based panels, paper and paperboard).

For HWPs the projections show an increase of the net-removals to around 1,900 Gg CO₂-equivalent in 2035 since 2015.

Table 3 Historic and projected net emissions and net removals from HWPs

Gg CO ₂ -e	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035
HWPs	-3,122	-2,569	-1,889	-3,461	-2,452	-1,254	-2,444	-2,194	-1,991	-1,890

3.2.3 Cropland (4.B)

Cropland has been a net-sink since 2001, mainly caused by an increase in soil carbon in cropland remaining cropland, due to specific management measures implemented by the Austrian Agri-Environmental Programme. This programme was introduced in 1995, as Austria joined the EU.

According to the 2006 IPCC Guidelines the effects of changes in management practices on the soil carbon stocks are reported during a 20-years transition period per default, after which the stocks are assumed to reach a new equilibrium state. This implies that for the reporting under the UNFCCC the implemented measures do not lead to further soil carbon stock increases after 20 years.

Consequently, the effect of the 20-years-period is strongly related with the starting date of the implementation of past Agri-Environmental measures. With the phase out of these management driven carbon sequestration effects in cropland soil due to reaching the new equilibrium stock, the cropland subcategory turn back into a net-source in the future, mostly driven by significant – but rather stable – emissions due to biomass losses in perennial cropland and soil carbon losses from land-use changes from grassland to cropland.

An evaluation of around 40,000 soil samples shows that the humus content increased in all regions by 0.1 to 0.4 % during 15 years as a result of the Agri-Environmental measures referred to above. According to the data many of the soil samples lie within the optimum humus range, a part of them on the upper end of this range and a part of them on the lower end. There are also sites where the humus content did not yet reach this optimum range. In case the further soil monitoring shows a different emissions profile, compared to the current estimates based on the 20-years transition period. In the longer term, Austria will reconsider moving to a country specific methodology in deriving the transition period.

After 2030, most of these areas will have passed the 20-years transition period and the soil carbon stocks will – even if the Agri-Environmental measures are continued – no longer increase. This effect led already in the last historic years to a reversal of the emission trend. In the last historic years areas under cropland turned into a net-source due to the losses in perennial biomass and soil carbon as a consequence of land-use changes which exceed meanwhile the decreasing removals in agricultural soil due to changed cropland management.

Table 4 Historic and projected net emissions and net removals from cropland

Gg CO ₂ -e	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035
Cropland	191	149	-7	-117	-104	20	160	292	321	228

3.2.4 Grassland (4.C)

The past trend shows that the subcategory grassland is a net-source since 1990. Because the land use changes to grassland are kept constant during the observation period of a NFI-cycle, the emission trends are quite constant during those years. The shift from one NFI cycle to the other (1994/1995, 2001/2002 and 2008/2009) leads to discontinuities between those years. According to the WEM scenario the grassland subcategory remains a net-source up to 2035 in approximately the same quantity as in the last historic years.

Table 5 Historic and projected net emissions and net removals from grassland

Gg CO ₂ -e	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035
Grassland	650	468	472	679	377	375	309	312	339	354

3.2.5 Wetlands (4.D)

Wetlands are protected in Austria (see PAM 21). Therefore, it is assumed that new drainage of wetland does not occur. Drained organic soil exist in the grassland subcategory, the emissions due to this activity are reported under grassland. Wetlands rewetting projects have been carried out in Austria in the lasts years to a minor extent at single sites. The removals from these activities are not yet estimated.

The historic data reported in Austria’s national greenhouse gas inventory show net-emissions from the subsector 5.D Wetlands of about 30 to 100 Gg CO₂-equivalent per year. The WEM projections assume similar emissions in the future due to conversions from forest land and grassland to wetlands.

Table 6 Historic and projected net emissions and net removals from wetlands

Gg CO ₂ -e	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035
Wetlands	42	30	36	47	69	59	48	49	49	49

3.2.6 Settlements (4.E)

The historic data reported in Austria’s national greenhouse gas inventory show net-emissions from the subsector 5.E Settlements of about 450 to 680 Gg CO₂-equivalent per year. The WEM projections assume emissions in the future at the lower end of this historic range due to reduced conversions of forests and agricultural land to settlement areas.

Table 7 Historic and projected net emissions and net removals from settlements

Gg CO ₂ -e	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035
Settlements	650	605	587	666	557	482	521	488	452	448

3.2.7 Other Land (4.F)

The historic data reported in Austria’s national greenhouse gas inventory show net-emissions from the subsector 5.F other land of about 170 to 490 Gg CO₂-equivalent per year. The WEM projections assume lower emissions in the future due to reduced conversions of forests to other land.

Table 8 Historic and projected net emissions and net removals from other land

Gg CO ₂ -e	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035
Other Land	458	392	381	335	215	178	147	127	116	116

4 List of measures to be implemented in order to pursue the mitigation potential, including policies and timetable foreseen for their implementation

4.1 Energy related Policies and Measures

The measures referred to in this chapter are referenced in the indicative Annex IV (j) of the LULUCF Decision.

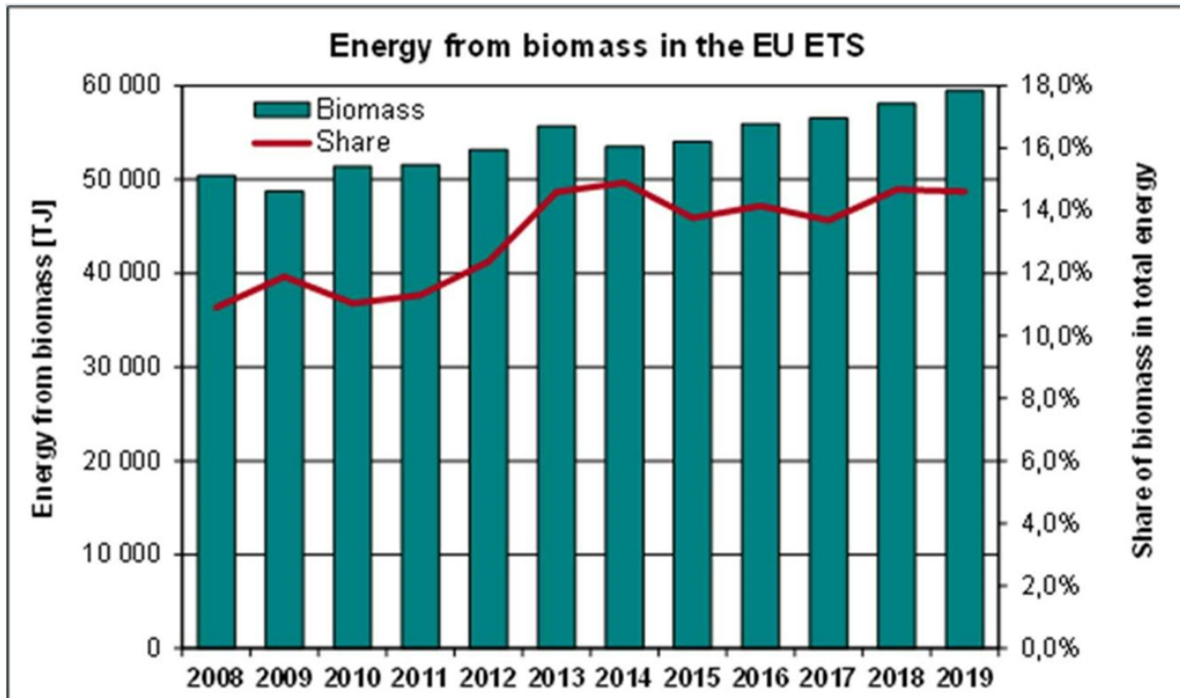
PAM 1 – Emissions trading Scheme

Since 2013, an EU wide fully harmonised system for allocation of free allowances is being applied, based on the revision of the EU-ETS Directive (2009/29/EC), with strictly harmonised rules on free allocation for stationary installations, combined with a Union-wide cap, which is characterised by a linear factor that provides for the reduction of GHG emissions by 21 % to be achieved in 2020 relative to 2005.

In Austria, around 200 installations are currently covered by EU ETS. Free allocation amounts to 22.5 million allowances in 2013 and went down to 18.8 million allowances in 2019.

Due to increasing scarcity of allowances over time, a further increase in biomass demand – which is accounted for as CO₂-equivalent-neutral – can be observed. Biomass consumption increased from below 11 % of total energy use in 2008 to almost 15 % in 2019.

Graph 6 Share of biomass consumed in ETS-installations from 2008 to 2019



It is expected that this increasing trend will continue in the future, in particular with rising allowance prices.

PAM 2 – Environmental Support Scheme

The main objective of the Environmental Support Scheme as last amended by Federal Law Gazette I No. 114/2020 is to provide economic incentives to promote the implementation of measures in the field of energy efficiency, climate and environmental protection.

The Environmental Support Scheme is managed by Kommunalkredit Public Consulting (KPC), commissioned by the Federal Ministry for Climate Action (BMK). According to the last annual report (Umweltinvestitionen des Bundes 2019), 71.1 million euros of support were granted to companies for 6,101 projects in 2019, whereof 60.1 million euros or around 85 % were of relevance for GHG mitigation. 621 projects with a support of 17.9 million euros fell into the subcategory of renewable energy use and 1,897 projects (30 million euros funding) involved energy efficiency measures.

Further information can be found on the webpage and in the annual reports of Federal ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (bmk.gv.at/themen/klima_umwelt/klimaschutz/ufi.html).

Out of the 621 renewable energy projects, 70 % promote the use of biomass for energy purposes. Those biomass projects with investment costs of approximately 79 million euros are calculated to bring about 86 Gg annual CO₂-equivalent emissions reductions, which means 1,900 Gg CO₂-equivalent in the course of their service life.

Table 9 The domestic environmental support scheme 2019; Support for Biomass Installations (Umweltinvestitionen des Bundes 2019)

	Number of projects	Environment related investment costs [million euros]	Subsidy [million euros]	Annual CO ₂ -e emissions reduction [Gg]	Total CO ₂ -e emissions reduction [Gg]
Renewable Energy	621	117	17.9	117,109	2,364,277
Biomass - Installations	303	22.7	5.8	35,064	701,289
Biomass - Microgrids	45	15.1	3.4	26,992	539,832
Biomass – District heating systems	39	22.0	2.6	10,060	201,192
Biomass – Distribution network	46	18.8	1.8	13,856	415,688

Additional measures such as PAM 5 “District Heating from Renewables” also promotes the use of renewables in the buildings sectors and is supported by the Austrian Environmental Support Scheme.

PAM 3 – Climate and Energy Fund (KLI.EN)

The Climate and Energy Fund relies on the power of role models. From 2007 to 2019 it has supported more than 144,000 climate mitigation projects and invested a total of 1.4 billion euros. The Climate and Energy Fund investments will deliver benefits in the short, medium (until 2030) or long (until 2050) term. The aim is a long-term transformation to a climate-friendly energy system. The projects supported by the Climate Fund have a direct impact

on Austria’s economy: every euro invested results in four euros of total investment. The Climate Fund spurs innovation and growth in areas that will determine Austria’s energy and climate future.

The Climate and Energy Fund focuses on three key areas:

- research in and development of renewable energy systems,
- development and testing of new transport and mobility systems,
- acceleration of climate mitigation measures and their success on the market (market penetration).

New energy technologies and transport systems require public acceptance. The Climate and Energy Fund has developed the “Model Regions” concept to help climate-friendly energy and mobility systems to be successful at the regional level. The idea of its “Flagship Projects” funding programme is to help new technical developments to be actually tested and implemented. Model Regions and Flagship Projects have model character and prove that GHG mitigation is practicable for everyone. Sustainability and efficiency continue to be the cornerstones of all Climate Fund activities. The Fund has made its mission to continuously reduce greenhouse gas emissions and improve energy efficiency. The near-future challenge to face is to accelerate market efficiency.

With regard to promoting renewable energy sources, the Climate and Energy Fund focussed its subsidies in 2019 on the replacement of old fossil-fuelled heating systems by highly efficient systems based on renewable energy, in particular solar and forest biomass.

Table 10 The Climate and Energy Fund 2019; Support for Biomass Installations (Geschäftsbericht 2019)

	Number of projects	Environment related investment costs [million euros]	Subsidy [million euros]
Modelregion - Biomass	5	0.144	0.031
Replacement of old biomass heating systems by highly efficient systems based on renewable energy	903	13.838	0.918

Additional measures such as M 7 “Improved building standards”, M 8 “Financial Support for climate-friendly construction and renovation” and M 9 “Renovation Cheque” promote the use of renewables in the buildings sectors.

PAM 4 – Promotion of Green Electricity

The Green Electricity Act 2012 (Federal Law Gazette I No. 75/2011) sets targets for additional electricity production from supported renewables for the year 2020 (compared to 2010). Besides Hydropower, Windpower and Photovoltaic, Biomass and Biogas should deliver additional 200 Megawatt electric (MW_{el}) in 2020.

The Act sets targets for additional electricity production from supported renewables for the year 2015 (compared to 2010). Biomass and Biogas should deliver additional 100 MW_{el} in 2015 with an increase in demand for forest biomass of about 1.2 million m³ in 2015. According to the “Green Electricity Report 2015” issued by Energy Control Austria, the biomass-target might be hard to reach.

The Act also includes a target to reach a share of 15 % of electricity from supported renewables in 2015, based on final electricity consumption. Depending on the final electricity consumption, it is expected that around 17 to 18 % of the final electricity consumption will be provided by supported renewable energy sources.

The financial incentive (average market price deducted) was 350 million euros in 2010 and 631 million euros in 2014. In addition to feed-in-tariffs, investment grants for small and medium hydropower are provided.

The feed-in-tariffs are set by the Federal Ministry for Digital and Economic Affairs (BMDW) in cooperation with the BMK and the Federal Minister of Social Affairs, Health, Care and Consumer Protection (BMS).

Table 11 Supported green electricity 2009 to 2019 [GWh]

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Biomass solid	1,958	1,987	1,969	1,983	2,013	1,941	2,043	1,982	1,999	2,014	1,582
Biogas	525	539	520	554	544	543	559	565	565	568	561
Biomass liquid	39	30	12	0	0	0	0	0	0	0	0
Total (without hydro)	4,503	4,647	4,464	5,057	5,768	6,498	7,650	7,998	8,903	8,279	9,073

PAM 6 – Klima:aktiv – Consumer awareness

As raising consumer awareness plays an essential role to strengthen dispersion and diffusion of those measures, the climate change initiative “klima:aktiv” (information available at: www.klimaaktiv.at) has been initiated by the Federal ministry for Agriculture, Forestry, Environment and Water Management in 2004. Several thematic programmes have been launched in the framework of klima:aktiv, which support among others:

- the mobilisation of woody biomass for energy purposes (“klima:aktiv” Energieholz, information available at: klimaaktiv.at/erneuerbare/energieholz.html) by market analysis and
- increasing the share of woody biomass used for the production of heat in the residential sector (“klima:aktiv” Erneuerbare Wärme, information available at: klimaaktiv.at/erneuerbare/erneuerbarewaerme.html).

This initiative combines various market-based measures and effectuates target-oriented implementation, for example by providing easier access to target groups and resources, by enhanced transfer of know-how with support in vocational training and networking of important actors, by the organisation and development of quality assurance and standards as well as by target group specific information and marketing. The impacts of these programmes are only implicitly included in the assumptions for the emission scenarios.

PAM 7 – Action Programme Timber Flow

In March 2009 the “Action Programme Timber Flow” (Aktionsprogramm Holzfluss, download at: netzwerk-land.at/forstwirtschaft/downloads/copy_of_aktionsprogramm-holzfluss-2008-2013) was developed by the Ministry to support a number of concrete measures – laid down in the Austrian Forest Dialogue, such as the preparation of forest management plans, the construction of forest roads, the purchasing of equipment, or the cooperation with the forest-based sector. The Action Programme has been endowed with 100 million euros from the Austrian Rural Development Programme 2007 to 2013. A comparable budget has been reserved in the programme period 2014 to 2020.

4.2 Policies and Measures in the Agriculture and Forestry Sector

Agricultural production primarily contributes to climate change with its CH₄ and N₂O emissions. In the year 2018 the category 3 agriculture contributed 9 % to the total of Austria’s greenhouse gas emissions (without LULUCF). The trend of GHG emissions from 1990 to 2018 shows a decrease of 11 % for this sector due to declining cattle numbers and various measures taken. Mainly due to the Austrian Rural Development Programme, in particular its Agri-Environmental Programme (see PAM 8), the use of mineral fertiliser declined considerably. The measures of the Austrian Rural Development Programme also contribute to increasing the share of renewable energy and to carbon sequestration in the LULUCF sector.

PAM 8 – Austrian Rural Development Programme

Period 2007 to 2013/2014

In line with the objectives of Regulation (EC) No. 1698/2005 and with the National Strategy the Austrian Rural Development Programme (RD) 2007 to 2013/2014 is organised by the following axes:

- Axis 1: Improving the competitiveness of the agricultur and forestry sector;
- Axis 2: Improving the environment and the countryside;
- Axis 3: Improving the quality of life in rural areas and diversification of the rural economy;
- Axis 4: Implementation of the Leader approach.

The RD 2007 to 2013/2014 has been provided for approximately eight billion euros of government support (BMLFUW 2016). The focus of financial resources was allocated to the Agri-Environmental Programme and measures M 211 and M 212, which earmark payments for the compensation of natural handicaps and mountain areas respectively. At the end of the programming period, these three measures accounted for 72 % of the financial resources of the programme.

The share dedicated for Austria in the EU finance plan was fulfilled. The major beneficiaries of measures in axes 1 and 2 were agriculture and forestry holdings whereas axes 3 and 4 measures are also targeted to beneficiaries in all sectors.

M 214 and M 215 – The Agri-Environmental Programme

This programme brings together measures M 214 and M 215. It offers 29 sub-measures to which farmers can subscribe and which aim to protect and enhance the natural resources soil, water, climate, and biodiversity. Among them are very specific measures such as the nature conservation measure or the preservation of rare domestic breeds (to maintain genetic diversity as a part of biodiversity) but also measures which affect a whole range of goals, for example support of organic farming. In 2013 participated in this programme 108,991 farms (73.1 % of all farms) who managed 2,097,295 hectare (91 % of the utilized agricultural area). A comprehensive study of soil samples collected during the past 20 years confirmed positive effects of the Agri-Environmental measure (M 214) and its predecessor programme on soil quality (humus, nutrient content, soil acidification) in Austria. The results show that the nutrient contents in the soil are moving from over-supply to “sufficient content” level. The content of humus in arable land is rising, thereby improving the soil and contributing to reducing the loss of soil organic matter (SOM). So the results give a good indication that SOM in Austrian arable lands is not declining and that the Agri-Environmental measures have a positive contribution to promote an even slight increase in the level of SOM in mineral soil.

The sub-measures which are crucial for this development are greening of arable land, reduced tillage by direct seed and seeding on mulch and organic farming. The potential for reduction of soil erosion is great and is being very well received. Due to the measures currently in place, soil erosion on utilized agricultural areas has been reduced by 10 % on average. This corresponds to estimated savings of several hundred thousand tons of soil per year. Both direct seed and seeding on mulch are the most innovative approaches to decrease erosion and increase soil fertility.

The sub-measures “Organic farming”, “Environmentally-friendly management of arable land and grassland” and “Greening of arable land” lead to a buildup of humus in the soil and thus to the sequestration of 218,600 tons of CO₂-equivalent annually on 600,000 hectare of arable land in the period 2007-2013/2014. In addition the measure “Renouncement on arable land” also contributes positively to mitigate climate change. Public expenditure for the period 2007 to 2014 can be found in table 12.

Besides the positive influence on the level of SOM in arable land, these measures also contribute to curbing greenhouse gas emissions.

Table 12 Overview of public expenditure related to the sub measures Austrian Agri-Environmental Programme [million euros] (Grüner Bericht 2015)

	2007	2008	2009	2010	2011	2012	2013	2014	total
Organic farming	85.8	88.5	92.4	99.1	99.6	99.8	97.8	95.0	758.0
Environmentally-friendly management of arable land and grassland	99.5	116.7	114.7	112.2	111.3	109.1	106.3	101.6	871.4
Renouncement on arable land	2.3	1.1	0.8	0.7	0.7	0.6	0.6	0.5	7.3
Erosion protection for fruit and hops	2.4	2.5	2.6	2.7	2.6	2.6	2.5	2.3	20.2
Erosion protection for vineyards	5.2	5.3	5.3	5.3	5.3	5.3	5.1	4.6	41.4
Regional programme “Ecopoints Lower Austria”	23.4	28.0	38.6	38.5	37.8	37.4	36.8	35.4	275.9
Greening of arable land	67.0	68.6	65.8	66.2	64.8	65.0	64.8	62.0	524.2
Direct seeding and seeding on mulch	6.1	5.8	5.4	5.6	5.5	5.7	5.6	5.3	45.0
Nature conservation	33.8	37.7	41.8	43.5	43.4	41.8	40.9	38.2	321.1
	325.5	354.3	367.5	373.7	371.1	367.2	360.4	344.9	2 864.5

M 111, M 331 and M 341 – Training and Information

A vocational training and information actions intend to increase the competitiveness of agricultural enterprises through the dissemination of knowledge and education, and raise the awareness for nature conservation and environmental protection. The measure supported educational programmes and projects during which were very comprehensive in terms of content and thus were very well accepted. M 111 forms the backbone of an educational offensive to enhance the so-called “human potential” of the people working in the field of agriculture and forestry, with the aim to train farmers and foresters. 72.1 million euros were provided for this measure during 2007 to 2014. M 331 strives to enhance the technical know-how of economic agents and, in connection therewith, the quality of life and a diversified economy in rural areas. The measure is part of an “educational offensive” in rural areas, with 46.9 million euros spent. The measure “Skills acquisition, animation and implementation” (M 341) aims to contribute to an integrated rural development through participative processes, with payment of 4.6 million euros.

M 122 – Diversification of forestry

This measure supports the acquisition of machinery by associations of forest owners or members of a machinery pool association, thereby increasing productivity and efficiency, including in biomass harvest. During the period 9,779 projects were funded, comprising a forest area of 3,422,000 hectare. In the period 2007 to 2014 about 42.2 million euros were spent for this measure.

M 123 – Increased value added

The objective of measure M 123 is to increase the value added chain of agricultural (M 123a and c) and forestry (M 123b and d) products by introducing new technologies and innovation, including promotion of renewable energy production, and thus to increase the competitiveness. In the period 2007 to 2014 about 191 million euros were spent for this measure.

M 124 – Cooperation for the development of new products, processes and technologies

From the extensive list of goals pursued by the measure “Cooperation for the development of new products, processes and technologies” (M 124) the most frequently supported one was “improvement of information transfer in the forestry sector”, followed by “improving efficiency” and “development of services for forest owner associations or their members”.

The goal according to which supported forest management associations should harvest and market an additional 2.5 million m³ of timber jointly has already been achieved.

M 125 – Construction of infrastructure

Within measure M 125 priority was assigned to the sub-measure (M 125a) construction of forest roads, to support accessibility to forest resources while minimising damages resulting from timber extraction. The proper management of extreme weather events, such as wind breakage events after disastrous storms and the fight against the ensuing spread of bark beetles depends on the accessibility of forests. During 2007 to 2015 more than 2,769 projects comprising in total 4,557 km of forest roads have been funded. In total during 2007 to 2014 about 81.3 million euros were spent for this measure.

M 221 – Afforestation and Reforestation of agricultural land

Although this measure is limited to some sparsely wooded regions, during the period 2007 to 2014 an area of around 239 hectare has been afforested, mainly to protect lands from erosion, but also to improve biodiversity and to mitigate climate change. In the period 2007 to 2014 about 1.6 million euros were spent for this measure.

M 224 and 225 – Natura 2000 and payments for Forest-Environmental measures

M 224 aims at expanding Natura 2000 areas in Austria by additional 35,000 hectare of forest areas. This measure gained only little acceptance by forest holders. Measure M 225 supports silvicultural activities such as natural regeneration and thinning with the aim to be applied to 35,000 hectare of forest areas. During 2007 to 2014 in total 555 hectare of forest areas have received financial support. In the period 2007 to 2014 about 0.13 million euros were spent in this measure.

M 226 – Rehabilitation of the forestry potential and introduction of preventive measures

This broad measure is directed towards increasing resilience of forest ecosystems to natural disturbances and preventive pest control. 16,230 projects have been administered in the period 2007 to 2014, with one-third or 42,000 hectare forest land focussing on rehabilitation measures and two-thirds (comprising 96,000 hectare) on preventive measures. The aim of these measures is to promote all forest functions in a sustainable

manner, including adaptation to climate change. In the period 2007 to 2014 about 109.3 million euros were spent in this measure.

Due to the storms “Paula” and “Emma” which struck in January and February 2008 in Styria and Carinthia and the following increase in bark beetle populations, this measure received high acceptance and was used intensively to mitigate the consequences of these disasters and to deal with the strong multiplication of harmful insects which followed in their wake.

M 311 – Diversification of the rural economy

This measure supported investments of rural enterprises toward the generation of income from non-agricultural activities, with an emphasis (sub-measure M 311a) on the promotion of small-scale renewable energy (for example local heat grids). In the period 2007 to 2014 about 29.8 million euros were spent in this measure.

M 321 – Provision of basic services

This broad measure was established to ensure the supply of basic services for the economy and to improve living conditions of the population in rural areas. Sub-measure (M 321c) was dedicated to promote renewable energy facilities and infrastructure and received 100.6 million euros financial support over the programming period. This sub-measure was strongly connected with the consumer awareness programme klima:aktiv (see PAM 6 above).

Table 13 Overview of public expenditure and total investment related to the measures referred to above [million euros] (BMLFUW 2016)

	Financial support made available 2007 to 2015	Total investment volume triggered	Public expenditure target
M 111	72.1	0.0	72.1
M 122	36.8	86.4	129.5
M 123	173.7	865.9	183.8
M 124	13.5	0.0	13.5
M 125	69.3	140.6	69.3
M 214 and 215	3,729.9	0.0	3,530.0

	Financial support made available 2007 to 2015	Total investment volume triggered	Public expenditure target
M 221	1.6	0.0	1.6
M 224	0.2	0.0	0.2
M 225	0.1	0.0	0.1
M 226	97.5	0.0	97.5
M 311	29.5	105.0	29.5
M 321	209.7	0.0	209.8
M 331	46.9	0.0	46.9
M 341	4.5	0.0	4.5

The measures listed in the Austrian Rural Development Programme for the period 2007 to 2013/2014 are referenced in the indicative Annex IV, in particular (a), (b), (g), (i) and (j) of the LULUCF Decision.

Period 2014–2020

The Austrian Rural Development Programme 2014 to 2020 was approved by the European Commission on 12 December 2014 (BMLFUW 2015). This was preceded by an ambitious programming process that started as early as in 2012 with comprehensive analyses of the strengths, weaknesses, opportunities and threats of the rural areas in Austria.

The programme contents were developed jointly with representatives from politics, agriculture, economy, science, training and advisory services, within the scope of a comprehensive and transparent participation process. In addition to expert groups for the development of concrete measures, a kick-off event was followed by five dialogue days for discussion with the general public.

The entire programming process was accompanied by an ex ante evaluation and a strategic environmental impact assessment that also contributed to quality assurance and internal consistency. The strategic environmental assessment, which concluded that the RD 2014 to 2020 will contribute to achieving the national Effort Sharing target, which is laid down in the Climate Change Act (see above) and promote the production of sustainable renewable resources including feedstock for energy.

As the RD 2014 to 2020 came rather late for the farmer's decisions, 2014 continued with the former programme under the same conditions. 2014 was an interim year between the Austrian Rural Development Programme of 2007 to 2013 and the RD 2014 to 2020, which effectively started in 2015.

The RD 2014 to 2020 contributes to the 6 EU Rural development Priorities (according to Regulation (EU) 1305/2013, Article 5) by implementing 16 measures and many sub-measures.

Relevant measures for mitigating climate change address priority 5 (promoting resource efficiency and supporting the shift towards a low carbon and climate resilient economy in agriculture, food and forestry sectors) and are listed below.

M 1 – Knowledge transfer and information actions (Regulation (EU) 1305/2013, Article 14)

Knowledge Transfer and Information is an important basis for raising awareness concerning energy and resource efficiency as well as environment and climate policy. This measure will thus contribute to priority 5 in general.

M 4 – Investments in physical assets (Article 17)

This measure supports investments in physical assets, for example

- in agricultural holdings with the aim to improve the overall performance by amongst others increasing resource and energy efficiency (and reduce demand for fossil fuels) thus contributing to focus area 5.C (promoting renewable energy) and
- in infrastructure related to development of agriculture and forestry to support sustainable management by adaptation to climate change.

In particular, sub-measure 4.4. „Support for non-productive investments linked to the achievement of agri-environment-climate objectives“, aims to improve the ecological conditions of wetlands, thus contributing to focus area 5.E (soil carbon conservation and sequestration).

M 6 – Farm and business development (Article 19)

This measure supports

- business start-up aid for young farmers and
- investments in creation and development of non-agricultural activities.

In particular, sub-measure 6.4 aims at supporting development of energy services based on renewable energy sources, reducing demand for fossil fuels and strengthening local energy supply, thus contributing to focus area 5.C (promoting renewable energy).

M 7 – Basic services and village renewal in rural areas (Article 20)

In particular, sub-measure 7.2 supports investments in renewable energy contributing to focus area 5.C.

Support is provided for investments

- in biomass-heating systems, local heat grids, replacement of old heating systems by biomass district heating systems, CHP-installations, digesters and installations for the production of methane and
- in dedicated climate and energy projects on community level, focussing amongst others on renewable energy.

Sub-measure 7.6 supports activities to identify potential for torrent and avalanche control, and is thereby directed towards introducing preventive measures for the protection and stabilisation of ecosystems and their carbon stocks.

M 8 – Investment in Development and Improvement of Forests Ecosystems

This broad measure covering activities referred to in Articles 21, 22 and 24 to 26 of Regulation (EU) 1305/2013 aims at improving the stability and resilience of forest ecosystems, amongst others to safeguard the future supply of wood and forest biomass.

Sub-measure 8.1. supports afforestation activities using tree species based on natural forest communities.

Sub-measure 8.4. supports preventive actions to protect forests from forest fires, natural disasters and catastrophic events as well as actions to restore forest ecosystems after those events, with the aim to avoid subsequent pest outbreaks.

Sub-measure 8.5 aims at increasing the resilience and environmental value of forest ecosystems, amongst others by promoting the establishment of protective infrastructure measures and silvicultural measures focussing on biodiversity.

Sub-measure 8.6. supports investments in forestry technologies and in processing, mobilising and marketing of forest products with the aim to support forest cooperatives to jointly mobilise and market timber and forest biomass.

Measure 8 contributes to focus area 5.C (promoting renewable energy), 5.D (reducing GHG emissions and ammonia) and 5.E (soil carbon conservation and sequestration).

M 10 – Agri-Environment-Climate measures (Article 28)

The Austrian Agri-Environmental Programme ÖPUL 2015 offers a large number of measures, which promote climate-friendly agricultural production practices and make a positive contribution to focus area 5.E (soil carbon conservation and sequestration).

Based on evaluation results about the climate change mitigation effect of relevant Agri-Environmental measures in the period 2007 to 2013, the carbon sink potentials of the ÖPUL 2015 measures were further developed. Farming practices within the Agri-Environmental Programme like reduced tillage, the greening of arable land, the implementation of diversified crop rotations, the preservation of grassland, as well as the use of organic fertilisers have positive effects on the carbon content of soil. While fertiliser restrictions as well as the complete abandonment of mineral fertilisers are reducing greenhouse gas emissions (laughing gas) are contributing to focus area 5.D (reducing GHG emissions and ammonia), which is not relevant for LULUCF and therefore not considered within the present report. All measures of the ÖPUL 2015, which contribute to reducing emissions or carbon sequestration, are listed below:

Sub-measure 10.1 – Environmentally sound and biodiversity promoting management has indirect impact on focus area 5.E (soil carbon conservation and sequestration), which is addressed for example by preventing conversion of grassland, preserving landscape elements, installing biodiversity sites or specific crop rotations.

Sub-measure 10.2 – Limitation of yield-increasing inputs has an impact on focus area 5.D (reducing GHG emissions and ammonia) for example by renunciation of mineral fertilisers.

Sub-measure 10.3 – Renouncement of fungicides and growth regulators on areas dedicated to cereal cropping has indirect impact on focus area 5.D (reducing GHG emissions and ammonia) by renunciation and therefore necessary reduced nitrogen fertilisation.

Sub-measure 10.6 – Greening of arable land – intermediate crops has an impact on focus area 5.E (soil carbon conservation and sequestration) by the active greening of land between two main crops and renunciation of mineral nitrogen fertilisers and pesticides and tillage operations throughout the greening period.

Sub-measure 10.7 – Greening of arable land – “evergreen” system has an impact on focus area 5.E (soil carbon conservation and sequestration) by all-season greening of at least 85 % of arable land (by growing main and intermediate crops) and renunciation of tillage operations throughout the greening period. Sustaining and, if possible, whole year round green cover on arable land increases the organic substance in the soil.

Sub-measure 10.8 – Direct seeding and seeding on mulch (including strip-till) has an impact on focus area 5.E (soil carbon conservation and sequestration) by direct seeding and seeding on mulch or strip-till-seeding, renunciation of ploughing tillage.

Sub-measure 10.9 – Low emission slurry and biogas spreading techniques has an impact on focus area 5.D (reducing GHG emissions and ammonia) surface-near spreading of at least 50 % of the liquid farm manure on arable land and grassland, for example by using trailing hose spreaders or liquid manure injection techniques.

Sub-measure 10.10 – Erosion protection in fruit, vine and hop production has an impact on focus area 5.E (soil carbon conservation and sequestration) by active area-wide greening of all machine tracks in vineyards, fruits and hops.

Sub-measure 10.16 – Preventative ground water protection (regional) has an impact on focus area 5.D (reducing GHG emissions and ammonia) and 5.E (soil carbon conservation and sequestration) by reduced use of fertilisers and renouncement of selected pesticides arable land at documentation on the use of nitrogen fertiliser, specific consultation and training. Preventing the conversion of grassland by ban on the ploughing up or renewal.

Sub-measure 10.17 – Management of arable areas particularly threatened by leaching (regional) has impacts on focus area 5.D (reducing GHG emissions and ammonia) and 5.E (soil carbon conservation and sequestration) by the establishment of a permanent green

cover mixture on arable land at risk of leaching, renunciation of fertiliser and pesticides on these area and conversion.

Sub-measure 10.18 – Preventative surface water protection on arable land (regional) has impacts on focus area 5.D (reducing GHG emissions and ammonia) and 5.E (soil carbon conservation and sequestration) by land set-aside on establishing a minimum 12-metre buffer strip adjacent to rivers or streams or by preserving existing, greened buffer strips along rivers or streams.

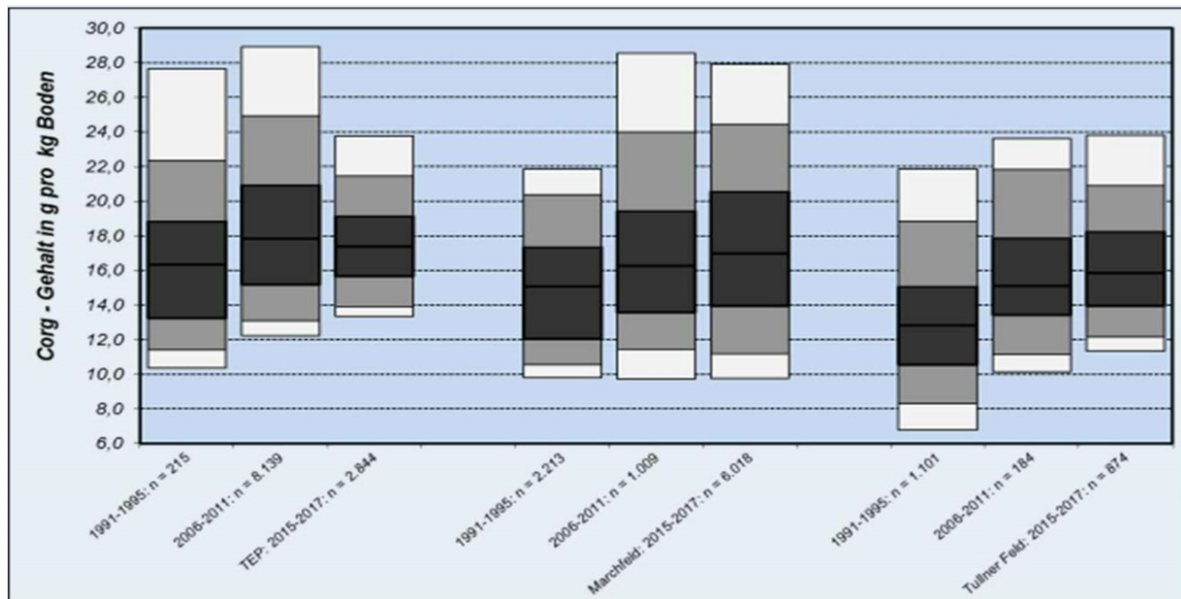
Sub-measure 10.19 – Nature conservation has indirect impact on focus area 5.E (carbon conservation and sequestration), which is addressed by extensive, near-to nature management, for example fertiliser reduction and renunciation, fallow land, preservation of landscape elements, soil preserving tillage systems, and others.

Sub-measure 10.20 – Natura 2000-Agriculture has indirect impact on focus area 5.E (carbon conservation and sequestration), which is addressed by extensive, near-to nature management, for example fertiliser reduction and renunciation, fallow land, preservation of landscape elements, soil preserving tillage systems, and others.

The impact indicator C39 provides information about the soil organic matter in arable land. For Austria C39 was calculated on the basis of soil samples from three representative arable regions: the Traun-Enns-Platte (TEP), the Marchfeld (MF) and the Tullner Feld (TF). Database is the soil testing within the ÖPUL measure 10.1.16 “Preventative ground water protection”. Soil sample results of the three areas show a median of 16 to 18 gram organic carbon per kilogram soil for the carbon content and a median of 36 to 51 tons per hectare for the carbon stocks in the top 20 cm (topsoil).

Graph 7 shows a wide variation of the humus contents of each arable region, which can be attributed to different soil types or site characteristics like the groundwater impact. To determine a trend, the median (accumulation of data) is considered. Results show that 10 to 15 years after the Agri-Environmental Programme was introduced, significant rises of the humus contents of arable soil are plainly evident. Within the past 8 to 10 years humus soil stabilised at a high level in the arable region Traun-Enns-Platte, while it was still slightly increasing in the regions of Tullner Feld and the Marchfeld.

Graph 7 Development of organic carbon contents over time in selected arable regions [TEP ... Traun-Enns-Platte in Upper Austria]



Source: UBA – Bewertung der Auswirkungen der Schwerpunktbereiche, 2019

For the long-term establishment of humus-enriching agricultural practices relevant educational measures and raising awareness are crucial. By the end of 2019 around 1,700 agricultural holdings participated in specific education and consulting measures of the Agri-Environmental Programme referring to priority area 5.E (promoting carbon storage and sequestration in agriculture and forestry). In addition to that, a pilot project concerning the subject of humus formation and erosion control started within the current ÖPUL 2015. The project aims to improve the databasis on the process of carbon storage and examines the effects of reduced tillage on soil humus. The compulsory soil testing combined with analysis and advice increases the participant's awareness of humus-building processes and nitrogen turnovers in soil.

Due to their high proportion of organic matter, grassland soil is an important carbon pool. The conversion of grassland into arable or permanent crop land or into settlements, traffic areas or economic areas result in high humus losses. Meadows and pastures are currently protected both under the first pillar of the Common Agricultural Policy (CAP), as part of greening and by various ÖPUL measures. Support for the tailored management of extensive grassland areas, and in particular wetland habitats with particularly high levels of soil organic matter, is provided under the "ÖPUL nature conservation" measure and the "Natura 2000 measure".

Greening arable land for as long as possible by growing catch crops and fodder also helps to develop humus – in 2019, more than 470,000 hectare, or around 35 % of Austria's arable land, were covered by the ÖPUL greening measures "intermediate crops" and "system evergreen". In addition to that, the machine tracks of around 42,000 hectare of orchards and vineyards were actively greened in the frame of the ÖPUL measure "Erosion protection for fruit, vineyards and hops".

The accumulation of organic matter and the protection against soil erosion, is also aided by the reduction in tillage implemented under the ÖPUL measure "Direct seeding and seeding on mulch". In 2019 on almost 137,500 hectare of arable land reduced tillage was put into practice by the implementation of this measure.

M 11 – Organic farming

This measure will have an impact on focus area and 5.E (soil carbon conservation and sequestration) by different system immanent measures. The more diverse crop rotation that is common in organic farming, as well as the use of legumes fixing nitrogen and the application of organic fertilisers (for example solid manure, slurry, compost) all contribute to the development of humus and carbon in agricultural soil. Intact agricultural nutrient cycles, the renouncement of pesticides and mineral fertilisers and the preservation of permanent grassland and existing landscape features support the maintenance of fertile soil and carbon storage.

By the implementation of soil-friendly farming systems the humus contents of organically farmed arable soil tend to be higher than of conventional one. High levels of humus make soil less vulnerable to erosion and give them a higher water storage capacity, which is of great importance regarding the predicted climate-related increase in drought events.

In 2019 almost 670,000 hectare of the agricultural land were managed organically, which corresponds to more than a quarter of Austria's total agricultural area. The promotion of organic farming has given high priority in Austria. Alone in 2019 organic farms received around 190 million euros within the Agri-Environmental Programme, which accounts for almost 40 % of the total ÖPUL budget. With its high share of organic farms and areas, Austria is holding a leading role both at the European level and globally.

M 15 – Forest-environmental and climate services and forest conservation (Article 34)

This broad measure aims at improving the environmental conditions of forest ecosystems, by providing payment for forest environment commitments and supporting the conservation and promotion of forest genetic resources. This measure will contribute to increasing resilience of forest ecosystems and to focus area 5.E, and will contribute to the EU 2020 Biodiversity Strategy.

The measures listed in the Austrian Rural Development Programme for the period 2014 to 2020 are referenced in the indicative Annex IV, in particular (a), (b), (g), (i) and (j) of the LULUCF Decision.

The Indicator Plan accompanying the Austrian Rural Development Programme for the period 2014 to 2020 (BMLFUW 2014) provides information on the total public expenditure provided for the respective measures listed above (see summary in Table 14), including assumptions on the total investment triggered.

Table 14 Overview of public expenditure and total investment related to the measures referred to above [million euros] (BMLFUW 2014)

	Public expenditure target for 2014 to 2020	Total investment volume triggered 2014 to 2020
M 1	112.0	0.0
M 4	862.0	3,662.0
M 6	172.0	272.0
M 7	679.0	0.0
M 8	165.0	0.0
M 10	2,310.0	0.0
M 11	784.0	0.0
M 15	7.0	0.0

The following table 15 shows the development of the Agri-Environment-Climate Programme, focussing on measures, which contribute to Carbon sequestration, in terms of areas, expenditures and numbers of participating enterprises for the years 2014 and 2019. The numbers show changes in areas as well as enterprises participating in those measures. In this context, it should be noted that the programme is an evolution from the ÖPUL 2007

to 2013/2014 programme, with adjustments made to the strategic orientation and the content-related processing. Raising the level of legally required environmental standards has impacts on the eligibility of the activities to be supported within the frame of the Agri-Environment-Climate Programme, which have to go beyond the minimum legal requirements.

Nevertheless, the participation in the Agri-Environment-Climate Programme remained high, demonstrating the great support of climate and environment measures by Austrian farmers.

Table 15 Participation in Agri-Environmental-Climate measures with a direct relevance for emission profiles of the LULUCF sector

	2014	2019	2014	2019	2014	2019
	Areas participating in the measures [hectare]		Enterprises participating		Financial support [million euros]	
Environmentally-friendly management of arable land and grassland	1,180,281	1,054,526	60,433	48,244	102.903	63.007
Greening of arable land - intermediate crops	408,979	273,538	44,103	24,937	61.911	41.706
Greening of arable land - system evergreen	0	200,248	0	13,294	0	15.930
Direct seeding and seeding on mulch (including strip-till)	134,163	137,448	12,592	11,137	5.309	8.099
Erosion protection for fruit, vineyards and hops	41,722	42,359	7,165	5,692	6.888	8.633
Preventative ground water protection	178,038	320,756	5,790	12,414	10.923	28.769
Arable land endangered by eluviation	50	1,362	20	382	0.015	0.587
Preventative surface waters protection	0	1,100	0	831	0	0.493
Nature conservation	74,384	78,970	20,195	18,824	38.165	39.760
Organic farming	392,946	517,294	19,208	23,641	94.960	128.653
Natura 2000 - Agriculture	0	84	0	35	0	0.012
EU Water Framework Directive - Agriculture	0	14,038	0	606	0	1.184

	2014	2019	2014	2019	2014	2019
	Areas participating in the measures [hectare]		Enterprises participating		Financial support [million euros]	
Regional programme "Ecopoints Lower Austria"*)	125,289	0	5,975	0	0	0
Total area participating in the Agri-Environmental-Climate Programme (without alpine land)	1,921,214	1,839,474				
Total number of enterprises participating in the Agri-Environmental-Climate Programme			102,260	90,795		
Total financial support [million euros]					503.0	450.0

*) no longer parts of the programme

We would like to note that there are several additional measures within the frame of the Agri-Environment-Climate programme, which are relevant for mitigating Climate Change. Those can be found in the list below:

- Einschränkung Betriebsmittel;
- Bodennahe-Gülleausbringung;
- Bewirtschaftung von Bergmähwiesen;
- Verzicht Fungizide/Wachstumsregulatoren;
- Pflanzenschutzmittelverzicht Wein/Hopfen;
- Alpung und Behirtung;
- Anbau seltener Kulturpflanzen;
- Silageverzicht;
- Tierschutz – Weide;
- Erhaltung gefährdeter Nutztierassen;
- Nützlingseinsatz im geschützten Anbau.

PAM 9 – Transport Target of the Climate and Energy Package

According to the Climate and Energy Package (mainly Renewable Energy Directive 2009/28/EC and Fuel Quality Directive 2009/30/EC), each Member State shall ensure that the share of energy from renewable resources in 2020 is at least 10 % of the final consumption of energy in transport (transport target). They are also obliged to achieve a transport target of 10 % substitution of non-renewable energy sources by renewables in 2020 at the latest. These efforts will lead to a reduction in the use of fossil fuels. A central element of both Directives is the obligation to comply with specific sustainability criteria, to be able to count biofuels towards reaching the transport target. These criteria mandate that biofuels shall not be sourced from land with high biodiversity value, for example primary forests or areas designated for nature protection purposes, and from land with high carbon stock, for instance wetlands or peatland.

The Austrian national system for agricultural feedstock operated by Agrarmarkt Austria (AMA) is the first national scheme, which has been assessed and approved at EU level by the European Commission in its implementing Decision (EU) 2016/708. This Decision states the compliance of the “Austrian Agricultural Certification Scheme” (AACS) companies with the sustainability conditions set out in Directives 98/70/EC and 2009/28/EC. The scheme covers agricultural feedstock and vegetable oils and is applied up to the initial processing of the feedstock. In 2018 the use of sustainable biofuels in the transport sector saved more than 1,500 Gg CO₂.

This measure is referenced in the indicative Annex IV (d) and (j) of the LULUCF Decision.

PAM 10 – Guiding Principles of Forest Management

It has been a guiding principle of Austrian forest management policy for more than 100 years to use forests in a sustainable manner, balancing the relevant ecological, economic and social functions. Austria is one of the most densely wooded countries in Central Europe with forests covering more than 47 % of the federal territory, which is almost two thirds higher than the European average. According to the Austrian Forest Inventory 2016/2018 (NFI 2016/2018) the forest as a characteristic element of the Austrian landscape has grown to cover a total area of about 4 million hectare. Ever since the beginning of the Austrian Forest Inventory in 1961 a continuous increase in forest cover

has been observed in Austria. Compared with the first inventory period 1961 to 1970, the forest cover has increased by almost 300,000 hectare to date.

The principle of sustainable management is laid down in § 1 of the Austrian Forest Act. It furthermore provides a strict regulatory framework, which should ensure that all forest functions are maintained (see PAMs 11 to 17).

Laws on nature conservation and landscape protection and on national parks have been enacted at provincial level.

In order to balance the various interests in forest utilisation and to assure the many benefits of the Austrian forest in the long term, the Federal Minister of Agriculture, Forestry, Environment and Water Management has adopted the Austrian Forest Strategy 2020+ in 2016, which was prepared within the frame of the Austrian Forest Dialogue (see PAM 18 below). It contains specific visions, goals and targets with regard to all the major forest issues. The programme's fields of action include amongst others "Contribution of Austrian Forests to Climate Protection", "Biological Diversity in Austrian Forests" and "Austria's International Responsibility for Sustainable Forest Management".

Forestry already plays a key role in the Austrian Climate policy, following the recommendations of the IPCC, which states that a sustainable forest management strategy aimed at maintaining or increasing forest carbon stocks, while producing an annual yield of timber, fibre or energy from forest, will generate the largest sustained mitigation benefit.

In 2018 renewables contributed around 33 % to the gross domestic energy consumption in Austria (Statistik Austria 2020), with approximately 45 % originating from woody biomass. According to the WEM and WAM scenarios the total domestic consumption of woody biomass will further increase to around 200 terajoule in 2030 respectively, resulting in a total biomass demand for energy purposes of around 25 million m³. However, sustainable production of biomass represents only one of the diverse functions of Austrian forestry, which contribute to climate change mitigation and adaptation.

This framing measure is already referenced in the seventh National Communication of Austria, submitted to the UNFCCC on 8 February 2018 (unfccc.int/documents/64720).

PAMs 11 to 17 – Relevant Provisions of the Forest Act

The relevant provisions of the Forest Act have remained largely unchanged since the submission of the Information on LULUCF Actions in June 2014. The respective PAMs remain effective.

This measures are referenced in the indicative Annex IV (g) to (i) of the LULUCF Decision.

PAM 18 – Austrian Forest Dialogue

The Austrian Forest Dialogue is a policy development process initiated in 2001 that is open, continuous and participatory in nature. It has become a much-lauded example of good governance both nationally and internationally.

As the first Austrian Forest Programme was adopted in 2005 it was decided in 2013 to develop a new Austrian Forest Strategy. In 2014 working groups were established to cover seven thematic action areas, one of those specifically targets climate change. The Austrian Forest Strategy 2020+ was adopted by all stakeholders on 12 May 2016 (bmlrt.gv.at/forst/oesterreich-wald/waldstrategie-2020/waldstrategie_paper.html). Climate Change is a core element of the Austrian Forest Strategy 2020+, which states that the forest and wood-based sector plays a pivotal role not only in tackling climate change but also in increasing resilience of our forest ecosystems.

Building on the first Forest Programme, the Forest Strategy 2020+ defines forest-political milestones for the years to come that were developed in a consensus-driven process by the different groups of society. The Austrian Forest Strategy 2020+ takes also into account the policy specifications of current national and international forest-related strategies, programmes and processes. These include the Austrian Biodiversity Strategy 2020+, the Austrian Forest Ecology Programme (ÖWÖP), the Austrian Strategy for Adaptation to Climate Change, the LE 2020 "Forest.Water" programme and the EU Forest Strategy, the EU Biodiversity Strategy, the Forest Europe Process, the United Nations Forum on Forests (UNFF), the Sustainable Development Goals of the United Nations (SDGs), the United Nations Framework Convention on Climate Change (UNFCCC) and the Convention on Biological Diversity (CBD).

The Austrian Forest Strategy 2020+ was jointly developed by 85 organisations involved in forest policy within the scope of the Austrian Forest Dialogue. These organisations include forest proprietors, beneficial owners as well as interest representatives and their compass ranges from government and non-governmental organisations all the way to local authorities.

The primary objective of the Austrian Forest Strategy 2020+ is to ensure and optimise all dimensions of sustainable forest management in a balanced way, paying special attention to the added value and the potential of the Austrian forestry and timber sectors. With this in mind, the Forest Strategy 2020+ is intended to help ensure the multifunctional services that forests render for present and future generations.

To operationalise the Austrian Forest Strategy 2020+, a Work Programme is elaborated which contains concrete measures to support the objectives of this strategy. One broad package of measures is called “Using wood is good for the climate – making forests climate-fit” (bmlrt.gv.at/forst/klimafitter_wald.html). This initiative aims to raise awareness of the broad public on one hand and to address forest owners on the other hand by fostering the use of wood in order to increase climate protection and by adapting forests to climate change. Additionally this initiative acknowledges the role forests play, implementing the Paris Agreement and the EU Climate and Energy Package.

This measure is referenced in the indicative Annex IV (g) of the LULUCF Decision.

PAM 19 – Forest Cooperatives

Cooperative wood harvesting is an appropriate measure to increase wood mobilisation especially from small-scale forest holdings. A major actor is the Austrian Forest Owner Cooperative (waldverband.at), a dedicated organisation of the Austrian Chamber of Agriculture, providing a platform for eight regional cooperatives for collective performance. The major goal is to increase the amount of wood harvested by means of joint production and joint marketing. The results of the latest NFI 2007/2009 show that the wood mobilisation from small-scale forest holdings has been increased by more than 50 %, compared to the former NFI 2000/2002. The initiative is also closely linked to measures adopted within the frame of Austrian Forest Dialogue.

This measure is referenced in the indicative Annex IV (g) of the LULUCF Decision.

PAM 20 – Task Force Renewable Energy

In 2006, Task Force Renewable Energy (see M 321.2 of the Austria Forest Dialogue) was established, comprising relevant experts and stakeholder, with the aim to define the domestic supply of different renewable energy sources, including forest biomass, and measures, which are necessary to mobilise the additional potential. The final report energiestrategie.at/images/stories/pdf/02_bmlfuw_09_erneuerbare2020.pdf also fed into the development of the Austrian Energy Strategy and reinforced the findings of the wood and biomass supply study, which forms the basis for establishing the Forest Management Reference Level 2013 to 2020.

This measure is referenced in the indicative Annex IV (j) of the LULUCF Decision.

PAM 21 – Protection of Wetlands

Austria currently has areas of 126,000 hectare wetlands, which are classified as “Ramsar-areas”. According to the Federal Constitution Act legislative power over issues related to natural protection lies with the provinces. The respective nature protection laws stipulate that wetlands, in particular its habitats and organisms, have to be protected.

This measure is referenced in the indicative Annex IV (d) of the LULUCF Decision.

Annex – Summary of policies and measures by sectors

Table 16 Mitigation action in Austria; Table 3.1. from Austria’s fourth Biennial Report [BMK 2019]

Name of mitigation action	Objective and/or activity affected	Type of instrument	Status	Brief description	Mitigation (Gg CO ₂) 2020/2030
EU Emission Trading Scheme (ETS)	Framework policy multi-sectoral policy	Economic, Regulatory	Implemented	The objective ist to limit the CO ₂ emissions of energy intensive stationary installations and aviation through a trading mechanism for emission certificates	NE
Domestic Environmental Support Scheme	Framework policy multi-sectoral policy	Economic	Implemented	Financial support to GHG mitigation projects (energy efficiency, renewables, waste, ...)	NE
Austrian Climate and Energy Fund (KLI.EN)	Framework policy multi-sectoral policy	Economic, Research	Implemented	Financial support to energy-relevant research projects to climate friendly transport projects and to market launch of new climate friendly technologies	NE
Increase the share of renewable energy in energy supply and district heating	Increase in renewable energy	Economic, Regulatory	Implemented	Granting fixed feed-in tariffs for various forms of electricity generation from renewable sources	3,500/4,900
Increase share of clean energy sources in transport	Low carbon fuels or electric cars	Economic, Regulatory	Implemented	Mandatory minimum share of biofuels in transport fuels, support for electric mobility	NE/4,490

Name of mitigation action	Objective and/or activity affected	Type of instrument	Status	Brief description	Mitigation (Gg CO ₂) 2020/2030
Increased share of renewable energy for space heating	Increase in renewable energy	Economic, Regulatory	Implemented	<ul style="list-style-type: none"> - Stepping up the replacement of heating systems; - District heating and district cooling Act; - Funding for wood heating systems and solar heating systems 	655/1,437
Implementation of EU agricultural policies	<ul style="list-style-type: none"> - improved cropland management and reduced fertiliser or manure use; - improved livestock and manure management; - activities improving grazing land or grassland management 	Economic, Regulatory	Implemented	<ul style="list-style-type: none"> - Implementation of the EU Common Agricultural Policy which takes into account the need for a reduction of environmental pollution from agricultural activity; - national agricultural support programme considering environmental aspects 	NE

References

BMNT 2019: Austria's Fourth Biennial Report in Compliance with the Obligations under the United Nations Framework Convention on Climate Change, according to Decisions 2/CP.17 and 19/CP.18 of the Conference of the Parties, submitted 30 Dec. 2019; unfccc.int/sites/default/files/resource/AT_BR4.pdf

BMLFUW 2014: Austrian Rural Development Programme 2014–2020; bmlrt.gv.at/land/laendl_entwicklung/erstellung_programm_le1420/einigungdetail_le.html

BMLFUW 2016: Ex post Evaluierungsbericht, LE-Programm 07-13 bmlrt.gv.at/land/laendl_entwicklung/le-07-13/evaluierung/Ex-post-Evaluierungsbericht.html

Braun et al. 2015: Endbericht, Kohlenstoffspeicherung durch Holzprodukte; bfw.ac.at/cms_stamm/050/PDF/holzkette/BOKU_HolzKohlenstoffpool-end.pdf

European Union 2013: Decision No 529/2013/EU of the European Parliament and of the Council of 21 May 2013 on accounting rules on greenhouse gas emissions and removals resulting from activities relating to land use, land-use change and forestry and on information concerning actions relating to those activities; eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:165:0080:0097:EN:PDF

Geschäftsbericht 2019: Annual Report of the Austrian Climate and Energy Funds; klimafonds.gv.at/wp-content/uploads/sites/6/31122019-Klima-und-Energiefonds-Bericht.pdf

BMLFUW 2015: Grüner Bericht 2015, prepared in accordance with § 9 of the Austrian Agricultural Law 1992; gruenerbericht.at/cm4/jdownload/download/2-gr-berichtterreich/1523-gb2015-pdf

Gschwantner et al. 2010: Weiterentwicklung des Wachstumssimulators PROGNAUS durch Einbindung klimarelevanter Parameter. In: Neumann, M. (editor), Auswirkungen des Klimawandels auf Österreichs Wälder – Entwicklung und vergleichende Evaluierung unterschiedlicher Prognosemodelle. Forschungsbericht A760631. Klima- und Energiefonds, Wien, S. 150. – OK

Kindermann 2010: Eine klimasensitive Weiterentwicklung des Kreisflächenzuwachsmodells aus PROGNAUS. Austrian Journal of Forest Science, S. 127, 147-178. – OK

Ledermann 2002: Ein Einwuchsmodell aus den Daten der Österreichischen Waldinventur 1981-1996. Centralblatt für das gesamte Forstwesen 119, S. 40-77.

Liski et al 2005: Carbon and Decomposition Model YASSO for Forest Soil. Ecol. Modell. 189, 168–182.

Liski et al 2009: Yasso07 User-Interface Manual. Finnish Environment Institute, Helsinki.

Statistik Austria 2020:

[statistik.at/web_en/statistics/energy_environment/energy/energy_balances/index.html](https://www.statistik.at/web_en/statistics/energy_environment/energy/energy_balances/index.html)

Umweltbundesamt 2019: GHG Projections and Assessment of Policies and Measures in Austria. Reporting under Regulation (EU) 525/2013. Umweltbundesamt Wien, 2019, Reports, Band 0687, ISBN 978-3-99004-506-0, 142 pp.

[umweltbundesamt.at/fileadmin/site/publikationen/rep0687.pdf](https://www.umweltbundesamt.at/fileadmin/site/publikationen/rep0687.pdf)

Umweltbundesamt 2020: Austria's National Inventory Report 2020. Submission under the United Nations Framework Convention on Climate Change and under the Kyoto Protocol. Umweltbundesamt Wien, 2020, Reports, Band 0724, ISBN: 978-3-99004-544-2, 780 pp.

[umweltbundesamt.at/fileadmin/site/publikationen/rep0724.pdf](https://www.umweltbundesamt.at/fileadmin/site/publikationen/rep0724.pdf)

Umweltinvestitionen des Bundes 2019: Report to the Parliament of Environmental Subsidies;

[umweltfoerderung.at/fileadmin/user_upload/media/publicconsulting/umweltinvestitionen_des_bundes_klima_und_umweltschutzmassnahmen_2019_barrierearm .pdf](https://www.umweltfoerderung.at/fileadmin/user_upload/media/publicconsulting/umweltinvestitionen_des_bundes_klima_und_umweltschutzmassnahmen_2019_barrierearm.pdf)



**Federal Ministry of Climate Action, Environment, Energy, Mobility, Innovation and
Technology**

Radetzkystraße 2, 1030 Vienna, Austria

[bmk.gv.at](https://www.bmk.gv.at)