GHG PROJECTIONS OF LAND USE, LAND USE CHANGE AND FORESTRY FOR NON-FOREST LAND IN AUSTRIA

Reporting under Art. 14 of Regulation (EU) 535/2013

DRAFT

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1 INTRODUCTION


For the next submission in 2017 under Art. 14 of the MMR the information included in these reports will be integrated in the Austrian report on “GHG Projections and Assessment of Policies and Measures” (chapter 2.4 and 3.4).

The projections presented here reflect the WEM (with existing measures scenario) for Austria. The reference year for all sub-categories is 2013.
2 SECTOR OVERVIEW

The sector 4 LULUCF has been a net sink in the past and is projected to remain a net sink until 2035. Between 2013 and 2015 the net-removals increase by approximately 3.5 Mt CO$_2$ eq which is due to an increase of the HWP sink in the same time. From 2025-2030 onwards the net sink decreases, which can also be explained by the similar trend in the dominating HWP pool. After 2030 the aggregated net sink of the two largest LULUCF sectors, 4.A Forest land and 4.G HWPs, are projected to remain stable, resulting in a stabilisation of the total net sink in the LULUCF-sector.

2.1 Past trend and scenarios (2013-2035) – GHG emissions from 4.LULUCF

![GHG emissions - 4. LULUCF total](image)

Source: Umweltbundesamt (2015b)

2.1 Forest land (4.A)

As can be seen from the past trend forest land has been a net sink since 1990, characterized by considerable variations due to weather conditions, timber demand, prices or wind throws. According to the WEM scenario the source category 4.A remains a net sink resulting in removals of -4.39 to -2.27 Mt CO$_2$eq. Nevertheless, the sink potential tends to decrease towards 2035. This can be explained by the increased use of forest biomass. It has to be noted that this trend is strongly based on the underlying assumptions applied to the models and that the actual trend can deviate substantially in case of unforeseen events.

2.2 Past trend and scenarios (2013-2035) - GHG emissions from 4.A Forest land
2.1.1 Methodology of the sectoral scenario

The emission projections for sector 4.A are based on a study on the GHG balance of the Wood Chain from the Austrian Forests “Treibhausgasbilanz der österreichischen Holzkette”, conducted by the Austrian Research Centre for Forests (BFW), the University of Natural Resources and Applied Life Sciences, Vienna (BOKU) and Umweltbundesamt which has been published in 2015 (Weiss et al 2015). The study developed several scenarios, with a Reference Scenario (R) which corresponds with the existing measures scenario (WEM).

The reference scenario has been established based on historic field data from the Austrian national forest inventory (NFI) 2007/09 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 using the increment of single trees. It is based on a derivative of the PROGANUS model. The model applies a various set of tree species specific, mathematical-statistical equations which describe growth of diameter and height of single individual trees. In addition, temperature and precipitation data was fed into the model to simulate climatic conditions. Models for salvage cutting and incidental fellings have been integrated as well. An ingrowth model estimates 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) has been applied (BFW, 2015).

To ensure consistency between category 4.A Forest land and 4.G HWPs, the timber volume and increment have been calibrated iteratively between the CALDIS model and the Forest Sector Model FOHOW2 which has been used for projections of HWPs (see chapter 2.7.1).
2.1.2 Assumptions

The reference scenario 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.

Wood imports are determined in accordance with future developments of wood export markets. The amount of wood available for imports to Austria is expected to decrease, resulting from an increase in installed wood processing capacities and use of wood for energy in exporting countries. The amount of sawlog, pulpwood and fuel wood available for exports is expected to decline by 50% until 2025 (compared to the levels of 2010). External supply of recycled paper will be limited to 1 million ton from 2015 onwards.

From 2025 to 2035 the supply curves which are applied in the model remain on the same level, but this does not imply that modelled imports to Austria remain constant (see Table 2-1). The demand of wood will to a very large extent be covered by the supply of the Austrian forest (from about 75% in 2010 to >90% until 2050).

Table 2-1 Amount of net imported sawlogs in the WEM scenario

<table>
<thead>
<tr>
<th>[million m³]</th>
<th>2010</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
<th>2035</th>
</tr>
</thead>
<tbody>
<tr>
<td>net imported sawlogs</td>
<td>4.30</td>
<td>3.32</td>
<td>2.39</td>
<td>2.06</td>
<td>2.00</td>
<td>1.97</td>
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<tr>
<td>Source: Braun et al. (2015)</td>
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With regards to policy assumptions, it is assumed that the national targets as defined in the National Renewable Energy Action Plan 2010 (BMWFJ, 2011) for the year 2020 will be achieved and that current subsidies for fuel wood will be continued until 2020. The renewable energy share will increase to 34% of the total gross final energy consumption by 2020, with 45% stemming from woody biomass. After 2020 the development of the domestic wood demand will be driven by market mechanisms only and will correspond with the demand for forest biomass resulting from the domestic energy scenarios from 2013 (Krutzler et al. (2013). It shall be noted that the WEM scenario includes the same assumptions for gross domestic consumption of woody biomass by Krutzler et al (2013) as it has been reported by Austria for the WEM scenario in the 2013 submission under the EU Monitoring Mechanism Decision.

The annual growth of GDP is set to 1.5% for Austria and 2.2% for OECD countries until 2025, after 2025 the WEM scenario assumes an annual growth of 1.5% (Braun et al. 2015). More details on economic assumptions are provided in Table 2-2.

---

1 The GDP growth rates were derived from the International Monetary fund and OECD, oil prices are in line with the assumptions for the baseline scenario of the AFORE 2013 project. More information can be found in Braun et al. 2015
Table 2-2 Economic assumptions for the WEM scenario

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<tbody>
<tr>
<td>GDP (%)</td>
<td>1.4</td>
<td>-3.8</td>
<td>2.1</td>
<td>2.7</td>
<td>0.6</td>
<td>1.3</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
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<tr>
<td>GDP OECD</td>
<td>0.1</td>
<td>-3.7</td>
<td>2.8</td>
<td>1.6</td>
<td>1.3</td>
<td>1.9</td>
<td>2.2</td>
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<tbody>
<tr>
<td>2008</td>
<td>94.7</td>
<td>65</td>
<td>79.6</td>
<td>107.6</td>
<td>112.5</td>
<td>127</td>
<td>146.7</td>
<td>167.6</td>
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<tr>
<td>2008</td>
<td>1.47</td>
<td>1.39</td>
<td>1.32</td>
<td>1.39</td>
<td>1.28</td>
<td>1.35</td>
<td>1.35</td>
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<tr>
<td>2008</td>
<td>0.98</td>
<td>0.98</td>
<td>1</td>
<td>1.03</td>
<td>1.06</td>
<td>1.13</td>
<td>1.24</td>
<td>1.37</td>
<td>1.67</td>
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<tr>
<td>2008</td>
<td>66</td>
<td>47.5</td>
<td>60.3</td>
<td>75.2</td>
<td>82.9</td>
<td>83.3</td>
<td>87.6</td>
<td>90.8</td>
<td>95.7</td>
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<tbody>
<tr>
<td>2008</td>
<td>29.4</td>
<td>21.2</td>
<td>26.9</td>
<td>33.5</td>
<td>36.9</td>
<td>37.1</td>
<td>39</td>
<td>40.4</td>
<td>42.6</td>
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<tbody>
<tr>
<td>2008</td>
<td>26</td>
<td>-28</td>
<td>27</td>
<td>25</td>
<td>10</td>
<td>0.1</td>
<td>1</td>
<td>0.7</td>
<td>0.5</td>
</tr>
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</table>

Source: Braun et al. (2015)

In comparison to the projection in the previous submission (2015) the sector 4.A remains a sink and does not become a source of GHG emissions. This can be explained by the impact of the financial crisis in 2008 (reduced production and demand of wood, see also Figure 2-8 in chapter 2.7) whose consequences had still influenced the reference year (2013) and therefore affected the projected time series. The projection of the previous submission was carried out before the economic crisis and assumed a continuation of trends as before the year 2008.

Table 2-3 Historic biomass drain, yearly values calculated on the basis of the Austrian NFI, after 2008 extrapolated trend on the basis of NFI 2007/09

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</thead>
<tbody>
<tr>
<td>historic biomass drain</td>
<td>23.03</td>
<td>18.46</td>
<td>17.75</td>
<td>23.48</td>
<td>27.28</td>
<td>30.39</td>
<td>31.08</td>
<td>25.89</td>
<td>25.89</td>
<td>25.89</td>
<td>25.89</td>
<td>25.89</td>
</tr>
</tbody>
</table>
2.1.3 Activities

It has been assumed that the area of forest land remains constant over time. A further split into forest land sub-categories (land conversions from and to forest land) was not applied in the study.

2.2 Cropland (4.B)

As can be seen from the past, total cropland has been a net sink since 2001, mainly caused by an increase of soil carbon in cropland remaining cropland, due to specific management measures implemented by the Austrian agri-environmental programme ÖPUL (details see 2.2.1). This programme was introduced in 1995, when 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, after which the stocks reach a new equilibrium state. This implies that the implemented measures do not lead to further soil carbon stock increases after 20 years\(^2\).

Consequently, the effect of the 20-years period is strongly related with the starting date of the implementation of past ÖPUL measures. With the phase out of these management driven C sequestration effects in cropland soil due to the reaching of a new equilibrium stock, the cropland category is projected to turn back into a net source around 2015, 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 soils samples (AGES 2011) shows that the humus content increased in all regions by 0.1 to 0.4% during 15 years as a result of the ÖPUL 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 would like to discuss this topic further with other Member States on EU level.

It is assumed that in Austria the areas under management of the most relevant ÖPUL measures will remain stable or slightly decrease until 2050, with the exception of areas subject to organic farming. After 2030, most of these areas will have passed the 20 years transition period and the soil carbon stocks will – even if the ÖPUL measures are continued – no longer increase and the decline in the related annual sink will be finished. This leads to a reversal of the emission trend in 2030. At that time the cropland sector turns to the rather stable emission level due to the rather stable perennial biomass losses and soil C stock losses as a consequence of land-use changes and decreases in perennial cropland.

\(^2\) These IPCC default transition periods could be changed by studies on country specific transition periods, but Austria has no such results.
2.2.1 Methodology

The emission projections for sector 4.B are based on projected areas from

- expert judgement by several experts from agricultural institutions in Austria and
- calculations carried out by the PASMA-model (Positive Agricultural Sector Model Austria), conducted by the University of Natural Resources and Applied Life Sciences, Vienna (BOKU). The PASMA model was developed by the Austrian Institute of Economic research (WIFO) (Wifo & Boku 2015) and has been also used for the projections of activity data for the Sector Agriculture (CRF Source Category 3).

For all subcategories of Cropland the arithmetic means of estimations resulting from expert judgements and calculations carried out by the PASMA-model have been used to derive the areas for the years 2020 to 2035. For consistency reasons the areas under management of the four most important cropland management measures of the ÖPUL programme have also been calculated with the same methodology, in order to derive soil organic Carbon stock changes in annual/perennial cropland remaining annual/perennial cropland.

The graph 3-1 shows discontinuities in the historic time series every 6 years corresponding with the starting point of the different RD programmes, in particular the respective ÖPUL-programmes, which ran from 1995-2000 (ÖPUL 95), 1998-2000 (ÖPUL 98), 2000/2001-2007 (ÖPUL 2000), 2007/2008-2013/2014 (ÖPUL 07-13) and 2015-2020 (ÖPUL 2020). The shift from one programming period to the other resulted in substantial changes of the areas under management by the ÖPUL measures and hence in the corresponding emissions profile.

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3 The historic data for Cropland shown in this figure will be published in the National Inventory Report (NIR) 2016. Due to a change in methodology in 2015 for soil in CL remaining CLit is not consistent with the information reported in NIR 2015.
• cropland with organic farming (“Biolandbau”): Structural support of organic farming has been in place since the 80s and was enlarged in 1990. Since 1995 organic farming is supported through the ÖPUL programme. For organic cropland a rapid development can be seen as part of the ÖPUL 2000 programme, where the area expanded from 77,930 ha (2001) to 152,900 ha (2007).

• cropland without mineral fertilizer use (“Verzicht”): This measure which renounces mineral fertilizer is part of the ÖPUL programme since joining the EU in 1995 until recent time and shows rather stable areas (about 40,000 ha).

• cropland with reduced fertilizer use (“Reduktion” bzw. “UBAG”): This measure to reduce mineral fertilizer was part of the ÖPUL programme since joining the EU in 1995 until 2006 and has been supported under this name. From 2007 to 2014 this measure was part of the ÖPUL measure “UBAG” (Umweltgerechte Bewirtschaftung für Acker und Grünland), which almost doubled the related cropland areas.

• cropland with mulch tillage and no-tillage (“Mulch- und Direktsaat”): This measure is part of the ÖPUL programme since joining the EU in 1995. It got a boost of arable area with the ÖPUL 2000 programme starting with 2001 from 7,944 ha in 2000 to 96,874 ha in 2001. In 2014 this measure was implemented at approximately 140,000 ha.

Areas with greening measures which can be combined with those four ÖPUL measures were assigned to the four measures. Thereby the contribution of greening measures to the soil organic carbon stock has been taken into account.

All emissions are calculated on the basis of the methodology used for Austrian Greenhouse Gas Inventory. A comprehensive description can be found in the Austrian National Inventory Report (Umweltbundesamt 2015b).

### 2.2.2 Assumptions

For the **model PASMA** the abolition of milk quota and suckler cow premium in 2015 is implemented in the WEM scenario, as well as the continuation of “cross compliance” and “greening” requirements. Market price developments are derived from OECD-FAO 2014 forecasts.

In detail the following policy measures are implemented in the WEM-scenario of the model PASMA:

• Sector specific measures implemented according to the Austrian Climate Protection Act, in particular in the context of the Austrian agri-environmental programme ÖPUL;

• Implementation of the CAP health check reform 2008 (mainly abolition of milk quota in 2015);

• Implementation of the CAP 2013 reform (in particular abolition of sugar quota and suckler cow premium);
• Internal convergence of direct payments ("regional premium" scheme instead of historic payments);

• Land is maintained in good agricultural and ecological condition ("cross compliance" and requirements for "greening" – in particular crop rotation requirements – are met);

• The programme for rural development is maintained in a modified way with different premiums (in particular for less favoured areas and organic farms) and measures;

• Loss of agricultural land to settlement area following the long term trend;

• Increase of milk yield per cow from 15% (2020) to 35% (2050) relative to reference period

These measures are the same as for the WEM projections of the Agriculture sector.

Global demand for food and technological progresses are a major driving force of sector developments. The transmission of demand and supply takes place via prices which are assumed to be set on global markets. Given the small size of Austria within EU-28, the assumption is be made that any domestic supply or demand shift does not affect equilibrium prices in the common market. Market price developments in the WEM scenario are derived from OECD-FAO 2014 forecasts apart from milk price projections. For this analysis, lower milk prices for Austria are assumed than those forecast by OECD-FAO (2014) for the EU. The reasoning behind the deviation is that for countries which are likely to expand milk production, lower prices may prevail over a long period until a new equilibrium establishes (see Schmid et al., 2011 for more elaborations on this expectation). Other assumptions, in particular technical progress in plant and animal production are based on Sinabell & Schmid (2005). Estimates of future milk yields per dairy cow are adapted to better fit recent findings and expert perceptions.

The forecast period in this study is going until 2050 but it should be noted that the OECD-FAO outlook for agricultural sector developments ends with 2023. Therefore, the assumption is made that beyond this year, prices will follow a linear trend. For further specifications on the scenario, see Sinabell et al. (2015).


Concerning expert judgement, it has been assumed that no changes in current policies (2013) occur. Some examples for underlying assumptions for cropland development from the expert judgements are provided for clarification purposes:

• Further structural change in agriculture, marginalisation (areas of farmland cease to be viable under an existing land use and socio-economic structure);

• Increasing yields due to technical progress;

• Increasing mechanisation;

• Land use trend revealed by past Farm Structure Surveys is continuing;

• Further increasing settlement due to population development;

• Climate change / Rising mean temperature;
- EU Common Agricultural Policy and World market prices are main driving forces;
- Change of nutrition behaviour;
- Increase of renewable energy sources;
- Waste reduction (incl. food waste).
- Regulatory restrictions (like cross compliance regulation)
- Increasing need for food

### 2.2.3 Activities

Both, results from the expert judgement and the PASMA model showed a continuing loss of agricultural land, particularly to settlement area, following the long term trend. This considerable loss of agricultural land by 2035 is mainly due to the secular trend of competition for land from urbanisation and traffic infrastructure.

For annual cropland approximate losses of 8 % in the long run until 2035 compared to the reference year 2013 are estimated. Perennial cropland is also expected to decline by 19 % within the period 2013-2035, which is mainly due to declining vineyard areas. This declining trend is estimated to result from an increase in the competition on global wine markets, leading to cheaper wine imports; there were however divergent views concerning the magnitude of the decline in vineyard areas. In addition, it is assumed that due to mechanisation, the phase out of vineyard management, in particular in margin areas, where no tractor management is possible, will continue.

Orchard areas are expected to remain more or less stable over the time period until 2035.

Land converted to cropland is expected to be reduced by 34% until 2035, resulting from increasing legal restrictions (cross compliance), aiming mainly at retaining grassland areas, thus reducing the conversion of grassland to annual cropland.

### 2.3 Grassland (4.C)

The past trend shows that the category grassland is a net source since 1990. Due to the fact that the land use change rates from forest land 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 category remains a net source resulting in an increase of emissions by 20 % from 2013 to 2035. The estimated reduction of the land-use change area in particular of annual cropland converted to grassland which is a net sink, leads to an increase of the net emissions of the total grassland category from 2025 to 2030.
2-4 Past trend and scenarios (2013-2035) – GHG emissions from 4.C Grassland

**GHG emissions - 4.C Grassland**

![Graph showing GHG emissions from 4.C Grassland over time](image)

*Source: Umweltbundesamt (2015b)*

### 2.3.1 Methodology

The emission projections for sector 4.C follow the same methodology as for the National Greenhouse Gas Inventory (Umweltbundesamt 2015b).

For all areas of the subcategories of 4.C Grassland the arithmetic means of estimations resulting from expert judgements and calculations carried out by the PASMA-model have been used to derive the areas for the years 2020 to 2035.

### 2.3.2 Assumptions

General assumptions for the PASMA model and the expert judgements are described in detail in chapter 2.2.2.

Concerning the expert judgements some specific examples for assumptions for grassland development are given:

- Further structural change in agriculture, marginalisation
- Stop of agricultural management at marginal extensive grassland, especially in mountain areas, leading to overgrowing of succession with shrubs, bushes and trees (scrub encroachment)
- Land use trend revealed by past Farm Structure Surveys is continuing
- Climate change / Rising mean temperature
- Rising livestock density and milk yields coupled with larger areas of more intensive grassland management
- EU Common Agricultural Policy and World market prices are main driving forces
- Change of nutrition behaviour
• Increasing pressure on grassland worth to be converted to cropland, but political measures to protect grassland remain in place

• Area of alpine pastures and meadows will decrease due to the phase out of agricultural management (succession with shrubs, bushes and trees)

### 2.3.3 Activities

The total grassland area is assumed to decline, mainly because of increasing settlement area and land-use change to forest land. This applies especially for the more extensive sub-categories, like one-cut meadows and alpine meadows and pastures, while more cut meadows are expected to decrease only slightly, remaining more or less stable.

### 2.4 Wetlands (4.D)

According to the historic trend wetland has been a net source since 1990 due to the emissions of the sub-categories forest land converted to wetlands and grassland converted to wetlands. The higher LUC areas to wetlands after 2005 to 2013 cause the observed increases in the emissions until 2013.

According to the WEM scenario wetland emissions decrease by 46% from 2013 to 2035. This is caused by the estimated lower LUC areas from forest land/grassland to wetland as compared to the most recent historic years. From 2015 to 2035 the emissions remain stable.

#### 2.5 Past trend and scenarios (2013-2035) – GHG emissions from 4.D Wetlands

![GHG emissions - 4.D Wetlands](image)

*Source: Umweltbundesamt (2015b)*

### 2.4.1 Methodology

The emission projections for sector 4.D follow the same methodology as for the National Greenhouse Gas Inventory (Umweltbundesamt 2015b).
2.4.2 Assumptions

The results of Real Estate Database show an average annual wetland area increase of 1% since 1990 (Umweltbundesamt 2015b). It was assumed that this long-time trend of wetland increase and LUC from forest land and grassland to wetlands will continue.

2.4.3 Activities

It has been assumed that the area of Wetlands increases further by the mean annual area of additional wetland from 1990-2013.

2.5 Settlements (4.E)

As can be seen from the historic trend 4.E Settlements have been a net source since 1990. According to the WEM scenario, emissions in category 4.E continue to follow the historic trend and therefore decrease by 26% from 2015 to 2035. This is caused by the fact that the average annual LUC areas to settlement are slightly smaller in the future (5,400 ha) than in the past years (1990-2013: average increase 6,800 ha).

2.5.1 Methodology

The projected areas for sector 4.E Settlements are based on:

- expert judgements
The arithmetic means of these sources were calculated to derive the areas for the years 2013-2035. The LUC areas of the other land-use categories to settlement were estimated on the basis of the historic trends, overall area consistency in all sectors (year-to-year area changes are equal to net LUC areas to/from the category) and the “availability” of cropland and grassland for settlement due to the estimated decline of the areas of these land use classes.

2.5.2 Assumptions

The expert judgements are based on the following assumption:

- The population is expected to grow continuously, with a concentration in urban and suburban regions and with a corresponding demand of infrastructure.

Assumptions for settlement development are described in detail in the study ÖROK (2015).

2.5.3 Activities

The area of settlements increases further as a result of an increased demand for land used for buildings, transport and infrastructure.

2.6 Other Land (4.F)

As in the past emissions from sector 4.F Other land are further declining, whereas emissions tend to stabilize in the period 2030-2035. This is because emissions in this category only occur in sub-sector forest land converted to other land where land-use changes are assumed to remain constant for the period 2013-2035.

2-7 Past trend and scenarios (2013-2035) – GHG emissions from 4.F Other land

Source: Umweltbundesamt (2015b)
2.6.1 Methodology

The areas for land use changes for forest land converted to other land are based on expert judgements that the annual LUC from forest land to other land remains constant as in the last years of the historic time-series.

2.6.2 Assumptions

See chapter 2.6.1

2.6.3 Activities

See chapter 2.6.1

2.7 Harvested Wood Products (4.G)

The category 4.G Harvested Wood Products is a net sink in Austria, with mean net removals of -4.41 Mt CO₂eq between 2013 and 2035. This category is subject to fluctuations as it is strongly influenced by variable market conditions (e.g. the effects of the economic downturn in 2008/09). From 2013 to 2020 the HWP-sink will increase due to the reasons:

- The reduced availability of wood for imports results in an increased mobilisation of domestic wood,
- Effects of changes in demand parameters such as the GDP and
- a shift from using wood for energy to producing HWP after 2020.

2.8 Past trend and scenarios (2013-2035) - GHG emissions from 4.G Harvested Wood Products

The model results show that the production of HWPs stabilises after 2020 resulting in a long term decline of the HWP-sink, as the amount of HWPs produced (inflow) and the outflow of the HWP-pool gradually balance out. This trend is also reflected in Table 2-4.

The production of sawnwood from domestic harvest slightly decreases between 2015 and 2035. Wood panels and paper show an increase in production and stagnate from 2025 onwards.

<table>
<thead>
<tr>
<th>HWP production</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
<th>2035</th>
</tr>
</thead>
<tbody>
<tr>
<td>sawnwood [million m³]</td>
<td>8.3</td>
<td>8.7</td>
<td>8.6</td>
<td>8.2</td>
<td>8.0</td>
</tr>
<tr>
<td>wood panels [million m³]</td>
<td>2.9</td>
<td>3.2</td>
<td>3.5</td>
<td>3.5</td>
<td>3.5</td>
</tr>
<tr>
<td>paper [million t]</td>
<td>2.3</td>
<td>3.1</td>
<td>4.2</td>
<td>4.3</td>
<td>4.4</td>
</tr>
</tbody>
</table>

*Source: Braun et al. (2015)*

### 2.7.1 Methodology of the sectoral scenario

Emissions and removals from category 4.G Harvested wood products have been estimated by applying the FOHOW2 model. The FOHOW2 model (Schwarzbauer and Stern, 2010; Schwarzbauer and Rametsteiner, 2001; Braun et al. 2015) is an economic model which covers the entire forest-based sector from forestry over intermediate products to end products under consideration of market mechanisms and economic circumstances. The model simulates carbon stocks and flows along the whole wood production chain. Historic trade statistics, production statistics and a national wood flow diagram (Lang and Nemestothy, 2012) served as model input data on wood consumption. The FOHOW2 model includes the elements of the forest product chain. Based on this, the model simulates all carbon fluxes of Harvested Wood Products (HWP) in Austria and calculates the carbon stocks and fluxes in accordance with the 2006 IPCC guidelines for GHG inventories.

### 2.7.2 Assumptions

Assumptions are in line with the information provided in chapter 2.1.2.
3 CHANGES WITH RESPECT TO THE SUBMISSION OF 2015

Table 3-1 Comparison of GHG projections 2015 and 2016 - LULUCF (in Gg CO\textsubscript{2}eq)

<table>
<thead>
<tr>
<th>Gg CO\textsubscript{2}eq</th>
<th>2013</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
<th>2035</th>
</tr>
</thead>
<tbody>
<tr>
<td>submission 2015</td>
<td>-1390</td>
<td>3508</td>
<td>5005</td>
<td>5005</td>
<td>5005</td>
<td>5005</td>
</tr>
<tr>
<td>submission 2016</td>
<td>-5347</td>
<td>-8836</td>
<td>-8332</td>
<td>-8668</td>
<td>-5142</td>
<td>-5416</td>
</tr>
<tr>
<td>Difference 2015/2016</td>
<td>-3957</td>
<td>-12344</td>
<td>-13337</td>
<td>-13673</td>
<td>-10147</td>
<td>-10421</td>
</tr>
</tbody>
</table>

The projections of the LULUCF sector have been completely revised since previous submissions. The 2015 projections for sector LULUCF were available only for sector 4.A Forest land. The inclusion of all sub-sectors led to substantial revisions of the time series.

In this submission the following sub-categories are reflected in the projections:

- 4.A Forest Land (updated)
- 4.B Cropland (new)
- 4.C Grassland (new)
- 4.D Wetlands (new)
- 4.E Settlements (new)
- 4.F Other land (new)
- 4.G Harvested Wood Products (new)

Sector 4.A Forest land has been completely revised due to methodological changes and the consideration of updated historic data. The projection of the previous submission based on a study (BFW, 2009) that was carried out before the impacts of the economic crisis became known. Therefore, these projections assumed a continuation of trends as before the year 2008/09. In the new projections sector 4.A remains a sink which can be explained by the impact of the financial crisis in 2008 (reduced production and demand of wood, see also Figure 2-8 in chapter 2.7) whose consequences had still influenced the reference year (2013) and also affected the projected time series.
4 REFERENCES


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