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ÖSTERREICHISCHES INSTITUT FÜR WIRTSCHAFTSFORSCHUNG

Universität für Bodenkultur Wien

Austrian Agriculture 2020-2050

Scenarios and Sensitivity Analyses on Land Use, Production, Livestock and Production Systems

Franz Sinabell (WIFO),
Martin Schönhart, Erwin Schmid (INWE-BOKU)

Research assistance: Dietmar Weinberger (WIFO)

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Abstract

Agriculture contributes approximately 10 percent to the emission of greenhouse gases in Austria. Therefore, it is important to evaluate the long-term development of the sector in order to assess whether Austria is achieving its emission targets. In three scenarios, adaptation paths of Austrian agriculture to changed price developments and political framework conditions up to 2050 are examined. The reduction of arable land observed so far was continued in the scenarios. The results show sustained production incentives for milk production. Contrary to recent observations, the results indicate a reduction in poultry meat production. In arable farming, maize production will increase, mainly due to the assumed productivity gains.

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1 Introduction and context of the study

EU Member States make considerable efforts to reduce CO_2 and other greenhouse gas (GHG) emissions. In 2007 the EU has adopted the legally binding target of reducing greenhouse gas emissions by 20 % by 2020 compared to 1990. The share of renewable energy sources of gross final energy consumption should be increased to 20 % EU-wide by 2020. Furthermore, energy efficiency was planned to improve by 20 % compared to a "business as usual" scenario. In the same year, Austria implemented the "Climate Strategy 2007" with a commitment to achieve the Kyoto-Targets for the period 2008 to 2012 (BMLFUW, 2007).

For the longer run, a coherent concept was presented in 2011 in the "Roadmap for the transition to a competitive low-carbon economy by 2050" by the European Commission (EU Roadmap; EC 2011). A gradual transformation towards a low-carbon economy by 2050 is to be accompanied by an EU-internal greenhouse gas emission reduction programme with the objective to reduce emissions in all sectors by at least 80 % compared to 1990. In the agricultural sector, greenhouse gas emissions are to be reduced within the range of -42% to -49% by 2050. Efficiency improvements, careful use of fertilisers and animal feed, biogas production and local diversification as well as product marketing were proposed as possible measures to attain the reductions. In addition, new processes should contribute to accumulating carbon in soils and forests. EU interim targets were set to reduce overall greenhouse gas emissions by 40 % by 2030 and by 60 % by 2040. The overall 2030 target was established in October 2014 in the climate and energy policy for 2030. The EU Roadmap was supplemented by the currently still valid EU Reference Scenario 2016 with trends until 2050 (EC 2016), in which measures already taken by the EU and the Member States were reflected.

In order to attain the objectives defined in 2007, EU put into force regulations on "effort sharing", the emission trading system (ETS), energy efficiency, renewable energy sources in 2009. One of the novelties introduced by these legal acts are definitions of specific targets. The Effort Sharing Decision (406/2009 EC of the European Parliament and of the Council of 23 April 2009) defines upper bounds of emissions for those sectors that are not part of the European Emission Trading System (EU ETS). For such sources (e.g. transport, buildings, agriculture) the EU's climate and energy package sets a reduction target of greenhouse gas emissions by around 10 % by 2020 compared with 2005.

Because it is relatively wealthy, Austria must reduce greenhouse gas emissions in sectors outside of ETS by 16 % between 2013 and 2020 compared with 2005. During the 8-year commitment period, a linear target path is to be adhered to. The maximum permissible levels of emissions in the starting year 2013 were calculated on the basis of the average emissions of the years 2008-2010 from sources outside ETS.

In national law Austria implemented the Climate Protection Act (national law KSG, BGBL. Nr. 106/2011) in 2011. To reach the targets defined in the Effort Sharing Decision, the Austrian Climate Protection Act developed a framework for establishing sector specific measures that are considered to contribute to lower emissions. Specific emission reduction objectives were defined for all relevant sectors – which includes agriculture – in a separate regulation (national law BGBl. I Nr. 94/2013) following the EU Decision 162/2013/EC of 26 March 2013 on determining Member States' annual emission allocations for the period from 2013 to 2020 pursuant to Decision No 406/2009/EC.

The annual maximum GHG emissions for Austrian agriculture were defined to be 8.0 mio. t CO_2eq for the period 2013 to 2015 and 7.9 mio t CO_2eq for the period 2016 to 2020.[1] Targets for all non-ETS sectors (including agriculture) are set to decline from 52.6 in 2013 to 48.8 mio t CO_2eq in 2020 (national law BGBl. I Nr. 128/2015). Due to a change in the UN accounting methodology effort sharing targets are to be reduced by 1 mio t CO_2eq in 2020 to 47.8 mio t CO_2eq (according to Decision 1471/2017/EC; see Anderl et al., 2018). The target of non-ETS emissions in Austria for 2030 is 36.7 mio t CO_2eq (-36% compared to 2005 which is equivalent to -28% compared to 2016).

To achieve these targets, policy interventions at various levels including regulations and economic incentives such as information and awareness campaigns and support programmes are necessary. Initiatives in Austria include a package of measures for the years 2013 and 2014 that was agreed upon by the Federal Government and the Länder (BMLFUW 2013). The implementation of these measures was reviewed by a working group in spring 2014. Subsequently, additional measures for the period 2015-2018 were agreed by the Federal Government and the Länder and were eventually adopted by the Council of Federal Ministers (BMLFUW, 2015). Corresponding resolutions of the Provincial Governors' Conference were passed on both action plans.

A consultation process targeted at the general public was initiated in the spring of 2016 with the publication of a Green Paper. It covered key principles such as the status quo of CO_2 emissions, energy consumption and future developments (BMWFW and BMLFUW 2016). In

[1] The original sector classification according to the Climate Strategy 2007 (BMLFUW 2007) was slightly adapted in order to improve accountability of different sectors. The sector classification according to the Climate Protection Act for the period 2013-2020 provides for agricultural machinery to be included in the agricultural sector (previously room heating and other small-scale consumption).

early 2018 a draft version of the Austrian climate and energy strategy was presented for public consultation among stakeholders and the general public. In May 2018 the Austrian Climate and Energy Strategy (dubbed "#mission2030") was adopted by the Austrian Federal Government. It aims at setting the framework for the Integrated Energy and Climate Plan for Austria, in which specific implementation measures for decarbonisation are finally set out (BMNT and BMVIT 2018).

The currently relevant program of measures was developed between federal and Länder authorities in compliance with the Climate Protection Act (BMLFUW, w.y.). Not all measures are traditional environmental policy instruments like standards or regulations. Concerning agriculture, one policy instrument is particularly important, the Agri-Environmental Program. It is co-financed by the EU as part of the Common Agricultural Policy's Programme of Rural Development. This programme was put into force in December 2014 and will be effective until 2020. This voluntary programme offers several measures that support farmers to adopt mitigation practices.

The topic of this analysis is to present scenarios of the Austrian agricultural sector for the period 2020 to 2050. The main interest lies in its production and relevant indicators of environmental impacts. The report is structured as follows: Likely sector developments are outlined next, followed by a short summary of the international situation on agricultural markets. Then, the model for the analysis is introduced before major assumptions are stated together with brief scenario descriptions. Finally, a discussion of the model results and the major findings of the sensitivity scenario are presented. The results are discussed in the context of previous studies (such as Sinabell, Schönhart and Schmid, 2014) and international studies (OECD, 2018 and EC, 2017).

Because there is considerable uncertainty about future situations on international markets, several scenarios are analysed. The scenario "with existing measures" (WEM) takes into account the currently existing legal framework, anticipated changes of the agri-environmental program and assumptions about market conditions as perceived in mid-2018. In the Appendix the detailed results of the scenarios are presented along with supplementary material that helps to interpret the results of the analysis.

2 Framework of the analysis

The development of the agricultural sector is mainly driven by the demand for farm commodities and public services, and by technological progress. Agricultural commodity markets have traditionally been focused on domestic markets. Since two decades the have become increasingly characterized by a reduction of trade impediments. Global demand for food and technological progresses are the main 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 can be made that any domestic supply or demand shift does not affect equilibrium prices in the common market.

In the past, many agricultural commodity prices were either set directly by policy makers or reflected heavy policy intervention (see details in the next chapter) such as the markets for milk and sugar until very recently. A reduction of farm commodity prices, initiated in 1992 in the EU (1995 adopted in Austria, as well) with a further bold step during the Agenda 2000 reform in 1999 and a further corroboration during the 2003 reform of the Common Agricultural Policy (CAP). Domestic prices of many important markets (grains and meat) have been near world market equilibrium during 2000 to 2006. Since 2007 EU markets have been exposed to the high price volatility that had been confined to world markets in the past.

Currently there are no signs that EU farm policy will intervene in markets as heavily as it did in past decades. Nevertheless, EU farm policy is concerned about price volatility and several EU member states have implemented schemes to help farmers to confine the consequences of volatile markets. Apart from this, existing foreign trade rules restrict the flow of agricultural commodities (e.g. meat, sugar) and for many goods of the downstream sectors of agriculture (e.g. ethanol) levies raise internal market prices above world market levels.

The demand for agricultural commodities has surged in recent years due to two major developments:

- several states - including the EU - have implemented very ambitious targets for biofuels which require feedstocks that are produced on agricultural land;
- economic growth at a global scale has been relatively high during recent years (apart from the dip in 2008 and 2009) and a larger share of world population can afford more livestock products.

Apart from demand for farm commodities, there is a significant demand for public goods which are provided by agriculture. This demand is still increasing and relevant for most production decisions in Austria. There are aspects that fall in two classes:

- the active provision of goods and services for which private markets do not exist (like open landscape, biodiversity), and
- the reduction of production intensities and emissions below the legally binding level of standards (e.g. support for organic farming, plantation of winter cover crops).

To the extent that discretionary policy interventions in farm commodity markets were reduced over the last decade, programmes to stimulate the support of public goods which addressed the farm sector, have proliferated.

The framework of the analysis is given by four major assumptions

- The development on farm commodity prices is mainly driven by the demand for farm commodities and technological progresses. In affluent societies with low population growth, the overall volume of food consumption will be relatively constant. Therefore, changing demand trends affect mainly the composition of food components (e.g. substitution of red meat by white meat). The demand from domestic market is only one determinant in agricultural markets. Due to a growing global population with higher incomes the demand for food will be increasing, however at a slower pace than in the previous decade (OECD, 2018). Given that EU markets are globally integrated this development will have an impact on EU agriculture.

- Society in the EU will be willing to pay for non-commodity outputs of the agricultural sector in the future, however, the large increase in such a public demand that was observed at the begin of the century will come to a halt.
- Technical progress will further increase productivity, however, likely at a lesser scale than previously observed due to environmental programmes and regulations that limit the use of many inputs (including fertilizer, plant protection substances, seeds). New technologies such as those emanating from digitization (e.g. artificial intelligence, digital smart farming) will mainly safe labor, improve quality and reduce environmental harm. Its output increasing effect will be minor.
- In Austria population and economy are likely to grow in the coming decades. One consequence is that more and more affluent people need more housing. The observed pressure to use agricultural land for residential and commercial purposes and the related infrastructure will therefore prevail.

These assumptions are made operational in using an agricultural sector model for Austria which was developed to evaluate farm policy changes. Given the partial character of the model, further assumptions must be made concerning the actual price levels. These are taken from publications focussing on market trends at EU-level.

3 Modelling the Austrian Agricultural Sector

In this chapter, we present an approach that strives to meet these challenges of forecasting agricultural production in a very detailed manner. The Positive Agricultural Sector Model Austria (PASMA) was developed to estimate the impact of the 2003 CAP reform on selected agricultural and environmental indicators to measure rural/agricultural development. The model has been continuously improved since then (Schönhart et al., 2014, Kirchner et al., 2016). PASMA depicts the political, natural, and structural complexity of Austrian farming in a very detailed manner (Figure 1).

The structure ensures a broad representation of production and income possibilities that are essential in comprehensive policy analyses, i.e., development analysis. Data from the Integrated Administration and Control System (IACS), Economic Agricultural Account (EAA), Agricultural Structural Census (ASC), Farm Accountancy Data Network (FADN), the Standard Gross Margin Catalogue, and the Standard Farm Labour Estimates provide necessary information on resource and production endowments for 35 regional production units (i.e. NUTS-3) in Austria.

Consequently, PASMA is capable to estimate production, labour, income, and environmental responses for each single unit. Most production activities are consistent with EAA, IACS and ASC activities to allow comparable and systematic policy analyses with official, standardised data and statistics.

The model considers conventional and organic production systems (crop and livestock), other relevant management measures from the Austrian Agri-Environmental Programme ÖPUL, and the support programme for farms in less-favoured areas (LFA). Thus the two most important components of the programme for rural development are covered on a measure by measure basis. Apart from major components of the programme for rural development the complete set of CAP policy instruments is accounted for, as well. Both, the set of instruments before and after the 2013 reform can be modelled explicitly.

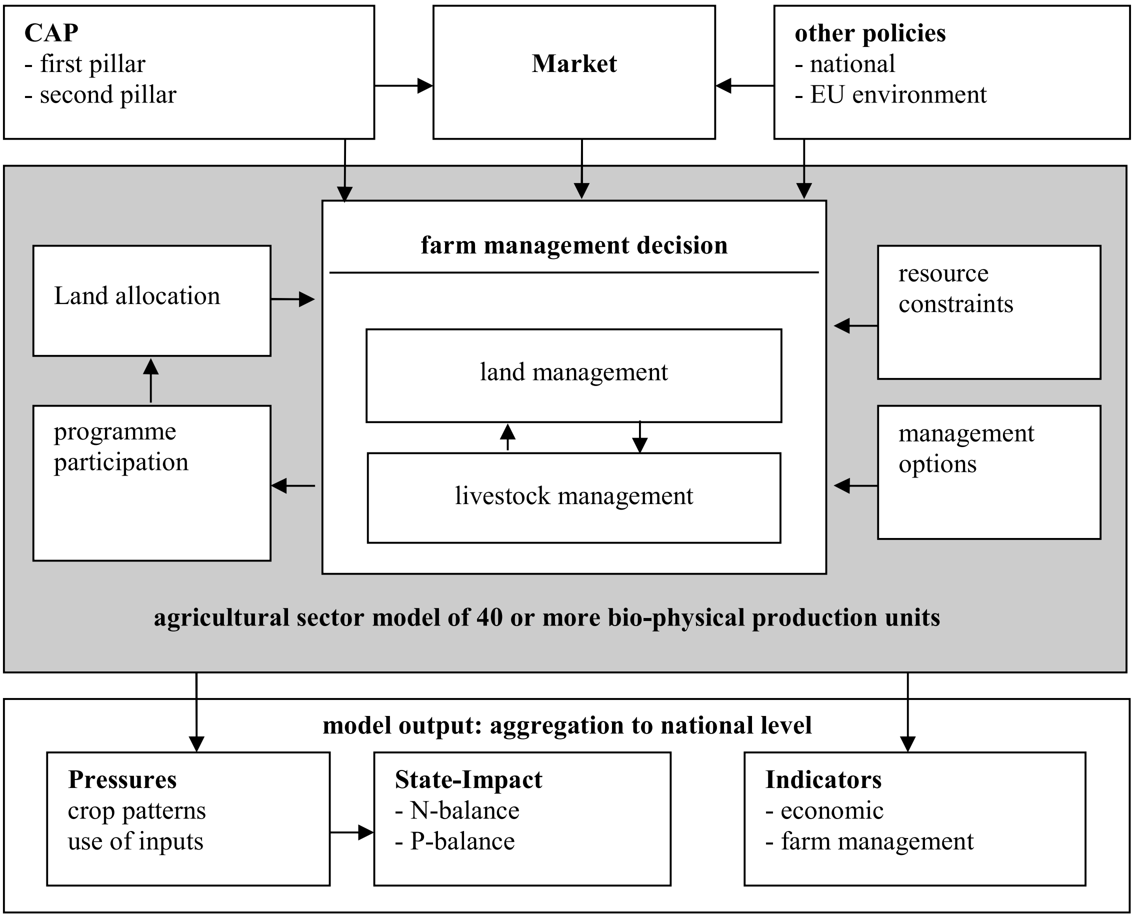

Figure 1: Structure of the agricultural sector model PASMA

Source: own construction.

The model maximises sectoral farm welfare and is calibrated to historic crop, forestry, livestock, and farm tourism activities by using the method of Positive Mathematical

Programming (PMP). Howitt (1995) has initially published PMP and since then it has been modified and applied in several models e.g., Lee and Howitt (1996), Paris and Arafini (1995), Heckelei and Britz (1999), Cypris (2000), Röhm (2001), Röhm and Dabbert (2003). This method assumes a profit-maximizing equilibrium (e.g. marginal revenue equals marginal cost) in the base-run and derives coefficients of a non-linear objective function on the basis of observed levels of production activities.

Two major conditions need to be fulfilled: (i) the marginal gross margins of each activity are identical in the base-run, and (ii) the average PMP gross margin is identical to the average LP gross margin of each activity in the base-run. These conditions imply that the PMP and LP objective function values are identical in the base-run. Another important assumption needs to be made by assigning the marginal gross margin effect to either marginal cost, marginal revenue or fractional to both. In PASMA, the marginal gross margin effect is completely assigned to the marginal cost and consequently coefficients of linear marginal cost curves are derived.

In PASMA, linear approximation techniques are utilized to mimic the non-linear PMP approach (Schmid and Sinabell, 2005). Thus large-scale models can be solved in reasonable time. In combination with an aggregation procedure, i.e., building convex combinations of historical crop and feed mixes (Dantzig and Wolfe, 1961; McCarl, 1982; Önal and McCarl, 1989, 1991), the model is robust in its use and results.

Therefore, PASMA consists of a set of three almost identical programming models. The purpose of the first one is to assign all farm activity levels i.e., crop, forestry, livestock, and farm tourism, and remaining cost shares from feed and manure balances. For instance, the area of meadows is recorded in various data sources listed above. However, information on which activities are actually carried out and to what extent are not available (e.g., grazing, hay, silage, or green fodder production activities). In the model, these activities and remaining cost shares (i.e., fertilizer and feed) are accordingly assigned using historical livestock records and detailed feed and fertilizer balances (phase 1). Phase 2 is the second LP in which the perturbations coefficients (Howitt, 1995) are incorporated to compute the calibration coefficients of a linear marginal cost curve primarily following the approach of Röhm and Dabbert (2003). The third non-linear model (phase 3) is the actual policy model. Calibration coefficients are built in using linear approximation techniques that allow calibration of crop, forestry, livestock, and farm tourism activities to observed and estimated shares. Other model features such as convex combinations of crop and feed mixes, expansion, reduction and conversion of livestock production, a transport matrix, and imports of feed and livestock are included to allow reasonable responses in production capacities under various policy scenarios.

4 Farm policy in Austria – two decades of efforts to reduce greenhouse gas emmission

4.1 The CAP Reform in 2003

In 1992, farm commodity prices that had been kept at high levels via government intervention were reduced significantly with a view to controlling excess production. In order to restrict to a minimum the resultant effects on farm incomes, premiums were introduced which were linked to the amount of land used for production and the number of livestock raised. Direct production incentives of higher prices were reduced, but it is still necessary to produce some crop such as wheat in order to get a crop premium. Additional premiums are granted when specified animals are slaughtered (bulls, oxen, calves, cows, heifers) or reared on the farm (suckler cows and heifers) and an extensification premium is granted when the number of livestock per hectare of land is below a specified limit.

In mid 2002, the European Commission published a mid-term review of the Agenda 2000 reform. The European Commission planned to decouple these premiums from production and to grant a transfer for the farm instead (dubbed "single farm payment"). This subsidy would be paid even if a farmer chose to produce nothing, as long as "land is maintained in good agronomic condition". The transfers which would be subject to decoupling (dubbed "crop premiums" or "livestock premiums" or "CAP premiums") are equivalent to more than half of the EU funds spent on agriculture

A final compromise on the proposals of the reform was reached on 26th June 2003. The key element is the introduction of a single farm payment (Greek Presidency, 2003; Fischler, 2003). This payment will replace premiums formerly linked to output or land.

When the reform proposals were drafted, it was anticipated that decoupled premiums have considerable impact on production incentives. Farmers will not need to plant certain crops or raise bulls in order to obtain financial support. In future, production decisions are expected to be based on market signals (i.e., prices) and consequently resource allocations are likely to improve.

The policy change has become effective on 1st January 2005. Payment entitlements are calculated on the basis of direct payments received in the reference period 2000-2002, they are transferable with or without land and between farmers within a region or a country. They can be only received if accompanied by eligible hectares and agricultural land is maintained in good ecological conditions.

Member States may choose to introduce the single farm payment in full or they may opt to keep some premiums attached to output or factor usage or to retain up to 10 % of direct payments for measures that have a positive environmental effect or improve the quality and marketing of agricultural products. In addition, they may implement the single farm payment at regional level. This implies a redistribution of money between farm enterprises (this option is chosen by Germany) and may lead to redistributions between regions.

Farm operators (but not the owners of land if they have rented it) are entitled to premiums based on historic payment entitlements (average of 2000 to 2002). These entitlements are weighted by premiums and will be adjusted during the reform period. The total of premiums per farm is divided by the sum of the relevant crop and forage area, thus obtaining the average farm premium per hectare. Premiums per hectare will therefore vary among farms.

All farmers receiving direct payments must set aside part of their land (small farms and organic farms are exempt) and will be subject to compulsory cross-compliance. Recipients of farm payments must abide by a list of 18 statutory European standards in the field of environment, food safety, and animal health and welfare (cross compliance). Direct payments to larger farms (above a threshold of € 5,000) were reduced by 3 % in 2005, 4 % in 2006 and 5 % from 2007 to 2013 (modulation). Channelling expenditure away from market policies will make more than € 1.2 billion available for rural development.

For cereals (apart from rye), the intervention price remains the same with some modifications. Other crop regulations were simplified, but some production related premiums (notably those for durum wheat, protein crops, and energy crops) have been introduced by the reform. A reformed milk quota system will be maintained until the 2014-15 marketing year (see Sinabell and Schmid, 2008). Regulated prices of butter and skimmed milk powder have been cut asymmetrically in four stages. The quota expanded moderately in 2006 and a decoupled milk quota premium was added to the single farm payment.

4.2 The CAP Reform in 2008

As decided in the 2003 reform, a "health check" was carried out 5 years later. The objective was to make adjustments to guarantee that the intended objectives of the reform will be met.

On 20 November 2008 the EU agriculture ministers reached a political agreement on the Health Check of the Common Agricultural Policy. Among a range of measures, the following agreements are of major importance for agricultural market today (EC, 2011):

- Phasing out milk quotas: Milk quotas were planned to expire by April 2015. A 'soft landing' was ensured by increasing quotas by one percent every year between 2009/10 and 2013/14. For Italy, the 5 percent increase was introduced immediately in 2009/10. In 2009/10 and 2010/11, farmers who exceed their milk quotas by more than 6 percent had to to pay a levy 50 percent higher than the normal penalty.
- Decoupling of support: The CAP reform "decoupled" direct aid to farmers i.e. payments were no longer linked to the production of a specific product. However, some Member States chose to maintain some "coupled" – i.e. production-linked - payments. These remaining coupled payments were planned to be decoupled and to be moved into the Single Payment Scheme (SPS), with the exception of suckler cow, goat and sheep premia, where Member States may maintain current levels of

coupled support. Eventually several Member States maintained support schemes also for sugar beet.

- Assistance to sectors with special problems (so-called 'Article 68' measures): Up to 2008, Member States could retain by sector 10 percent of their national budget ceilings for direct payments for use for environmental measures or improving the quality and marketing of products in that sector. This possibility became more flexible and was used by some Member States to implement risk mitigation programmes.
- Using currently unspent money: Member States applying the Single Payment Scheme were allowed either to spend money from their national envelope for Article 68 measures (which finance measures to control income volatility in some EU member states) or to transfer it into the Rural Development Fund.
- Shifting money from direct aid to Rural Development: All farmers receiving more than € 5,000 in direct aid had their payments reduced by 5 percent and the money was transferred into the Rural Development budget. This rate was increased to 10 percent by 2012.
- Abolition of set-aside: The requirement for arable farmers to leave 10 percent of their land fallow was abolished.
- Cross Compliance: Aid to farmers is linked to the respect of environmental, animal welfare and food quality standards. Farmers who did not respect the rules faced cuts in their support. This so-called Cross Compliance was simplified, by withdrawing standards that were not relevant or linked to farmer responsibility. New requirements were added to retain the environmental benefits of set-aside and improve water management.
- Intervention mechanisms: Intervention was abolished for pig meat and set at zero for barley and sorghum. For wheat, intervention purchases were maintained during the intervention period at the price of €101.31/tonne up to 3 million tonnes. Beyond that, it interventions was planned to be done by tender. For butter and skimmed milk powder, limits will be 30,000 tonnes and 109,000 tonnes respectively, beyond which intervention will be by tender.
- The energy crop premium was abolished.

4.3 The CAP Reform in 2013 and the Multiannual Framework 2014-2020

The most recently implemented reform of the CAP was initiated by the Commission in 2011. For the first time the entire CAP was reviewed all at once and the European Parliament acted as co-legislator with the Council. This new role was due the Lisbon Treaty that gave more power to the European Parliament.

The current CAP maintains the structure of two pillars, but it introduces a new architecture of direct payments. The objective is to have payments better targeted, more equitable and greener. The role of direct payments as a safety net that strengthen rural development has become more important.

During the phase of the debate on the reform scenarios which would have implied substantial reductions of farm payments were seen to be realistic. To the surprise of many observers, the overall budget for agriculture did not change very much. The instruments of the CAP and how they are implemented was decided by the farm ministers in co-operation with the parliament (see Hofreither and Sinabell, 2013 for a detailed account of the debate). For the allocation of funds available, the heads of Member States and the European Parliament had to find and agreement. The Commission had proposed that, in nominal terms, the amounts for both pillars of the CAP for 2014-2020 would be frozen at the level of 2013. Compared to the Commission proposal, the amount for pillar 1 was cut by 1.8% and for pillar 2 by 7.6% (in 2011 prices). A total amount of EUR 362.8 billion for 2014-2020, of which EUR 277.9 billion is foreseen for Direct Payments and market-related expenditure (Pillar 1) and EUR 84.9 billion for Rural Development (Pillar 2) in 2011 prices.

The reform aimed at improving sustainability by the combined and complementary effects of various instruments:

- there is a simplified cross-compliance requirement which is a compulsory basic layer of environmental requirements and obligations to be met in order to receive direct payments from Pillar 1;
- on top of this 30% of direct payments are reserved, from 2015 onwards, for a new policy instrument in Pillar 1, the Green Direct Payment (for the maintenance of permanent grassland, ecological focus areas and crop diversification);[2]
- at least 30% of the budget of each Rural Development programme were reserved for voluntary measures that are beneficial for the environment and climate change.

Equity concerns were addressed in the CAP reform as well. A more balanced, transparent and more equitable distribution of direct payments among countries and among farmers was agreed upon. The outcome of the agreement is not a uniform payment throughout the Union but a reduction in disparities of the level of direct payments between Member States, known as *external convergence*. Agricultural policy makers hope to reinforce the credibility and legitimacy of the support system at EU level by this step.

The level of direct payments per hectare, which is currently based on historic parameters in many countries including Austria, is progressively adjusted with the introduction of a minimum national average direct payment per hectare across all Member States by 2020. This element of the reform is called *internal convergence* within the Member States. Payments will no longer be based on uneven historical references of more than a decade ago but rather on a fairer and more converging per hectare payment at national or regional level.

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[2] Several studies analysed the effectiveness of this instrument, among them EC 2016, EC 2017, European Court of Auditors, 2017.

In addition, Member States have further possibilities to rebalance payments with the introduction of the redistributive payment, voluntary capping and degressivity (reduction) of payments, beyond the mandatory cuts which will apply to the Basic Payment above a certain threshold.

In a nutshell, the most important changes compared to the previous CAP reforms from an Austrian perspective are

- The annual volume of direct payments (1st Pillar) in Austria was set to 693 Mio. EUR until 2020 (compared to 733 Mio. EUR (2007-2013).
- The annual volume of the Program of Rural Development (2nd Pillar) is practically the same as in the previous phase with 1.1 Billion EUR financed by the EU by 50% and federal funds and funds of Länder.
- Young farmers will qualify for special support financed from the 1st pillar – this will make investments in new production facilities more likely.
- A very small part of the support from the 1st pillar is granted as "coupled support". In order to qualify for such payment, farmers have to produce farm products. In the case of Austria 2% of direct payments will be channeled to Alpine farming which will make cattle and milk production in alpine region more profitable.
- The internal convergence of direct payments brings about considerable changes of the distribution of farm payments in Austria. The consequence will be that regions in which cattle and milk production prevails will benefit (Kirner and Wendtner, 2012 and Kirner, 2011).

For the preparation of the follow up reform published in 2018, the EC carried out several evaluation studies. Regarding GHG emission reduction Pérez Domínguez et al. (2016) identified a positive impact. Its extent, however was difficult to determine and quantify. The findings regarding greening were unambiguous: "It is clear that the 'greening' measures have not fully realised their intended potential to provide ambitious benefits for climate and environment" is a major conclusion of EC's impact assessment (SWD(2018) 301 final).

4.4 The proposals of the CAP reform in 2018 and the proposed Multiannual Framework 2011-2027

In June 2018 the European Commission published legislative proposals for a reformed Common Agricultural Policy (CAP) that are consistent with the proposals of the Multi-Annual Financial Framework for the period 2021-2017.[3]

The reformed CAP will pursue nine policy goals:

[3] The text in the following paragraphs is based on the materials presented at and linked to the following web-page: https://ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy/future-cap_en (retrieved 12 Nov 2018).

1. to ensure a fair income to farmers
2. to increase competiveness
3. to rebalance the power in the food chain
4. climate change action
5. environmental care
6. to preserve landscapes and biodiversity
7. to support generational renewal
8. vibrant rural areas
9. to protect food and health quality

In its proposal, the European Commission puts a priority on environmental and climate change. Mandatory requirements include

- preserving carbon-rich soils through protection of wetlands and peatlands
- obligatory nutrient management tool to improve water quality, reduce ammonia and nitrous oxide levels
- crop rotation instead of crop diversification

Farmers will have the possibility to contribute further and be rewarded for going beyond mandatory requirements. EU countries will develop voluntary eco-schemes to support and incentivise farmers to undertake agricultural practices beneficial for the climate and the environment (see next chapter for previous implementations in Austria).

The European Commission proposes a more flexible system and a change of responsibilities by simplifying and modernising the way the CAP works. The policy will shift the emphasis from compliance and rules towards results and performance. Member States are becoming responsible to develop strategic plans, that set out how they intend to meet the 9 EU-wide objectives using CAP instruments while responding to the specific needs of their farmers and rural communities. The new way of working will also entail

- streamlining administrative processes: countries shall submit only one strategic plan covering direct payments, rural development and sectorial strategies
- making environmental protection easier: through a set of standards and objectives at EU level, each country shall adapt environmental and climate actions to the reality on the ground

Figure 2 provides an overview of key aspects of the current green architecture of the CAP, based on three different layers of measures: cross-compliance, green direct payments and rural development measures, strengthened by other tools (EC, 2018). *Cross-compliance* is a mechanism that links the CAP to farmers' compliance with various basic standards, as well as to their application of fundamental good practice. Its mission is essentially to help agriculture to develop sustainably and link the CAP better to other EU policies, including in the area of the environment and climate. The system includes two types of requirement:

- Statutory Management Requirements (SMRs): These are 13 requirements arising from non-CAP EU legislation, in the field of the environment, food safety, animal and plant health and animal welfare.
- Good Agricultural and Environmental Condition (GAEC): GAEC standards have their legal basis within the CAP and are specified by Member States. The seven EU standards relate to management of water, soil and landscape features – in the last case, with explicit reference to habitats. EU standards are translated into national standards, taking into account local needs and specific situations.

When farmers who receive CAP payments do not respect the standards concerned, their payments under these schemes can be reduced. Cross-compliance thus helps to provide a foundational level of action with regard to the environment and climate.

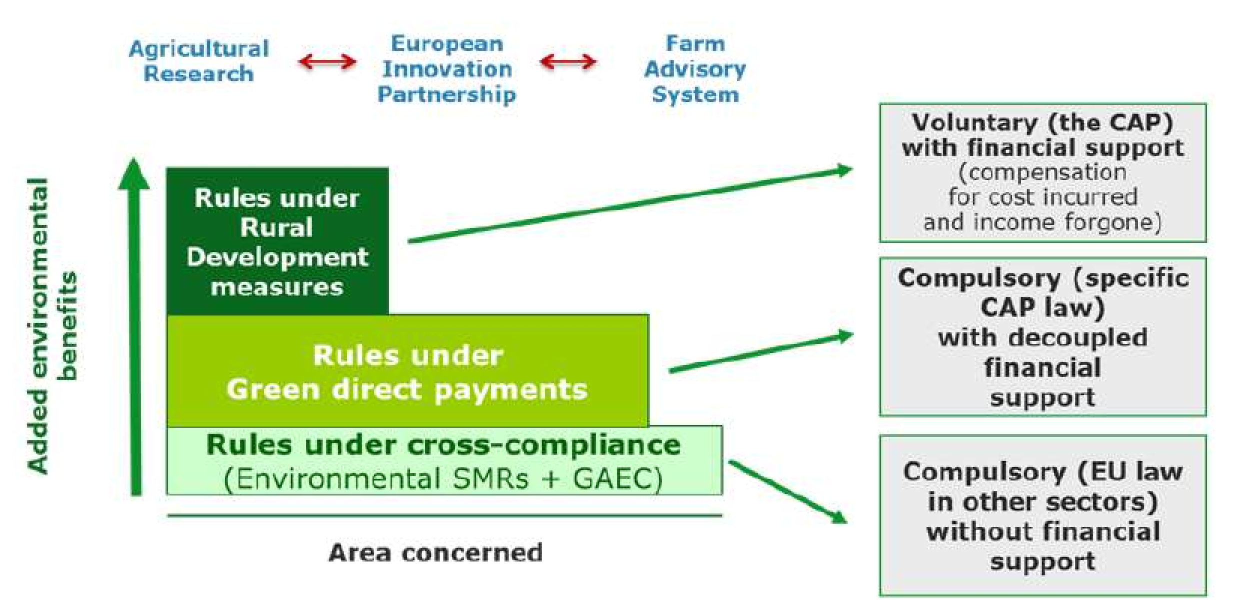

Figure 2: Green Elements of the CAP

Source: EC, 2018.

Direct area based payments to farmers are necessarily conditional on *cross-compliance*. An additional type of payments, *Payments for agricultural practices beneficial for the climate and the environment* (also known as "green direct payments", "greening"), have the explicit mission of enhancing farming's environmental performance.

The greening architecture introduced by the 2013-20 CAP reform will be replaced by a 'more targeted, more ambitious yet flexible approach'. Member States will have more flexibility to choose the options most suited to local needs, involving a mixture of mandatory and voluntary measures to meet the environmental and climate objectives defined at EU level (McEldowney, 2018).

Farmers may receive CAP payments when they:

- maintain a certain level of crop diversity on their arable land;
- maintain permanent grassland;
- devote a certain portion of their arable land (labelled "ecological focus area - EFA") to biodiversity-friendly practices and features – including landscape features, fallow land, buffer strips, use of catch crops and nitrogen-fixing crops, and others.

Various measures available through the EU's rural development policy (indicated by the dark green area in Figure 2) can be used for environment- and climate-related purposes (see Annex II for the full list of measures). Its current implementation in Austria and an outlook for the years after 2020 are presented in the next section.

In early summer 2018 the European Commission also presented the proposal for the multiannual financial framework (MFF) for the period 2021 to 2027. The European Commission also published a proposal for a regulation establishing rules on support for strategic plans to be drawn up by Member States under the Common agricultural policy (CAP Strategic Plans) and financed by the European Agricultural Guarantee Fund (EAGF) and by the European Agricultural Fund for Rural Development (EAFRD) (COM (2018) 392 final) with annexes that contain proposals for country specific allocations of CAP funds for the period 2021 to 2027. Effectively the budget allocated for agriculture is smaller than in the previous financing period (mainly explained by BREXIT). Depending on the relative shares of payments for the first and second pillar of the CAP the country specific consequences for transfers to the farm sector are different. Details of country specific payment schemes according to this proposal are explained and discussed by Matthews (2018a and b).

4.5 Focus on the Programme for Rural Development – an important policy tool to mitigate greenhouse gas emission of agriculture

After the Agenda 2000 reform in 1999, the programme for rural development (dubbed "second pillar of the CAP") was introduced in the EU. A volume of 91 bn EUR from EU funds was allocated for the programme period 2007-2013 (EK, 2009) but this amount was reduced to 85 bn EUR for the period until 2020. This amount has been topped by contributions of Member States up to 50% depending on the level of development. For the period 2021 to 2027 the planned nominal allocation for Pillar 2 payments by the EU is 78 bn EUR (COM(2018) 392 final Annex IX). Member States may top up such payments at a larger scale than in the current period.

The programme for rural development is of eminent importance for the Austrian agricultural sector, because transfers from this source outweigh transfers from the "first pillar of the CAP", e.g. instruments that have been commodity related.

The previous programme ended in 2014 and the current programme started in 2015. The main elements of the previous programme which are also prevalent for the current period were:

- a genuine EU strategy for rural development will serve as the basis for the national strategies and programmes;
- less detailed rules and eligibility conditions will leave more freedom to the Member States on how they wish to implement their programmes;
- a strengthened bottom-up approach will better tune rural development programmes to local needs.

The Agri-Environmental Programme 2015-2020 is not organized in axes as was the case with the previous programme. Goals are bundled according to priorities and focal points. Climate protection goals are ranking high in this programme. Specific targets are set in priority 1, 4, and 5 because climate mitigation (and adaptation) is a horizontal issue that has to be addressed in every programme (see details in European Commission, 2013).

The relevant measures (and the relevant support schemes of the agri-environmental programme) are (see Kaupe, s.a. and BMLFUW, 2014b):

- increase pasture and alpine grazing (information, knowledge transfer, advisory services, specific agri-environmental measures)
- adaptations in pork feeding management (knowledge transfer, advisory services, investment aid)
- coverage of slurry tanks (investment aid)
- slurry fermentation (diversification aid, investment aid, renewable energy support, elementary services support)
- drag hose slurry spreading (investment aid, AE climate measures)
- organic farming (specific AE support scheme)
- reduction of mineral fertilizer use (specific AE support scheme)
- sustainable nitrate management, winter cover crops, permanent soil cover (specific AE support scheme focussed on groundwater protection)
- minimum tillage, strip tillage and mulch seeding (specific AE support scheme)
- fuel efficient driving of tractors (investments in elementary services support)
- electric engines for irrigation facilities (investments in elementary services support)

The allocation of funds and the rate of adoption for specific measures in Austrian agriculture is regularly reported by the minister of agriculture's "Green Report" (Grüner Bericht). The most recent report covered the programme period until the year 2017 (BMNT, 2018): Transfers for agri-environmental and climate related measures dropped from 397 mio € in 2013 to 287 mio € in 2017. Payments for organic farming increased in the same period from 98 mio € to 115 mio €. The decrease of transfers was taken into account in the previous report on long term scenarios of Austrian agriculture (Sinabell, Schönhart und Schmid, 2015). For the new programme period (2021 to 2027) another decrease is to be expected (see next chapter).

5 Markets and economic development

5.1 International food markets

European farm commodity markets are interlinked with international food markets in many ways. Given the imbalances between supply and demand in many markets, the EU is a major exporter, in particular of cereals, milk and white meat. The policy efforts to bring domestic market prices closer to equilibrium prices (see above) brings about that the gap between domestic prices world market prices is narrowing. Domestic supply – apart from heavily regulated products like milk – therefore is increasingly determined by the fluctuation of world market prices. Global demand for food and technological progresses (e.g., the adoption GMO crops in major producing countries, organic food production) will be major driving forces of agricultural production during the next decade to come. Over the medium-term, world agricultural markets are projected to be essentially supported by rising food demand driven by an improved macro-economic situation, higher population, urbanisation and changes in dietary patterns (OECD-FAO, 2018). Widespread economic growth and an expanding livestock sector are projected to set the stage for a strengthening of world demand and maintaining a low stock-to-use ratio.

Cereals trade would also expand, particularly in developing economies, driven by rising income, diet diversification and higher demand for livestock products and feeds, allowing for a gradual, albeit moderate, price increase over the medium term. The medium-term prospects for the oilseed sector are expected characterised by increasing demand due to expanding growth of the biofuel market.

Meat markets are projected to be characterised by an expansion in production, consumption and trade with world meat prices showing moderate strength. Prospects for rising meat demand would mainly emerge from a favourable macro-economic environment of sustained income growth, notably in Asia and Latin America. World meat trade would increase, and prices remain firm over the medium term as growing consumption is mostly expected to take place in countries that are net importers with limited possibilities to proportionally and competitively increase domestic supply (in quantity and quality).

The medium-term outlook for the dairy sector is expected to remain dominated by a strong expansion in global demand for dairy products. The latter would reflect not only income growth in many regions of the world, but also changes in consumer preferences towards dairy products.

5.2 National energy policies

Austrian energy policy is committed to substitute non-renewable energy sources by renewable ones. Raw materials produced by agriculture are a major alternative source. Two major legal sources are of interest in this context: the Austrian law for the provision of green electricity (Ökostromgesetz) and the European bio-fuel directive (EU, 2003) which has been repealed by the EU Directive on Renewable Energy (Directive 2009/28/EC). A directive to reduce indirect land use change for biofuels and bioliquids was put in force in 2015 ((EU)2015/1513).

Both measures are channelled to the agricultural via the price system: the regulations to boost bioenergy crop production work like a subsidy on farm commodities. Because Austrian sources of feedstock are not favoured over imported ones, the relevant production incentives in Austria are dominated by the price signals from regional and global markets.

Due to the mechanism of the bioenergy policies currently in place, the best approach to model them is to take prices which are relevant for markets in the EU as a reference and to analyse their effects on local production (Stürmer et al., 2013). This approach is motivated by the observation that the previously observed large expansion of biogas production plants has stopped abruptly. Only approximately 30,000 ha of land are used to produce material for these plants. The fact that there is no longer an expansion is important because biogas production competes in most cases directly with beef and milk production. A more profitable biogas sector would weaken the perspectives of milk production in Austria.

In late 2016 the Commission published a proposal for a revised Renewable Energy Directive to make the EU a global leader in renewable energy and to ensure that the 2030 target is met. The Commission, the Parliament and the Council reached a political agreement in mid 2018. It includes a binding renewable energy target for the EU for 2030 of 32%, with a clause for an upwards revision by 2023. The implications for the Austrian energy policy are not yet determined.

5.3 Baseline economic assumptions

Several assumptions must be made to run the model outlined above. These are basically input prices which are derived from other sources (OECD-FAO, 2018). Price projections are based on assumption about the development of key indicators like population and GDP growth, and GDP deflator taken from OECD-FAO (2018). Forecasts on world oil prices are based on Umweltbundesamt (2018) (see Table 2) which are slightly higher than those of OECD-FAO (2018).

Table 1: Assumptions on macro-economic variables in the European Union, 2018 – 2027

		2018	2019	2020	2021	2022	2023	2024	2025	2016	2027
real GDP	%	2.0	1.7	1.6	1.6	1.6	1.5	1.5	1.5	1.5	1.4
price deflator	%	1.6	1.7	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.7
GDP deflator	%	1.4	1.6	1.6	1.7	1.7	1.7	1.7	1.7	1.7	1.7
Population	%	0.15	0.13	0.11	0.08	0.06	0.05	0.03	0.03	0.02	0.02
world oil price	USD/barrel	63.7	67.1	68.3	69.3	70.4	71.5	72.6	73.7	74.9	76.1

Source: OECD-FAO, 2018.

Table 2: Assumptions on macro-economic variables for Austria, 2010 – 2050

parameter	2010	2020	2030	2040	2050
Population (in Mill)	8.4	8.8	9.3	9.6	9.7
GDP (bn €2013)	298.1	344.7	400.1	469.0	542.5
Household income €2013/person	19,637.1	21,688.4	24,047.8	27,675.8	32,366.6
Exchange rate US$/€	1.326	1.2	1.2	1.2	1.2
oil price [US$ 2016/boe]	n.a.	96.7	120.9	133,6	148.5
carbon price (EUR 2016/t CO_2)	n.a.	15.5	34.7	51.7	91.0

Source: Umweltbundesamt (2018) based on GEM-E3.

Several sources are available which can be used as basis of price forecasts. In this study, all prices but energy prices are derived from OECD-FAO outlooks on agricultural markets (see OECD-FAO, 2018). A comparison of this OECD-forecasts with projections of the Commission of the EU (European Commission, 2017) shows that international bodies have very similar assumptions about future development of key economic indicators. Due to the type of model used in this analysis, assumptions on the Austria economic environment (GDP growth, population dynamics, etc.) are not necessary. But they are embedded in the exogenous price assumptions. Other driving forces (prices, technology, constraints) are referenced in the following sections.

5.4 Specific assumptions on farm commodity prices

The assumptions underlying future policy variables and future prices of farm commodities are referenced in the appendix. The forecast period in this study is going until 2050. For the period beyond 2027 OECD-FAO forecasts are not available. Therefore, the assumption is made that beyond this year, prices will follow the trend. The assumptions on prices are referenced in Table 3 and Table 4.

All price projections apart from milk price projections are based on OECD-FAO 2018 forecasts. Price estimates are specific for the Austrian market situation. Based on previously observed wedges between prices in the EU and Austria, estimates for the coming periods were made. In the previous analysis (Sinabell, Schönhart, Schmid, 2015), lower milk prices for Austria were assumed than those forecast by OECD-FAO (2014) for the EU. The reasoning was that for countries which are likely to expand milk production, lower prices may prevail over a long period until a new equilibrium establishes. Market reports do not confirm this assumption. Milk prices in Austria have been slightly higher than in most other EU countries (see e.g. Agrarmarkt Austria, 2018).

In Austria the market for organic products is very important and many organic products are sold at a premium price. Price premia are based on 5 year average observations reported by LBG (various years).

5.5 Baseline data

PASMA, applied for the quantitative analysis, is a positive mathematical programming model (see chapter 3). Such models are calibrated to observed data. The data for which the model is calibrated are describing the Austrian agricultural sector in 2016. The major sources of baseline data are results of the most recent agricultural census (Statistik-Austria, 2018) and administrative data at municipality level provided by BMNT (2018).

Table 3: Observed and projected nominal farm prices for crop products in Austria (€ per ton or 100 l)

	ø2007/2009	ø2015/2017	2020	2030	2040	2050
Wheat	143.17	138.35	139.69	153.90	167.71	181.53
Coarse wheat	114.46	118.45	119.60	131.77	143.59	155.42
Durum	209.47	206.34	208.34	229.53	250.13	270.73
Rye	120.13	127.81	134.32	149.33	163.35	177.37
Coarse grains	101.50	106.15	111.55	124.02	135.66	147.30
Barley	113.52	107.13	112.58	125.16	136.91	148.66
Oats	110.30	125.67	132.07	146.83	160.61	174.40
Triticale	108.88	110.38	115.99	128.96	141.06	153.17
Spelt	261.83	257.92	260.43	286.92	312.67	338.42
Maize	131.00	136.68	143.63	159.69	174.68	189.67
Beans	223.37	262.71	279.69	333.55	386.49	439.43
Peas	142.29	155.04	165.07	196.86	228.10	259.34
Soy-beans	282.54	332.31	342.78	396.76	452.06	507.36
Sunflower	228.95	296.09	305.43	353.52	402.79	452.07
Sugar-beet	27.97	26.29	26.91	31.60	36.14	40.68
Starch potatoes	55.09	88.16	92.65	103.01	112.67	122.34
Rape-seed	275.35	327.57	337.90	391.10	445.62	500.14
Fruits	343.47	342.93	343.03	339.84	338.12	336.40
Wine	365.00	770.23	728.66	772.18	793.85	815.52

Source: own assumptions based on OECD-FAO, 2018.

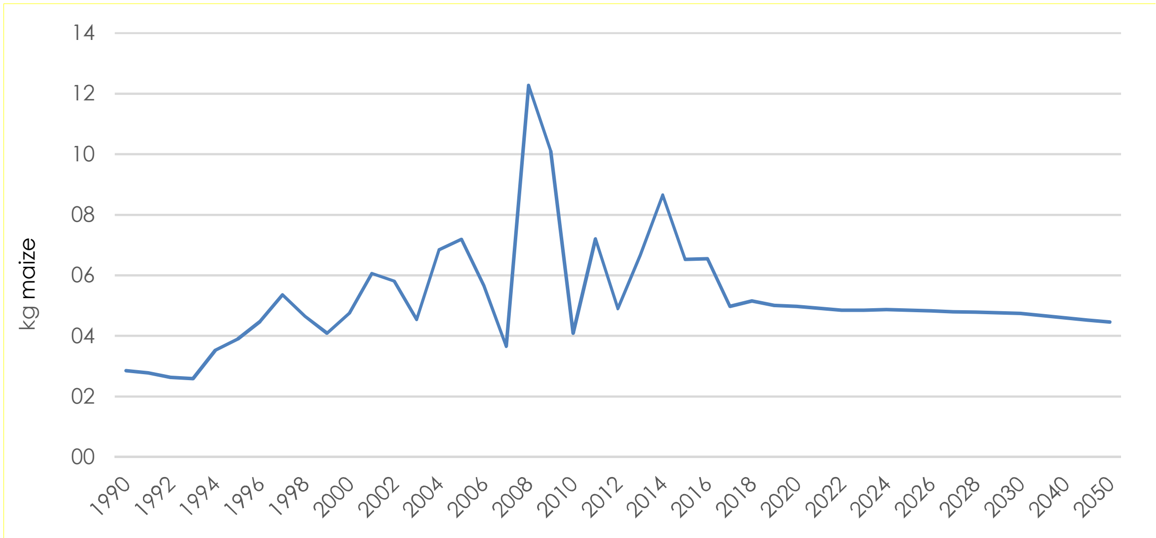

Figure 3: Rate of exchange between 1 kg N (mineral fertilizer) and x kg of maize

Source: Statistik Austria, AMA, own estimates based on OECD-FAO, 2018 and Umweltbundesamt, s.a.

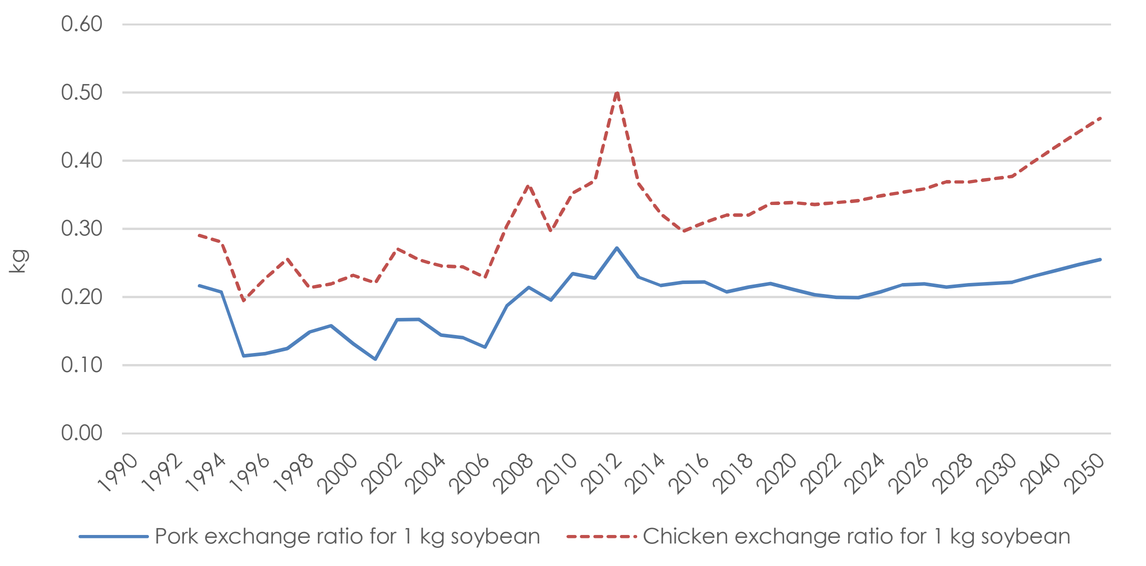

Figure 4: Rate of exchange between 1 kg Soybeans and x kg of pork / chicken meat

Source: Statistik Austria, AMA, own estimates based on OECD-FAO, 2018 and Umweltbundesamt, s.a.

The expected physical rate of exchange between agricultural outputs and agricultural inputs is likely to prevail as in the past (see Figure 3). Following the trend, approximately the value of 4 kg of maize were necessary to buy 1 kg of N in 1990 whereas 8 kg of maize will be necessary to buy 1 kg of N in 2025. According to the price forecasts of OECD-FAO (2018) and Umweltbundesamt (2018) ever more agricultural products will become necessary to purchase the same amount of fertilizers. This makes both organic and inorganic fertilizers more valuable which stimulates more efficient use and more care when applying fertilizers on land.

Table 4: Observed and expected nominal farm prices for livestock products in Austria and milk yields

	Unit € per	Ø2007/ 2009	Ø2015/ 2017	2020	2030	2040	2050
milk-A-quota[2)] and milk	kg	0.32	0.46	0.49	0.63	0.76	0.89
veal	kg SW[2)]	5.02	5.80	5.33	5.39	5.47	5.56
heifer for breeding	head	1,631.60	1,887.33	1,734.70	1,754.37	1,782.17	1,809.98
heifer for suckler cow	head	1,212.00	1,170.37	1,075.73	1,087.92	1,105.16	1,122.41
beef of heifer	kg SW	2.72	3.47	3.19	3.22	3.28	3.33
mutton	kg SW	0.60	0.64	0.60	0.63	0.67	0.72
beef (oxen)	kg SW	3.15	3.95	3.63	3.67	3.73	3.79
sheep cheese	kg	0.54	0.67	0.72	0.92	1.11	1.30
pork	kg SW	1.42	1.53	1.62	1.79	1.89	1.99
beef	kg SW	3.09	3.81	3.51	3.55	3.60	3.66
turkey	kg LW	1.18	1.49	1.40	1.46	1.49	1.52
fallow deer	kg SW	2.38	2.61	2.40	2.42	2.46	2.50
Wool	kg	0.53	0.62	0.62	0.62	0.62	0.62
goat meat	kg SW	2.89	3.42	3.23	3.41	3.63	3.84
goat cheese	head	1.37	1.63	1.73	2.23	2.69	3.14
male calves	head	382.91	428.15	393.53	397.99	404.30	410.61
male calves for beef	kg SW	441.10	493.23	453.34	458.48	465.74	473.01
female calves	head	293.64	305.23	280.54	283.72	288.22	292.72
female calves for beef	kg SW	424.70	441.46	405.76	410.36	416.86	423.36
eggs	unit	0.14	0.19	0.18	0.18	0.19	0.19
chicken	kg SW	0.88	1.08	1.01	1.05	1.07	1.10
gilt	head	270.43	296.51	313.26	346.02	365.17	384.32
young chicken	head	3.34	4.10	3.86	4.00	4.09	4.18
cow	kg SW	2.14	2.62	2.41	2.43	2.47	2.51
sow	kg SW	0.99	1.11	1.17	1.29	1.36	1.44
sheep meat	kg SW	4.11	4.61	4.35	4.59	4.88	5.18
average milk yield per cow	kg pa	6,041	6,734	7,097	7,435	8,111	8,787

Source: own assumptions based on OECD-FAO, 2018.

Note: [1)] kg SW is kg carcasse. [2)] Milk-A-quota is no longer effect after March 2015.

5.6 Other assumptions

For this report a detailed set of assumptions was developed in a process that included the expertise of farm production experts from the Austrian Chamber of Agriculture, the Austrian Agency for Health and Food Security (AGES) and participants of three meetings of the project board established for this study.

A proposal of draft assumptions was developed in mid 2018 and an online survey was conducted in early autumn to collect the views of agricultural experts in Austria. The draft assumptions as communicated with the experts via the online survey are presented (in German) in Appendix 3 and the summary of responses is presented there as well.

6 The scenario 'with existing measures' and the sensitivity of results

In this section, the scenarios which are investigated in this study are outlined. We compare the scenario With Existing Measures (WEM) with three sensitivity scenarios.

WEM uses price projections of OECD/FAO from 2018 for the EU, the existing legal framework regarding regulations in agriculture, farm policy after reform following the proposals of the European Commission from mid 2018 and climate change measures as implemented in the Austrian agri-environmental programme 2014-2020 and assumptions on the programme thereafter. Projections of OECD/FAO end in 2027 and a new multi-annual financial framework and another agricultural policy reform is likely to start in 2028. For the period from 2030 to 2050 the following general assumptions are made:

- prices will change following the projected trend from 2016 to 2027
- policy will not change after 2020 but remain until 2050
- technology assumptions are made explicit for crop yields and milk yield per cow

Productivity in other livestock sectors (mainly feed requirements) is assumed not to change. This assumption is justified by the conjecture that more consumers are likely to prefer less intensive production systems in future and that producers will respond accordingly.

Throughout the scenarios additional exogeneous assumptions are made:

- loss of agricultural land following the long term trend
- increase of milk yield per cow at a lower level than the long-term trend based on the assumption that animal welfare friendly production systems will prevail in future

The following policy measures are implemented:

- sector specific measures implemented according to the Austrian Climate Protection Act, in particular in the context of the Austrian agri-environmental programme
- implementation of the CAP health check reform 2008 (mainly abolition of milk quota in 2015)
- implementation of the CAP 2013 reform (in particular the abolitions of sugar quota and suckler cow premiums)

- 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 requirement) are met)
- over the projection period, the programme for rural development is maintained, however in a modified way with different levels of premiums (in particular for less favoured areas and organic farms) as specified in the policy assumption table 5.

Table 5: Comparison of farm policy assumptions of WEM-scenarios in the assessment 2015 ('WEM 2015') and the current assessment 2018 ('WEM 2018')

	WEM 2015			**WEM 2018**		
	2020	2030	2050	2020	2030	2050
CAP 1st pillar						
livestock premia	no	no	no	no	no	no
protein crop premium				no	no	no
regional direct payments	yes	yes	yes	yes	yes	yes
greening (CAP reform 2013)	yes	yes	yes	no	no	no
conditionality				yes	yes	yes
volume direct payments				664.8	664.8	664.8
regional distribution like 2020				yes	yes	yes
CAP 2nd pillar						
volume mio Eur p.a. (EU+AT)	1090	1090	1090	1090	960	960
compensatory payments mio Eur p.a				260	222	222
agri-env. payments total mio Eur p.a.	472	472	472	426		
organic farming scheme mio Eur p.a.	112	112	112	116	99	99
other agri-environmental premia	330	330	330	310	265	265
organic premium grassland Eur/ha	70-225	70-225	70-225	70-225	60-180	60-180
organic premium cropland Eur/ha	230-450	230-450	230-450	230-450	200-400	200-400
organic premium perm. crops Eur/ha	< 700	< 700	< 700	< 700	< 700	< 700
ban of agri-chemicals	60	60	60	60	60	60
UBAG/UBB arable land Euro per ha	15-45	15-45	15-45	15-45		
UBAG/UBB grassland Euro ja ha	15-45	15-45	15-45	15-45		

Source: Sinabell, Schönhart und Schmid, 2015 (grey columns "WEM 2015"); own assumptions (unshaded columns "WEM 2018")
[1)] implementation of measures of agri-environmental programme 2007-2013.

Sensitivity analyses

- a sensitivity scenario "WEMsens constant prices" which is like WEM 2018, i.e. it includes constant prices and variable costs for all years while productivity parameters (crop yields and milk yield per cow) change in the same manner as in WEM 2018;

- a sensitivity scenario "WEMsens with lower milk prices and higher pork prices" which is like WEM 2018 but assumes that milk prices are lower by 20% while pork prices are higher by 20%;
- a sensitivity scenario "WEMsens higher fertilizer prices" which is like WEM 2018 but assumes that prices for nitrogen, phosphate, and potassium fertilizers are 20% higher than in WEM 2018.

7 Results and their sensitivity

7.1 Overview of the scenario results "with existing measures" WEM 2018 on land use and production

The detailed results of the scenario analysis are provided in the tables in the appendix. The results partly deviate from previous analyses of the Austrian farm sector after the 2003 CAP-reform (Sinabell and Schmid, 2003; Schmid and Sinabell, 2004 and 2005; Sinabell, Schönhart and Schmid, 2011; Sinabell, Schönhart and Schmid, 2015). An important reason is that this report presents a scenario analysis with a new set of policies and price assumptions.

The changes made by the CAP reform 2013 are less radical than the changes that had been made in the reform period 2003 and 2008. The assumed reform which will be implemented from 2021 onwards in WEM will have substantial consequences. The most visible one is that transfers to the agricultural sector will be nominally declining.

The agri-environmental program will be intact in the future and its relatively generous support of organic farming has significant consequences. The fact that the payment scheme for farms in disadvantaged regions will be maintained has the same consequences: livestock farming, in particular beef and milk production, will be attractive in Austria. Organic farms need livestock in order to recycle nutrients and farms in mountain regions with grassland as the prevailing land use do not have many production options apart from ruminants.

An important aspect that has to be considered is the considerable loss of agricultural land over the period of four decades when observed data are compared to simulation results in 2050. One element of the loss of agricultural land is exogenously given, namely the resource restriction the model PASMA can use. Changes within these limits between types of land and land use intensities and afforestation are model results.

The most important results of the **scenario WEM 2018** compared to the **situation observed in recent years** and compared to **the results of the WEM scenario from 2015** (Sinabell, Schönhart and Schmid, 2015) are:

The number of **cattle** is likely to increase slightly compared to the observed levels. This result is not consistent with the observed declining trend over the last decades.

- An increasing number of cattle is consistent with the results of WEM 2015. However, the number of cattle in WEM 2018 is significantly lower than it was projected in WEM 2015.
- Different price assumptions are one explanation why the current projections of WEM 2018 show a relatively smaller cattle herd than WEM 2015.
- The lower levels of expected milk yields per cow in WEM 18 compared to WEM 2015 are a second explanation.
- Regarding policy, the assumption is made that support for farms in mountain areas will be lower than previously assumed in WEM 2015. This makes farm production relatively less profitable.

The number of **suckler cows** is expected to slightly decrease in 2020 with little increases until 2050 compared to recent levels and their production will prevail at relatively high levels.

- The Programme of Rural Development and the coupled alpine farming premium are favourable for extensive cattle production even when premiums are lower than previously assumed. The availability of grassland and relatively high beef prices make this type of production attractive.
- Comparing to projections of WEM 2018 with those made in WEM 2015 shows that there is practically no change in the longer run.

The heads of **heifers, calves and other cattle** are determined by dairy cow and suckler cow number as well as relative price relationships and production costs; fluctuations in the stocking rate are in the range of rates previously observed and reflect the possibility of imports and exports. Results of WEM 2018 are consistent with the change of dairy cows and suckler cows. Therefore, most non-cow cattle categories have smaller numbers compared to WEM 2015.

According to the results of WEM 2018 the production of swine and pork is going to decline by approximately 10% in 2050 compared to 2017. This result is in line with expectations of pig production experts who expect production to decline mainly due to limitations in production facilities. An expected smaller number of pigs is in contrast to results in WEM 2015 which indicated a sharp increase. The reason explaining the difference between WEM 2018 and WEM 2015 is the expected price. According to the most recent OECD/FAO projections prices for pork will be significantly lower than projected in 2014.

According to the model results **poultry** production will likely decrease. The reduction of head of chicken will be approximately 20% until 2050. This result is *not* consistent with the observed trend of increasing numbers of heads. Following international projections (European Commission, 2017) one would expect more poultry as well. The explanations for the model results are:

- The model result is the consequence of relative prices, production costs and coefficients of feed utilisation and observed production mixes among other factors.
- Compared to the price level in the reference period (before 2018), prices are going to be lower in 2020 and periods thereafter. Therefore there is no production incentive the model could capture.
- Relatively high feed costs (mainly soy meal) make the production of poultry meat unprofitable. The assumption is made that feed conversion does not improve over the projected period. Therefore, high input costs cannot be compensated in the model.
- An additional explanation for the results on poultry production is that poultry producers report about gloomy perspectives because tight animal welfare regulations relative to competitors imply that poultry and egg production in Austria has to cope with considerable higher costs than producers in other countries (aiz, 2015).

The acreage of **agricultural land** will be reduced mainly due to the secular trend of competition for land from urbanisation and traffic infrastructure in Austria. The projections imply that arable land will decline by 11% until 2050. The decline of agricultural land is partly exogenously given, the adjustments between different land categories are a result of the model. The result therefore fits to observations and previous model results.

The reduction of land resources implies that crops with high yields and yield increases will become more competitive. The loss of land is counterbalanced and compensated by higher yields per hectare. Therefore, the volume of **harvested crops** in 2050 is very similar to observed levels. This result of WEM 2018 is consistent with previous projections. Aspects like pests are not considered in the model but are not very likely to restrict the expansion of specific crops because the policies in place guarantee minimum crop rotations (which is an element of the CAP 2013 reform and which is an element of the CAP 2018 proposals).

In 2050, the acreage of **crop legumes** will be similar to the acreage observed during the last decade. However, according to the model, the sharp expansion of soy bean production which was observed since 2014 is going to come to a halt. The effect of a relatively high price of soy-beans is not sufficient to counterbalance the relatively faster growing yields of competing crops as well as agronomic constraints.

The sales of **mineral nutrients** are likely to decline very slightly in the very long run. This result is consistent with the *long* term trend but **not** consistent with observations of more recent sales data. According to the results of WEM 2015 the amount of nutrient sales was projected to decline significantly. There are two explanations why WEM 2018 does not confirm the results of WEM 2015:

- Relative prices between inputs and outputs are such that it is more profitable to use purchased inputs than in the projections of 2015.
- In the projection of WEM 2015 the number of livestock is higher than in WEM 2018. The model assumes that manure is a well suited substitute for mineral fertilizer with cheap trade options within NUTS-3 regions and therefore a smaller amount of mineral fertiliser is needed.
- In WEM 2018 the yield increases of crops are slightly higher than in WEM 2015. The model assumes a linear relationship between crop yield and nutrient requirements.

7.2 Overview of the scenario results "with existing measures" WEM 2018 on land use changes

Land use changes can be an important source or sink of greenhouse gases. There are two aspects of land use changes that need to be accounted for in different ways:

1. the change of the total sums of various land use types, and
2. changes of land uses in between various land use types without affecting the total sum of land different use types.

In PASMA, the tool used to calculate the projections presented in this report is well suited to analyse land uses changes of type 1. Within the limits of exogenously given land capacities, PASMA allocates various types of land to the most profitable type of use. Some restrictions apply to account for technical feasibilities and crop rotation requirements. As a result, the model produces output on changes of hectares for each land category (arable land, various types of grassland, area of orchards, wine yards) and crop areas on arable land.

Type 2 land use changes are subtler and need special attention. A farmer may take a plot of arable land and turn it to grassland or to an orchard. Because soil carbon content of grassland and orchard is higher than in arable land, such a land use change will contribute to an accumulation of carbon in soil in the long run. The opposite is true if a farmer turns grassland into arable land.

It may happen that type 1 land use change is null and at the same time type 2 land use change is significant. In Austria, in particular in pre-alpine regions, many farmers use the "Egart" system: arable land is turned into pasture and after approximately five years, the pasture is ploughed and used for another five year period as arable land. In this system the total amount of arable land and pasture land does not change but a land use change takes place every five years.[4]

[4] Regulation EU 764/2004 defines the term „permanent grassland" and the conditions that need to be met in order to qualify for direct payments. Arable land which has been continuously planted with grass or other forage plants for 5 years and which is not part of the crop rotation is defined as "permanent grassland".

PASMA is a model of representative farms and does not account for the land use of single plots. Results on land uses of PASMA are therefore of type 1. These results are very detailed and elaborated:

- the type of land (arable land, various grassland types, orchards, wine yard),
- the type of farming system (organic farming, low intensity, conventional farming),
- the tillage system (plough, minimum tillage),
- the rate of participation of agri-environmental programmes (e.g. cover crops)

The features of PASMA are therefore well suited to identify many aspects of land use changes. However, the limitation is that type 2 land use changes can not be identified. To model such land use changes, another type of model is necessary that models the use of single plots.

The projection on land use changes in this report are based on the following approaches:

- type 1 land use changes are a model output of PASMA;
- type 2 land use changes are based on model output of PASMA in combination with trend projections and expert judgement about changes of land uses within categories.

The empirical basis of type 2 land use changes is given by data provided by Umweltbundesamt (2018). The results of these statistics are based on an analysis of information on single plots from administrative IACS data. Because farmers report the status of each plot every year and because inspections are made, these data are very reliable. The projections presented in this report are therefore

a) based on trend parameters that use very reliable observations,

b) model outputs that are fully consistent with the other results presented in this report and

c) judgements of experts who assume that observed behaviour of farmers is a good predictor of future behaviour.

The results of land use changes are therefore fully consistent with the results presented in the previous section as far as type 1 land use changes are concerned. Type 2 results are presented in the appendix in Table 21 and following tables.

7.3 The sensitivity of WEM 2018 results

The results of sensitivity scenarios in comparison to the scenario WEM 2018 are summarized as follows:

Scenario milk prices -20% and pork prices +20%:

As expected, production responds to changing relative prices significantly. In this sensitivity scenario the number of cows remains more or less unchanged compared to the reference period and the number of pigs increases significantly. The results show that relative prices between livestock categories are very important for the model results.

Scenario constant prices:

As expected, production changes are not as strong as in WEM 2018, however very similar. The number of dairy cows increases but not as strong as in WEM 2018. The acreage of arable land does not decline as strongly indicating the important role of changing price - variable cost relations particularly with respect to mineral fertilizers.

Scenario higher fertilizer prices:

As expected, the amount of commercial fertilizer is declining compared to WEM 2018. The reduction is equivalent to 3 percentage points. Such a small reaction is consistent with empirical findings that the price elasticity of mineral fertilizer is very small. Even significantly higher prices induce only a small change.

8 Plausibility check and discussion of the simulation results

The assumptions and results presented here were shown to a panel of agricultural experts in Austria. Many of them did not respond to the invitation to give comments. This is considered consent. A few experts made detailed comments and raised important questions about specific results. Due to time and resource constraints it was not possible to explore the validity of concerns and make adjustments to the model or specific assumptions. In order to highlight the most important concerns, a summary of comments questioning the results of WEM 2018 scenarios is presented here in short:

- The volatility of fertilizer prices is very high. In the scenario with high N prices one might expect a shift towards organic production.
    - Model result interpretation: There are substantial declines in conventional arable land but hardly any changes in organic production. There are two reasons: i) the model is rather robust with respect to shifts between conventional and organic production in order to acknowledge the substantial observed costs of system changes; ii) changes in fertilizer prices do change the relative advantages of organic farming but not its absolute advantages.
- The specific assumptions on the CAP post 2021 should be justified in a better way and in more details.
- The model results show that fattening of calves will become more profitable in Austria. However, it is a fact that exports to the Netherlands make such a scenario unrealistic.
    - Model result interpretation: Calve numbers are a function of cow numbers. PASMA decides whether to export calves or enter into calf fattening subject to price – variable cost – feed cost relationships.

- An expansion of the number of cows is not feasible because capacities of dairies are limited, and actual sales opportunities are not as rosy as assumed. In the best case one might expect a constant number of dairy cows.
    - Model result interpretation: Sales opportunities in PASMA are only given by the exogenous milk price. Increases of livestock numbers in a particular category are due to possible shifts in housing capacities to the respective livestock category.
- The development of the numbers of breeding sows is unexpected. One would expect a smaller number given that more piglets per sow and year are expected in future.
    - Model result interpretation: A change in piglet numbers is not assumed in the WEM scenario.
- A decline of pork production is not expected in the medium term. Given current trends, a constant number of heads is to be expected.
    - Model result interpretation: The decline in pork production is a result of competition between different livestock categories, alternative feed uses, changing costs etc. As shown by the sensitivity scenario, pork production is very price sensitive. Because milk production benefits from higher prices, the model reacts with a smaller pork production.
- The declining number of chicken and turkeys is 'completely unrealistic' because recent observations indicate exactly the opposite trend.
    - Model result interpretation: The explanation given above for pork is valid for chicken as well. In the long run the terms of trade deteriorate significantly versus the main feed ingredient (soy meal – see figure 2). One assumption of WEM 2018 is that feed efficiency will not increase – this explains part of the results.
- An increasing number of bulls is very questionable given the price situation and expectations.
    - Model result interpretation: Bull fattening is a function of available calves which depends on cow numbers. PASMA decides whether to export calves or enter into calf or bull fattening subject to price – variable cost – feed cost relationships.
- The number of goats and sheep is likely to increase. Consumer demand for sheep and goat products is increasing and this will stimulate production.
    - Model result interpretation: small ruminant production competes with cattle production for resources in the model, which can be an explanation for this model result. Furthermore, the small farm structure with many part time farms in small ruminant production is more difficult to model with a strict gross margin-maximizing model.

All the arguments raised by the experts who were consulted are well justified and plausible. The careful assessment of the projections is an important contribution to be better able to interpret the results.

The conclusion is that results projected for 2020 are likely closer to the expectations of the experts than to the model results. The main reason is that production responses in reality are smooth and not abrupt as suggested by the model. Its output need to be interpreted as results due to an average steady-state situation. The model results show immediately the effect of lower prices in the poultry sector. One must keep in mind that model choices are based on simplifications and assumptions. Due to its static nature, PASMA does not show the pace of dynamic adjustment.

An appraisal of the results of the scenarios requires to account for the following aspects:

- the model is designed to evaluate in great detail a large number of changes that affect the decision making of Austrian farmers; one of its main advantages is a careful representation of production regions;
- the model is calibrated to the land allocation in an observed period (2016) and the parameters are reflecting the cost and price situation during the reference period (average of 2015-2017); simulations based on these parameters reflect therefore an observed situation;
- the model optimizes gross margins but is not designed to simulate investment behaviour of farmers in a detailed manner and it is not dynamic; therefore, long term scenarios are analysed in a specific manner that has to be taken into account when results are compared;
- the outputs represent scenarios, which are best interpreted with each other. Interpretation of single scenario runs is less robust and interpretation as projections, prognosis, or trend is invalid;
- because most parameters are derived from observation during the calibration run, interventions to modify the model behaviour are limited and many results can only be explained by referring to the observed situation;
- the model is based on observed situations therefore completely new solutions not yet found in reality cannot be represented by the model; knowing this means that the situation in 2050 will certainly be very different from the situation captured by the model because many technologies available by then are not even know of by today; however, the same is true for the expert expectations;

9 Reflections on the uncertainties of the results

Finally, it has to be stressed that scenarios on the future are exposed to a range of **uncertainties** which have to be kept in mind when the results of this analysis are considered:

- **Model uncertainty:** The first type of uncertainty is related to the type of model. The model is static by design and adjustments to future situations are calculated in discrete steps which are based on exogenous assumptions (prices, costs, technical coefficients) and model-endogenous coefficients (marginal costs) which are based on observations in the reference period. Investment costs are not considered in the model as it is based on gross margin calculations. The model assumes swift adaptation of land uses and management and efficient use of resources. In practice such adaptations may be overoptimistic because farmers are not able/willing to adjust as the model suggests. Such a situation may happen e.g. if the model allocates nutrients in a most cost-effective way in a region while actually there may be frictions that prevent this (e.g. blocked roads). In order to account for this type of uncertainty different scenarios are analysed in this study in which technical coefficients are set at different levels (e.g. loss of nutrients; efficiency of feeding; number of lactations).

- **Market uncertainty:** A review of past projections of OECD-FAO and the observed outcomes on the markets suggests that there is considerable deviation between those two. The range of such uncertainties can be accounted for and actually is discussed broadly in the most recent OECD-FAO report (2018). To account for this type of uncertainty in the analysis presented here would require making hundreds of simulations which capture alternative price scenarios with various probabilities. The benefit would be a more realistic view on the range of potential future outcomes. The costs to achieve this would be considerable and probably not worth the efforts because the most likely scenario is the scenario chosen for this analysis. A value added of taking into consideration market uncertainty would be to attach a certain probability to the most likely scenario based on observations in the past.
- **Policy uncertainty**: Policies affect decisions of farmers and other market participants in various ways. The range of policies is not limited to agricultural policies alone: energy policies affect energy prices and this input costs; urban planning regimes affect the decisions to develop of residential and commercial areas which have an impact on the availability of agricultural land; climate protection policies are likely to take into consideration the results of studies like this one and induce incremental or significant adjustments. In order to account for this type of uncertainty different scenarios need to be analysed in which policy instruments are set at different levels (e.g. rate of support for organic farms).

We may conclude that a range of uncertainties are directly addressed in this analysis. To analyse more than one plausible scenarios is the way to account for the immanent problem that statements about the future are uncertain.

For the interpretation of the results one should acknowledge that none of the scenarios analysed in this study is a "business as usual scenario". Such a scenario would not reflect the current incentive structure for the agricultural sector. Because both, Climate Strategy and the measures of the new agri-environmental program are still not yet determined, it is hardly possible to conjecture that observed trends are likely to prevail for the coming decades.

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Appendix I: Detailed model results

Table 6: Observed data – Part I

	2010	2015	2016	2017
Population size - dairy cows [head]	532,735	534,098	539,867	543,421
Population size - suckling cows [head]	260,883	224,348	216,678	207,007
Population size - TOTAL cattle 1-2 years [head]	443,652	439,081	432,043	438,591
Population size - TOTAL cattle 1-2 years CON [head]	369,188	365,001	354,411	355,917
Population size - TOTAL cattle 1-2 years ORG [head]	74,464	74,080	77,632	82,674
Population size - breeding heifers 1-2 years [head]	187,386	194,493	192,455	190,364
Population size - fattening heifers & bulls & oxen 1-2 yr [head]	256,266	244,588	239,588	248,227
Population size - breeding heifers 1-2 years CON [head]	155,935	161,679	157,874	154,480
Population size - breeding heifers 1-2 years ORG [head]	31,451	32,814	34,581	35,884
Population size - fattening heifers & bulls & oxen 1-2 yr CON [head]	213,254	203,322	196,537	201,436
Population size - fattening heifers & bulls & oxen 1-2 yr ORG [head]	43,012	41,266	43,051	46,791
Population size - cattle <1 year [head]	634,052	624,483	632,150	623,517
Population size - cattle <1 year CON [head]	527,631	519,123	518,562	505,984
Population size - cattle <1 year ORG [head]	106,421	105,360	113,588	117,533
Population size - cattle >2 year [head]	141,959	135,600	133,653	130,940
Population size - cattle >2 years CON [head]	118,132	112,722	109,637	106,258
Population size - cattle >2 years ORG [head]	23,827	22,878	24,016	24,682
Population size - breeding sows [head]	284,691	249,655	240,756	243,694
Population size - litter, young & fattening pigs [head]	2,849,465	2,595,796	2,552,047	2,576,388
Population size - litter <20kg [head]	764,542	683,354	660,555	667,802
Population size - young pigs 20-50kg [head]	839,543	744,004	743,550	736,698
Population size - fattening pigs >50kg [head]	1,245,380	1,168,438	1,147,942	1,171,888
Population size - young & fattening pigs >20kg [head]	2,084,923	1,912,442	1,891,492	1,908,586
Population size - litter & young pigs [head]	1,604,085	1,427,358	1,404,105	1,404,500
Population size - chicken [head]	13,918,813	15,079,069	15,079,069	15,079,069
Population size - layer (incl. chicks for layers) [head]	7,061,377	7,997,468	7,997,468	7,997,468
Population size - broiler [head]	6,857,436	7,081,601	7,081,601	7,081,601
Population size - other poultry [head]	725,600	692,482	692,482	692,482
Population size - turkeys [head]	615,813	600,497	600,497	600,497
Population size - other poultry (excl. turkeys) [head]	109,787	91,985	91,985	91,985
Population size - sheep [head]	358,415	353,710	378,381	401,480
Population size - goats [head]	71,768	76,620	82,735	91,134
Population size - horses [head]	106,280	120,000	120,000	130,000
Population size - others [head]	47,575	41,812	41,812	41,812
Population size - TOTAL cattle [head]	2,013,281	1,957,610	1,954,391	1,943,476
Population size - other cattle [head]	1,480,546	1,423,512	1,414,524	1,400,055
Population size - Swine without litter [head]	2,369,614	2,162,097	2,132,248	2,152,280
Population size - TOTAL Swine [head]	3,134,156	2,845,451	2,792,803	2,820,082
Population size - TOTAL poultry [head]	14,644,413	15,771,551	15,771,551	15,771,551
Milk yield - dairy cows [kg milk animal^{-1} year^{-1}]	6,100	6,579	6,759	6,865
Milk yield - suckling cows [kg milk animal-1 year-1]	3,500	3,500	3,500	3,500
2-year average nutrient (N) consumption [t N/yr]	88,465	120,934	126,438	120,163
Nitrogen left for spreading [Mg N year^{-1}]	134,409	132,266	132,606	,
N excretion on pasture, range and paddock [Mg N/yr]	10,198	9,937	10,085	,
Sewage sludge produced [t dm]	262,805	234,880	237,982	236,180
Sewage sludge agriculturally used [t dm]	44,354	46,861	48,314	47,549
Sewage sludge agriculturally used [%]	16,9	20,0	20,3	20,1
N-input from agriculturally used sewage sludge [t N]	1,730	1,828	1,884	1,854
Compost produced [t dm]	504,530	543,623	568,005	570,122
Compost applied in sector agriculture [%]	18	20	21	21
Compost applied in sector agriculture [t dm]	93,140	107,489	116,967	117,254
N content [%]	1,4%	1,4%	1,4%	1,4%
N-input from agriculturally used compost [t N]	1,304	1,505	1,638	1,642
Biogas-slurry from vegetable/plant-inputs [Mg N year^{-1}**]**	7,102	7,978	7,881	n,v,

Table 7: Observed data – Part II

	2010	2015	2016	2017
Cereals total [ha]	802,152	766,461	770,950	762,000
Wheat [ha]	302,852	302,965	315,088	295,029
Rye [ha]	45,699	39,563	37,312	34,476
Barley [ha]	168,891	151,769	140,425	138,903
Oats [ha]	26,576	23,501	22,512	23,245
Maize (corn) [ha]	201,137	188,728	195,252	209,476
Other cereals [ha]	56,997	59,934	60,360	60,872
Potato [ha]	21,973	20,368	21,221	22,991
Sugar beet [ha]	44,841	45,284	43,353	42,792
Fodder beet [ha]	193	134	133	131
Silo- green maize [ha]	81,239	91,989	84,643	82,188
Clover-hey [ha]	89,555	81,772	78,406	76,732
Rape [ha]	53,803	37,529	39,662	40,502
Sunflower [ha]	25,411	19,061	18,189	22,018
Soja bean [ha]	34,378	56,895	49,791	64,467
Horse- /fodderbean [ha]	4,344	10,780	10,823	10,296
Peas [ha]	13,562	7,274	7,733	6,721
Vegetables [ha]	9,112	9,455	10,143	10,282
Oil pumpkin [ha]	26,464	31,816	38,928	22,397
Cabbage [ha]	944	801	738	688
Lattuce [ha]	480	464	456	422
Spinach [ha]	476	554	567	673
Salad [ha]	497	386	361	361
Tomato [ha]	175	188	178	179
Green peppers [ha]	146	156	147	159
Cucumbers [ha]	411	402	373	362
Carrots [ha]	1,623	1,632	1,814	1,836
Onion [ha]	2,905	3,360	3,512	3,535
Peas [ha]	13,562	7,274	7,733	6,721
Soja beans [ha]	34,378	56,895	49,791	64,467
Horse/field beans [ha]	4,344	10,780	10,823	10,296
Clover hey, lucerne etc. [ha]	106,080	100,364	96,672	94,209
Other field forage [ha]	16,525	18,592	18,266	17,477
Wechselwiesen [ha]	59,169	57,503	52,117	50,029
Cover crops (Winterbegrünungen) [ha]	300,969	276,689	275,547	268,515
Aea organic soils [ha/yr]	12,954	12,954	12,954	12,954

Table 8: Observed data – Part III

	2010	2015	2016	2017
Cereals [1000 t]	4,776	4,784	5,642	4,813
Wheat [1000 t]	1,518	1,726	1,970	1,437
Rye [1000 t]	161	171	188	129
Barley [1000 t]	778	840	860	782
Oats [1000 t]	98	96	95	77
Maize (corn) [1000 t]	1,956	1,638	2,180	2,076
Oth.grains [1000 t]	265	312	349	313
Potato [1000 t]	672	536	767	653
Sugar beet [1000 t]	3,132	2,836	3,614	2,925
Fodder beet [1000 t]	11	7	8	8
Silo- green maize [1000 t]	3,557	3,807	4,172	3,697
Clover-hey [1000 t]	682	484	636	514
Rape [1000 t]	171	112	142	117
Sunflower [1000 t]	66	38	60	51
Soja bean [1000 t]	95	136	153	193
Horse- /fodderbean [1000 t]	11	25	28	23
Peas [1000 t]	31	19	19	15
Vegetables [1000 t]	457	442	473	452
Oil pumpkin [1000 t]	15	19	30	15
Cabbage [1000 t]	58	43	42	38
Lattuce [1000 t]	15	13	14	13
Spinach [1000 t]	9	11	13	11
Salad [1000 t]	26	17	16	19
Tomato [1000 t]	44	56	55	54
Green peppers [1000 t]	14	15	14	15
Cucumbers [1000 t]	41	44	47	47
Carrots [1000 t]	86	67	98	98
Onion [1000 t]	154	168	163	145
Peas [1000 t]	9	10	9	12
N in crop residues returned to soils [Mg N/yr]	76,758	75,466	85,957	n,a,

Table 9: Model results WEM-scenario – Part I

	Scenario WEM			
	2020	2030	2040	2050
Population size - dairy cows [head]	549,709	564,939	571,727	578,515
Population size - suckling cows [head]	215,504	217,501	219,576	221,650
Population size - TOTAL cattle 1-2 years [head]	438,157	441,380	443,656	445,932
Population size - TOTAL cattle 1-2 years CON [head]	360,977	363,122	365,507	367,893
Population size - TOTAL cattle 1-2 years ORG [head]	77,180	78,258	78,149	78,039
Population size - breeding heifers 1-2 years [head]	194,773	197,151	199,333	201,515
Population size - fattening heifers & bulls & oxen 1-2 yr [head]	243,383	244,229	244,323	244,418
Population size - breeding heifers 1-2 years CON [head]	160,276	162,149	163,969	165,789
Population size - breeding heifers 1-2 years ORG [head]	34,497	35,002	35,363	35,725
Population size - fattening heifers & bulls & oxen 1-2 yr CON [head]	200,701	200,973	201,538	202,103
Population size - fattening heifers & bulls & oxen 1-2 yr ORG [head]	42,683	43,256	42,785	42,314
Population size - cattle <1 year [head]	640,000	654,883	662,365	669,847
Population size - cattle <1 year CON [head]	525,001	537,210	543,347	549,485
Population size - cattle <1 year ORG [head]	114,999	117,673	119,018	120,362
Population size - cattle >2 year [head]	134,702	136,715	137,806	138,896
Population size - cattle >2 years CON [head]	110,892	112,585	113,938	115,291
Population size - cattle >2 years ORG [head]	23,810	24,130	23,868	23,605
Population size - breeding sows [head]	238,099	236,295	230,922	225,549
Population size - litter, young & fattening pigs [head]	2,523,584	2,473,685	2,390,396	2,307,107
Population size - litter <20kg [head]	646,170	641,271	626,690	612,108
Population size - young pigs 20-50kg [head]	738,016	720,326	693,317	666,308
Population size - fattening pigs >50kg [head]	1,139,399	1,112,088	1,070,389	1,028,690
Population size - young & fattening pigs >20kg [head]	1,877,415	1,832,414	1,763,706	1,694,998
Population size - litter & young pigs [head]	1,393,655	1,360,250	1,309,246	1,258,243
Population size - chicken [head]	13,995,491	12,777,768	12,421,182	12,064,596
Population size - layer (incl. chicks for layers) [head]	7,362,694	6,772,970	6,627,646	6,482,321
Population size - broiler [head]	6,632,797	6,004,798	5,793,537	5,582,275
Population size - other poultry [head]	666,174	557,798	593,299	628,799
Population size - turkeys [head]	577,683	483,704	514,488	545,273
Population size - other poultry (excl. turkeys) [head]	88,490	74,094	78,810	83,526
Population size - sheep [head]	373,735	376,335	369,686	363,036
Population size - goats [head]	81,848	84,095	82,513	80,930
Population size - horses [head]	119,177	118,008	118,184	118,360
Population size - others [head]	41,376	40,641	40,610	40,580
Population size - TOTAL cattle [head]	1,978,072	2,015,419	2,035,130	2,054,840
Population size - other cattle [head]	1,428,363	1,450,480	1,463,403	1,476,326
Population size - Swine without litter [head]	2,115,514	2,068,709	1,994,628	1,920,547
Population size - TOTAL Swine [head]	2,761,684	2,709,980	2,621,318	2,532,655
Population size - TOTAL poultry [head]	14,661,665	13,335,567	13,014,481	12,693,395
Milk yield - dairy cows [kg milk animal^{-1} year^{-1}]	7,097	7,435	8,111	8,787
Milk yield - suckling cows [kg milk animal-1 year-1]	3,500	3,500	3,500	3,500
2-year average nutrient (N) consumption [t N/yr]	128,083	123,083	121,254	119,425
Nitrogen left for spreading [Mg N year^{-1}]	133,553	135,193	135,721	136,249
N excretion on pasture, range and paddock [Mg N/yr]	9,968	9,968	9,968	9,968
Sewage sludge produced [t dm]	236,347	236,347	236,347	236,347
Sewage sludge agriculturally used [t dm]	47,575	47,575	47,575	47,575
Sewage sludge agriculturally used [%]	20,1	20,1	20,1	20,1
N-input from agriculturally used sewage sludge [t N]	1,855	1,855	1,855	1,855
Compost produced [t dm]	–	–	–	–
Compost applied in sector agriculture [%]	–	–	–	–
Compost applied in sector agriculture [t dm]	115,191	115,154	115,154	116,487
N content [%]	–	–	–	–
N-input from agriculturally used compost [t N]	1,613	1,612	1,612	1,631
Biogas-slurry from vegetable/plant-inputs [Mg N year^{-1}]	–	–	–	–

Table 10: Model results WEM-scenario – Part II

	Scenario WEM			
	2020	2030	2040	2050
Cereals total [ha]	683,707	648,725	627,217	605,708
Wheat [ha]	302,652	286,935	278,525	270,115
Rye [ha]	36,978	35,272	34,123	32,973
Barley [ha]	134,428	125,494	120,607	115,720
Oats [ha]	21,814	20,953	20,389	19,824
Maize (corn) [ha]	187,836	180,071	173,574	167,076
Other cereals [ha]	59,316	60,238	59,719	59,199
Potato [ha]	21,130	19,959	19,398	18,837
Sugar beet [ha]	41,266	38,213	36,822	35,431
Fodder beet [ha]	114	112	101	89
Silo- green maize [ha]	82,765	80,667	79,042	77,416
Clover-hey [ha]	77,305	76,012	73,841	71,670
Rape [ha]	38,600	36,077	35,224	34,372
Sunflower [ha]	17,379	17,155	16,485	15,816
Soja bean [ha]	48,135	47,673	45,489	43,306
Horse- /fodderbean [ha]	10,669	10,616	10,233	9,851
Peas [ha]	7,285	6,943	6,710	6,478
Vegetables [ha]	9,829	9,578	9,299	9,019
Oil pumpkin [ha]	36,843	36,067	34,921	33,774
Cabbage [ha]	726	672	664	656
Lattuce [ha]	449	416	411	406
Spinach [ha]	558	517	511	505
Salad [ha]	355	328	324	321
Tomato [ha]	175	162	160	158
Green peppers [ha]	144	134	132	130
Cucumbers [ha]	367	340	336	332
Carrots [ha]	1,786	1,652	1,633	1,613
Onion [ha]	3,456	3,198	3,160	3,122
Peas [ha]	7,285	6,943	6,710	6,478
Soja beans [ha]	48,135	47,673	45,489	43,306
Horse/field beans [ha]	10,669	10,616	10,233	9,851
Clover hey, lucerne etc. [ha]	95,315	93,721	91,044	88,367
Other field forage [ha]	19,352	20,203	20,326	20,449
Wechselwiesen [ha]	60,266	62,808	65,614	68,421
Cover crops (Winterbegrünungen) [ha]	266,546	255,054	243,696	232,339
Aea organic soils [ha/yr]	12,954	12,954	12,954	12,954

Table 11: Model results WEM-scenario – Part III

	Scenario WEM			
	2020	2030	2040	2050
Cereals [1000 t]	5,007	4,999	5,038	5,076
Wheat [1000 t]	1,632	1,636	1,666	1,696
Rye [1000 t]	165	170	176	183
Barley [1000 t]	805	784	769	754
Oats [1000 t]	92	93	95	98
Maize (corn) [1000 t]	1,992	1,970	1,968	1,966
Oth.grains [1000 t]	321	346	363	379
Potato [1000 t]	667	660	653	645
Sugar beet [1000 t]	3,103	3,028	3,052	3,077
Fodder beet [1000 t]	7	7	6	5
Silo- green maize [1000 t]	4,154	4,447	4,632	4,816
Clover-hey [1000 t]	602	598	553	508
Rape [1000 t]	133	135	139	142
Sunflower [1000 t]	48	48	47	45
Soja bean [1000 t]	158	165	164	164
Horse- /fodderbean [1000 t]	25	27	29	31
Peas [1000 t]	17	16	15	15
Vegetables [1000 t]	479	461	441	421
Oil pumpkin [1000 t]	17	17	17	17
Cabbage [1000 t]	40	40	37	35
Lattuce [1000 t]	13	13	12	11
Spinach [1000 t]	12	11	11	10
Salad [1000 t]	17	17	16	15
Tomato [1000 t]	54	54	50	47
Green peppers [1000 t]	15	15	14	13
Cucumbers [1000 t]	45	45	42	39
Carrots [1000 t]	86	86	80	75
Onion [1000 t]	155	155	145	135
Peas [1000 t]	10	10	9	9
N in crop residues returned to soils [Mg N/yr]	83,128	80,833	81,019	81,204

Table 12: Model results WEM-sens-1-scenario – Part I

	Scenario WEM-sens-1			
	2020	2030	2040	2050
Population size - dairy cows [head]	492,073	521,477	531,952	542,427
Population size - suckling cows [head]	207,346	212,406	212,082	211,758
Population size - TOTAL cattle 1-2 years [head]	400,045	417,711	422,715	427,720
Population size - TOTAL cattle 1-2 years CON [head]	329,742	345,117	348,770	352,422
Population size - TOTAL cattle 1-2 years ORG [head]	70,303	72,593	73,946	75,298
Population size - breeding heifers 1-2 years [head]	177,058	185,189	188,089	190,989
Population size - fattening heifers & bulls & oxen 1-2 yr [head]	222,987	232,522	234,627	236,731
Population size - breeding heifers 1-2 years CON [head]	144,684	152,204	154,470	156,737
Population size - breeding heifers 1-2 years ORG [head]	32,373	32,984	33,618	34,253
Population size - fattening heifers & bulls & oxen 1-2 yr CON [head]	185,057	192,913	194,299	195,685
Population size - fattening heifers & bulls & oxen 1-2 yr ORG [head]	37,930	39,609	40,327	41,045
Population size - cattle <1 year [head]	583,249	612,845	621,864	630,883
Population size - cattle <1 year CON [head]	478,447	502,726	510,124	517,522
Population size - cattle <1 year ORG [head]	104,802	110,120	111,740	113,361
Population size - cattle >2 year [head]	121,649	127,359	129,250	131,142
Population size - cattle >2 years CON [head]	100,490	105,263	106,754	108,245
Population size - cattle >2 years ORG [head]	21,159	22,096	22,496	22,897
Population size - breeding sows [head]	271,445	264,642	258,545	252,447
Population size - litter, young & fattening pigs [head]	3,104,267	3,028,676	2,952,198	2,875,720
Population size - litter <20kg [head]	736,665	718,203	701,655	685,106
Population size - young pigs 20-50kg [head]	930,710	908,252	884,694	861,135
Population size - fattening pigs >50kg [head]	1,436,892	1,402,220	1,365,849	1,329,478
Population size - young & fattening pigs >20kg [head]	2,367,602	2,310,473	2,250,543	2,190,614
Population size - litter & young pigs [head]	1,757,534	1,715,126	1,670,638	1,626,151
Population size - chicken [head]	14,904,531	14,079,828	13,654,178	13,228,528
Population size - layer (incl. chicks for layers) [head]	7,829,609	7,342,484	7,028,884	6,715,284
Population size - broiler [head]	7,074,923	6,737,344	6,625,294	6,513,243
Population size - other poultry [head]	664,547	618,471	618,064	617,658
Population size - turkeys [head]	576,273	536,317	535,964	535,612
Population size - other poultry (excl. turkeys) [head]	88,274	82,154	82,100	82,046
Population size - sheep [head]	357,706	375,814	375,809	375,803
Population size - goats [head]	77,544	81,526	80,306	79,086
Population size - horses [head]	117,070	117,482	116,739	115,996
Population size - others [head]	40,919	41,269	41,201	41,133
Population size - TOTAL cattle [head]	1,804,361	1,891,797	1,917,864	1,943,930
Population size - other cattle [head]	1,312,288	1,370,321	1,385,912	1,401,503
Population size - Swine without litter [head]	2,639,047	2,575,115	2,509,088	2,443,060
Population size - TOTAL Swine [head]	3,375,712	3,293,318	3,210,742	3,128,166
Population size - TOTAL poultry [head]	15,569,078	14,698,298	14,272,242	13,846,185
Milk yield - dairy cows [kg milk animal^{-1} year^{-1}]	7,097	7,435	8,111	8,787
Milk yield - suckling cows [kg milk animal-1 year-1]	3,500	3,500	3,500	3,500
2-year average nutrient (N) consumption [t N/yr]	131,424	124,471	122,269	120,066
Nitrogen left for spreading [Mg N year^{-1}]	127,907	132,250	133,061	133,871
N excretion on pasture, range and paddock [Mg N/yr]	9,968	9,968	9,968	9,968
Sewage sludge produced [t dm]	236,347	236,347	236,347	236,347
Sewage sludge agriculturally used [t dm]	47,575	47,575	47,575	47,575
Sewage sludge agriculturally used [%]	20,1	20,1	20,1	20,1
N-input from agriculturally used sewage sludge [t N]	1,855	1,855	1,855	1,855
Compost produced [t dm]	–	–	–	–
Compost applied in sector agriculture [%]	–	–	–	–
Compost applied in sector agriculture [t dm]	111,992	112,825	112,825	112,713
N content [%]	–	–	–	–
N-input from agriculturally used compost [t N]	1,568	1,580	1,580	1,578
Biogas-slurry from vegetable/plant-inputs [Mg N year^{-1}]	–	–	–	–

Table 13: Model results WEM-sens-1-scenario – Part II

	Scenario WEM-sens-1			
	2020	2030	2040	2050
Cereals total [ha]	695,278	660,755	636,853	612,950
Wheat [ha]	305,776	290,773	281,097	271,421
Rye [ha]	37,294	35,377	34,283	33,189
Barley [ha]	137,299	127,696	122,339	116,982
Oats [ha]	22,129	21,392	20,800	20,208
Maize (corn) [ha]	192,780	185,516	178,333	171,149
Other cereals [ha]	60,878	62,318	61,081	59,845
Potato [ha]	21,275	20,070	19,467	18,865
Sugar beet [ha]	41,549	38,576	37,047	35,517
Fodder beet [ha]	115	112	100	89
Silo- green maize [ha]	85,049	83,008	80,737	78,465
Clover-hey [ha]	78,222	77,572	75,145	72,717
Rape [ha]	39,304	36,573	35,629	34,685
Sunflower [ha]	17,472	17,172	16,530	15,889
Soja bean [ha]	48,606	49,316	46,786	44,257
Horse- /fodderbean [ha]	11,182	11,098	10,699	10,300
Peas [ha]	7,441	6,932	6,748	6,565
Vegetables [ha]	9,863	9,645	9,354	9,064
Oil pumpkin [ha]	37,486	37,395	36,417	35,439
Cabbage [ha]	728	674	667	660
Lattuce [ha]	450	417	412	408
Spinach [ha]	560	518	513	507
Salad [ha]	356	329	326	322
Tomato [ha]	175	162	161	159
Green peppers [ha]	145	134	132	131
Cucumbers [ha]	368	341	337	334
Carrots [ha]	1,789	1,658	1,640	1,621
Onion [ha]	3,463	3,209	3,173	3,138
Peas [ha]	7,441	6,932	6,748	6,565
Soja beans [ha]	48,606	49,316	46,786	44,257
Horse/field beans [ha]	11,182	11,098	10,699	10,300
Clover hey, lucerne etc. [ha]	96,445	95,644	92,651	89,658
Other field forage [ha]	19,968	20,141	20,476	20,810
Wechselwiesen [ha]	43,969	46,165	51,636	57,106
Cover crops (Winterbegrünungen) [ha]	272,572	261,113	248,954	236,796
Aea organic soils [ha/yr]	12,954	12,954	12,954	12,954

Table 14: Model results WEM-sens-1-scenario – Part III

	Scenario WEM-sens-1			
	2020	2030	2040	2050
Cereals [1000 t]	5,085	5,081	5,109	5,136
Wheat [1000 t]	1,651	1,660	1,683	1,706
Rye [1000 t]	167	171	177	184
Barley [1000 t]	825	800	781	763
Oats [1000 t]	93	95	97	100
Maize (corn) [1000 t]	2,019	1,997	1,999	2,000
Oth.grains [1000 t]	330	359	371	383
Potato [1000 t]	673	665	656	646
Sugar beet [1000 t]	3,125	3,057	3,071	3,084
Fodder beet [1000 t]	7	7	6	5
Silo- green maize [1000 t]	4,220	4,502	4,628	4,753
Clover-hey [1000 t]	665	617	569	521
Rape [1000 t]	136	137	140	144
Sunflower [1000 t]	49	48	47	45
Soja bean [1000 t]	159	170	169	167
Horse- /fodderbean [1000 t]	27	28	30	32
Peas [1000 t]	17	16	15	15
Vegetables [1000 t]	480	464	443	423
Oil pumpkin [1000 t]	17	18	18	18
Cabbage [1000 t]	40	40	38	35
Lattuce [1000 t]	13	13	12	11
Spinach [1000 t]	12	12	11	10
Salad [1000 t]	17	17	16	15
Tomato [1000 t]	54	54	51	47
Green peppers [1000 t]	15	15	14	13
Cucumbers [1000 t]	45	45	42	39
Carrots [1000 t]	86	86	81	75
Onion [1000 t]	156	156	146	137
Peas [1000 t]	10	10	10	9
N in crop residues returned to soils [Mg N/yr]	79,729	78,587	79,155	79,723

Table 15: Model results WEM-sens-2-scenario – Part I

	Scenario WEM-sens-2			
	2020	2030	2040	2050
Population size - dairy cows [head]	549,556	565,153	571,976	578,798
Population size - suckling cows [head]	216,282	218,262	220,131	221,999
Population size - TOTAL cattle 1-2 years [head]	437,327	440,893	443,351	445,810
Population size - TOTAL cattle 1-2 years CON [head]	359,894	362,414	365,024	367,634
Population size - TOTAL cattle 1-2 years ORG [head]	77,433	78,478	78,327	78,176
Population size - breeding heifers 1-2 years [head]	194,564	197,174	199,374	201,575
Population size - fattening heifers & bulls & oxen 1-2 yr [head]	242,762	243,719	243,977	244,236
Population size - breeding heifers 1-2 years CON [head]	160,074	162,117	163,975	165,833
Population size - breeding heifers 1-2 years ORG [head]	34,490	35,057	35,399	35,742
Population size - fattening heifers & bulls & oxen 1-2 yr CON [head]	199,819	200,297	201,050	201,802
Population size - fattening heifers & bulls & oxen 1-2 yr ORG [head]	42,943	43,421	42,928	42,434
Population size - cattle <1 year [head]	640,423	655,617	662,983	670,348
Population size - cattle <1 year CON [head]	525,348	537,812	543,854	549,896
Population size - cattle <1 year ORG [head]	115,075	117,805	119,129	120,452
Population size - cattle >2 year [head]	134,858	136,911	137,980	139,050
Population size - cattle >2 years CON [head]	110,903	112,688	114,033	115,378
Population size - cattle >2 years ORG [head]	23,956	24,222	23,947	23,672
Population size - breeding sows [head]	238,016	235,447	230,294	225,141
Population size - litter, young & fattening pigs [head]	2,520,533	2,465,481	2,384,608	2,303,735
Population size - litter <20kg [head]	645,944	638,972	624,988	611,003
Population size - young pigs 20-50kg [head]	736,905	718,005	691,711	665,417
Population size - fattening pigs >50kg [head]	1,137,683	1,108,504	1,067,909	1,027,315
Population size - young & fattening pigs >20kg [head]	1,874,589	1,826,509	1,759,620	1,692,731
Population size - litter & young pigs [head]	1,391,557	1,355,866	1,306,213	1,256,560
Population size - chicken [head]	13,970,761	12,748,085	12,393,116	12,038,146
Population size - layer (incl. chicks for layers) [head]	7,353,617	6,761,790	6,615,853	6,469,916
Population size - broiler [head]	6,617,144	5,986,295	5,777,262	5,568,230
Population size - other poultry [head]	660,493	553,937	589,557	625,177
Population size - turkeys [head]	572,757	480,356	511,244	542,133
Population size - other poultry (excl. turkeys) [head]	87,736	73,582	78,313	83,045
Population size - sheep [head]	375,948	378,928	371,648	364,369
Population size - goats [head]	82,655	84,759	82,984	81,209
Population size - horses [head]	119,255	118,054	118,187	118,319
Population size - others [head]	41,384	40,647	40,611	40,575
Population size - TOTAL cattle [head]	1,978,445	2,016,835	2,036,421	2,056,006
Population size - other cattle [head]	1,428,890	1,451,682	1,464,445	1,477,208
Population size - Swine without litter [head]	2,112,605	2,061,956	1,989,915	1,917,873
Population size - TOTAL Swine [head]	2,758,549	2,700,929	2,614,902	2,528,876
Population size - TOTAL poultry [head]	14,631,254	13,302,023	12,982,673	12,663,323
Milk yield - dairy cows [kg milk animal^{-1} year^{-1}]	7,097	7,435	8,111	8,787
Milk yield - suckling cows [kg milk animal-1 year-1]	3,500	3,500	3,500	3,500
2-year average nutrient (N) consumption [t N/yr]	123,911	118,279	116,597	114,916
Nitrogen left for spreading [Mg N year^{-1}]	133,589	135,249	135,775	136,302
N excretion on pasture, range and paddock [Mg N/yr]	9,968	9,968	9,968	9,968
Sewage sludge produced [t dm]	236,347	236,347	236,347	236,347
Sewage sludge agriculturally used [t dm]	47,575	47,575	47,575	47,575
Sewage sludge agriculturally used [%]	20,1	20,1	20,1	20,1
N-input from agriculturally used sewage sludge [t N]	1,855	1,855	1,855	1,855
Compost produced [t dm]	–	–	–	–
Compost applied in sector agriculture [%]	–	–	–	–
Compost applied in sector agriculture [t dm]	116,418	114,881	114,881	116,386
N content [%]	–	–	–	–
N-input from agriculturally used compost [t N]	1,630	1,608	1,608	1,629
Biogas-slurry from vegetable/plant-inputs [Mg N year^{-1}]	–	–	–	–

Table 16: Model results WEM-sens-2-scenario – Part II

	Scenario WEM-sens-2			
	2020	2030	2040	2050
Cereals total [ha]	681,072	643,591	622,354	601,117
Wheat [ha]	300,342	283,736	275,206	266,676
Rye [ha]	36,603	34,760	33,683	32,605
Barley [ha]	134,256	124,675	119,918	115,160
Oats [ha]	21,916	20,870	20,428	19,986
Maize (corn) [ha]	187,955	179,550	173,120	166,690
Other cereals [ha]	59,608	59,921	59,596	59,271
Potato [ha]	20,828	19,709	19,157	18,605
Sugar beet [ha]	40,799	37,688	36,166	34,644
Fodder beet [ha]	113	113	102	91
Silo- green maize [ha]	83,338	81,061	79,130	77,199
Clover-hey [ha]	77,045	75,843	73,786	71,729
Rape [ha]	38,320	35,593	34,818	34,043
Sunflower [ha]	17,107	16,839	16,197	15,556
Soja bean [ha]	48,249	47,341	45,553	43,765
Horse- /fodderbean [ha]	10,744	10,604	10,361	10,118
Peas [ha]	7,308	6,954	6,710	6,467
Vegetables [ha]	9,704	9,471	9,193	8,916
Oil pumpkin [ha]	37,053	35,920	34,787	33,655
Cabbage [ha]	724	670	659	649
Lattuce [ha]	448	414	408	401
Spinach [ha]	557	515	507	499
Salad [ha]	354	327	322	317
Tomato [ha]	174	161	159	156
Green peppers [ha]	144	133	131	129
Cucumbers [ha]	366	339	333	328
Carrots [ha]	1,781	1,647	1,621	1,595
Onion [ha]	3,446	3,187	3,137	3,087
Peas [ha]	7,308	6,954	6,710	6,467
Soja beans [ha]	48,249	47,341	45,553	43,765
Horse/field beans [ha]	10,744	10,604	10,361	10,118
Clover hey, lucerne etc. [ha]	94,995	93,512	90,976	88,439
Other field forage [ha]	19,320	20,604	20,726	20,847
Wechselwiesen [ha]	54,966	57,921	60,301	62,680
Cover crops (Winterbegrünungen) [ha]	266,307	254,166	242,675	231,185
Aea organic soils [ha/yr]	12,954	12,954	12,954	12,954

Table 17: Model results WEM-sens-2-scenario – Part III

	Scenario WEM-sens-2			
	2020	2030	2040	2050
Cereals [1000 t]	4,995	4,959	5,008	5,056
Wheat [1000 t]	1,620	1,618	1,647	1,676
Rye [1000 t]	164	168	174	180
Barley [1000 t]	806	779	766	752
Oats [1000 t]	92	92	95	99
Maize (corn) [1000 t]	1,991	1,957	1,963	1,970
Oth.grains [1000 t]	323	345	362	380
Potato [1000 t]	657	651	644	637
Sugar beet [1000 t]	3,068	2,987	2,997	3,008
Fodder beet [1000 t]	7	7	6	5
Silo- green maize [1000 t]	4,189	4,489	4,660	4,831
Clover-hey [1000 t]	575	560	516	472
Rape [1000 t]	132	133	137	141
Sunflower [1000 t]	48	47	46	44
Soja bean [1000 t]	158	163	164	165
Horse- /fodderbean [1000 t]	25	27	29	32
Peas [1000 t]	17	16	15	15
Vegetables [1000 t]	473	456	436	416
Oil pumpkin [1000 t]	17	17	17	17
Cabbage [1000 t]	40	40	37	35
Lattuce [1000 t]	13	13	12	11
Spinach [1000 t]	12	11	11	10
Salad [1000 t]	17	17	16	15
Tomato [1000 t]	54	53	50	46
Green peppers [1000 t]	15	14	13	13
Cucumbers [1000 t]	45	44	42	39
Carrots [1000 t]	86	85	79	74
Onion [1000 t]	155	154	144	134
Peas [1000 t]	10	10	9	9
N in crop residues returned to soils [Mg N/yr]	82,204	79,920	80,102	80,284

Table 18: Model results WEM-sens-3-scenario – Part I

	Scenario WEM-sens-3			
	2020	2030	2040	2050
Population size - dairy cows [head]	544,486	549,782	555,565	561,348
Population size - suckling cows [head]	216,520	216,658	216,556	216,455
Population size - TOTAL cattle 1-2 years [head]	434,490	438,306	440,181	442,057
Population size - TOTAL cattle 1-2 years CON [head]	356,984	360,614	361,922	363,230
Population size - TOTAL cattle 1-2 years ORG [head]	77,506	77,692	78,260	78,828
Population size - breeding heifers 1-2 years [head]	193,616	194,985	196,566	198,147
Population size - fattening heifers & bulls & oxen 1-2 yr [head]	240,874	243,320	243,615	243,910
Population size - breeding heifers 1-2 years CON [head]	159,085	160,367	161,664	162,961
Population size - breeding heifers 1-2 years ORG [head]	34,531	34,618	34,902	35,185
Population size - fattening heifers & bulls & oxen 1-2 yr CON [head]	197,898	200,246	200,257	200,268
Population size - fattening heifers & bulls & oxen 1-2 yr ORG [head]	42,975	43,074	43,358	43,642
Population size - cattle <1 year [head]	636,116	640,892	645,927	650,962
Population size - cattle <1 year CON [head]	521,815	525,733	529,863	533,993
Population size - cattle <1 year ORG [head]	114,301	115,159	116,064	116,969
Population size - cattle >2 year [head]	134,357	135,239	136,119	136,999
Population size - cattle >2 years CON [head]	110,384	111,210	111,931	112,653
Population size - cattle >2 years ORG [head]	23,974	24,029	24,187	24,346
Population size - breeding sows [head]	237,646	235,659	234,422	233,185
Population size - litter, young & fattening pigs [head]	2,522,208	2,495,476	2,480,159	2,464,842
Population size - litter <20kg [head]	644,940	639,546	636,189	632,833
Population size - young pigs 20-50kg [head]	737,958	729,570	724,869	720,167
Population size - fattening pigs >50kg [head]	1,139,309	1,126,359	1,119,101	1,111,842
Population size - young & fattening pigs >20kg [head]	1,877,268	1,855,930	1,843,970	1,832,010
Population size - litter & young pigs [head]	1,393,546	1,377,706	1,368,828	1,359,950
Population size - chicken [head]	14,758,597	14,290,472	14,011,869	13,733,267
Population size - layer (incl. chicks for layers) [head]	7,775,103	7,482,217	7,341,561	7,200,905
Population size - broiler [head]	6,983,494	6,808,255	6,670,308	6,532,362
Population size - other poultry [head]	676,651	662,694	636,710	610,727
Population size - turkeys [head]	586,769	574,666	552,134	529,602
Population size - other poultry (excl. turkeys) [head]	89,882	88,028	84,577	81,125
Population size - sheep [head]	376,424	373,282	367,358	361,434
Population size - goats [head]	82,540	79,703	78,282	76,861
Population size - horses [head]	119,829	119,539	118,888	118,236
Population size - others [head]	41,629	41,384	41,163	40,942
Population size - TOTAL cattle [head]	1,965,969	1,980,876	1,994,348	2,007,821
Population size - other cattle [head]	1,421,483	1,431,094	1,438,783	1,446,473
Population size - Swine without litter [head]	2,114,914	2,091,589	2,078,392	2,065,195
Population size - TOTAL Swine [head]	2,759,854	2,731,134	2,714,581	2,698,027
Population size - TOTAL poultry [head]	15,435,248	14,953,166	14,648,580	14,343,994
Milk yield - dairy cows [kg milk animal^{-1} year^{-1}]	7,097	7,435	8,111	8,787
Milk yield - suckling cows [kg milk animal-1 year-1]	3,500	3,500	3,500	3,500
2-year average nutrient (N) consumption [t N/yr]	129,274	133,508	138,125	142,743
Nitrogen left for spreading [Mg N year^{-1}]	133,034	133,552	134,080	134,608
N excretion on pasture, range and paddock [Mg N/yr]	9,968	9,968	9,968	9,968
Sewage sludge produced [t dm]	236,347	236,347	236,347	236,347
Sewage sludge agriculturally used [t dm]	47,575	47,575	47,575	47,575
Sewage sludge agriculturally used [%]	20.1	20.1	20.1	20.1
N-input from agriculturally used sewage sludge [t N]	1,855	1,855	1,855	1,855
Compost produced [t dm]	–	–	–	–
Compost applied in sector agriculture [%]	–	–	–	–
Compost applied in sector agriculture [t dm]	117,540	116,299	116,299	117,431
N content [%]	–	–	–	–
N-input from agriculturally used compost [t N]	1,646	1,628	1,628	1,644
Biogas-slurry from vegetable/plant-inputs [Mg N year^{-1}]	–	–	–	–

Table 19: Model results WEM-sens-3-scenario – Part II

	Scenario WEM-sens-3			
	2020	2030	2040	2050
Cereals total [ha]	691,813	687,928	685,319	682,710
Wheat [ha]	305,924	303,949	304,134	304,320
Rye [ha]	36,989	36,492	36,328	36,163
Barley [ha]	137,150	136,298	135,479	134,659
Oats [ha]	22,091	21,967	21,714	21,460
Maize (corn) [ha]	189,659	189,221	187,665	186,108
Other cereals [ha]	59,702	59,993	59,539	59,086
Potato [ha]	21,027	20,737	20,664	20,590
Sugar beet [ha]	41,887	41,204	41,477	41,749
Fodder beet [ha]	130	127	117	108
Silo- green maize [ha]	82,862	84,716	84,148	83,580
Clover-hey [ha]	76,706	77,180	76,355	75,530
Rape [ha]	38,826	38,584	38,739	38,895
Sunflower [ha]	17,545	17,211	17,389	17,567
Soja bean [ha]	48,701	48,173	47,044	45,914
Horse- /fodderbean [ha]	10,728	10,923	10,703	10,484
Peas [ha]	7,550	7,471	7,310	7,150
Vegetables [ha]	10,041	9,902	9,845	9,789
Oil pumpkin [ha]	37,148	36,414	36,006	35,598
Cabbage [ha]	754	748	730	712
Lattuce [ha]	466	462	451	440
Spinach [ha]	579	575	561	548
Salad [ha]	368	365	357	348
Tomato [ha]	181	180	176	171
Green peppers [ha]	150	149	145	141
Cucumbers [ha]	381	378	369	360
Carrots [ha]	1,853	1,839	1,795	1,751
Onion [ha]	3,586	3,559	3,474	3,389
Peas [ha]	7,550	7,471	7,310	7,150
Soja beans [ha]	48,701	48,173	47,044	45,914
Horse/field beans [ha]	10,728	10,923	10,703	10,484
Clover hey, lucerne etc. [ha]	94,576	95,161	94,144	93,127
Other field forage [ha]	19,404	19,202	19,079	18,955
Wechselwiesen [ha]	53,136	42,186	40,568	38,950
Cover crops (Winterbegrünungen) [ha]	269,297	268,433	263,561	258,689
Aea organic soils [ha/yr]	12,954	12,954	12,954	12,954

Table 20: Model results WEM-sens-3-scenario – Part III

	Scenario WEM-sens-3			
	2020	2030	2040	2050
Cereals [1000 t]	5,043	5,184	5,370	5,556
Wheat [1000 t]	1,651	1,738	1,829	1,921
Rye [1000 t]	166	177	189	201
Barley [1000 t]	822	852	864	876
Oats [1000 t]	93	97	101	106
Maize (corn) [1000 t]	1,989	1,976	2,025	2,075
Oth.grains [1000 t]	323	345	361	377
Potato [1000 t]	662	671	681	691
Sugar beet [1000 t]	3,150	3,265	3,445	3,625
Fodder beet [1000 t]	8	7	7	6
Silo- green maize [1000 t]	4,152	4,667	4,976	5,286
Clover-hey [1000 t]	573	526	503	480
Rape [1000 t]	134	144	152	160
Sunflower [1000 t]	49	48	49	50
Soja bean [1000 t]	159	166	170	173
Horse- /fodderbean [1000 t]	25	27	30	33
Peas [1000 t]	17	17	17	16
Vegetables [1000 t]	490	476	467	457
Oil pumpkin [1000 t]	17	18	18	18
Cabbage [1000 t]	40	39	38	37
Lattuce [1000 t]	13	13	12	12
Spinach [1000 t]	11	11	11	11
Salad [1000 t]	17	16	16	16
Tomato [1000 t]	53	52	51	50
Green peppers [1000 t]	14	14	14	14
Cucumbers [1000 t]	44	43	43	42
Carrots [1000 t]	85	83	82	80
Onion [1000 t]	154	150	148	145
Peas [1000 t]	10	10	10	9
N in crop residues returned to soils [Mg N/yr]	83,940	84,519	85,555	86,591

Table 21: Area of annual and perennial cropland and grassland and the conversion between annual, perennial cropland and grassland (vice versa)

Area annual LUC

CRF code	category name	unit	observed				WEM				WEM-sens-3			
			2010	2015	2016	2017	2020	2030	2040	2050	2020	2030	2040	2050
4B	Cropland	kha	1,442	1,424	1,415	1,407	1,368	1,295	1,257	1,219	1,383	1,360	1,350	1,339
4B1	Cropland remaining cropland	kha	1,440	1,417	1,407	1,400	1,363	1,288	1,250	1,213	1,376	1,352	1,342	1,332
4B11	Annual cropland remaining annual cropland	kha	1,370	1,347	1,337	1,329	1,293	1,224	1,188	1,152	1,306	1,285	1,275	1,265
4B12	Perennial cropland remaining perennial cropland	kha	69	69	69	69	69	64	62	60	69	67	66	66
4B13	Perennial cropland to annual cropland	kha	0	0	0	0	0	0	0	0	0	0	0	0
4B14	Annual cropland to perennial cropland	kha	0	1	1	1	0	0	0	0	0	0	0	0
4B2	Land converted to cropland	kha	2	8	8	8	6	7	7	7	7	8	8	8
4B21	Forest land converted to cropland	kha	0	0	0	0	0	0	0	0	0	0	0	0
4B22	Grassland converted to cropland	kha	2	8	7	7	6	7	7	7	7	8	8	8
4B22a	Grassland converted to annual cropland	kha	2	7	7	7	6	7	7	7	6	8	8	7
4B22b	Grassland converted to perennial cropland	kha	0	0	0	0	0	0	0	0	0	0	0	0
4C	Grassland	kha	1,509	1,406	1,378	1,378	1,344	1,296	1,251	1,206	1,344	1,296	1,251	1,206
4C1	Grassland remaining grassland	kha	1,507	1,400	1,371	1,371	1,337	1,289	1,244	1,199	1,337	1,289	1,244	1,199
4C1a	Grassland remaining grassland - Mineral soil	kha	1,507	1,400	1,371	1,371	1,337	1,289	1,244	1,199	1,337	1,289	1,244	1,199
4C1b	Grassland remaining grassland - Organic soil	kha	0	0	0	0	0	0	0	0	0	0	0	0
4C2	Land converted to grassland	kha	2	7	7	6	7	7	7	7	7	7	7	7
4C21	Forest Land converted to grassland	kha	1	1	1	1	1	1	1	1	1	1	1	1
4C22	Cropland converted to grassland	kha	1	6	6	6	6	6	6	6	6	6	6	6
4C22a	Annual cropland converted to grassland	kha	1	6	6	6	6	6	6	6	6	6	6	6
4C22b	Perennial cropland converted to grassland	kha	0	0	0	0	0	0	0	0	0	0	0	0

Table 22: Areas of perennial cropland split into ÖPUL measures "Erosionsschutz Obst und Wein", other perennial croplands

	observed				WEM				WEM-sens-3			
	2010	2015	2016	2017	2020	2030	2040	2050	2020	2030	2040	2050
Total wine yard: Calculated (interpolated) areas for emission calculation [ha]	45,480	46,278	46,756	46,756	46,179	44,643	43,252	41,860	46,218	44,890	43,925	42,961
1995-2014: ÖPUL-Maßnahme "Erosionsschutz Wein", ab 2015: ÖPUL-Maßnahme "Erosionsschutz Obst, Wein, Hopfen": nur Weinflächen. Quelle: 1995-1999: Grüner Bericht 2015, Tab.5.2.17. 2000-2017: Grüner Bericht 2018, Tab. 5.2.2.9.	36,564	26,241	28,958	30,163	30,363	28,737	27,902	27,053	30,363	29,867	29,645	29,410
Total orchard area: Calculated (interpolated) areas for emission calculation in ha	16,671	17,563	17,663	17,663	17,916	14,458	13,232	12,006	18,934	18,528	18,144	17,759
1995-2014: ÖPUL-Maßnahme "Erosionsschutz Obst und Hopfen", ab 2015 ÖPUL-Maßnahme "Erosionsschutz Obst, Wein, Hopfen": nur Obstflächen. Quelle: 1995-2000 Grüner Bericht 2015, Tab.5.2.17. 2001-2017: Grüner Bericht 2018, Tab. 5.2.2.9.	11,332	10,530	11,548	12,278	12,478	11,810	11,466	11,118	12,478	12,274	12,183	12,086

Table 23: ÖPUL-Maßnahme Verzicht auf Mineraldünger (1995-2013) bzw. Einschränkung ertragssteigernder Betriebsmittel (ab 2014

						observed			
activity	tillage	Greening	Manure	crop residues	input	2010	2015	2016	2017
Areas covered by individual agricultural measures [ha]	full + reduced	no	yes	low	medium	3,410	2,103	1,850	1,825
	full + reduced	no	yes	high	medium	4,350	2,683	2,360	2,328
	full + reduced	no	no	low	medium	2,364	1,458	1,282	1,265
	full + reduced	no	no	high	medium	2,473	1,525	1,341	1,323
	full + reduced	yes	yes	low	high with manure	9,220	5,686	5,001	4,935
	full + reduced	yes	yes	high	high with manure	15,246	9,403	8,271	8,160
	full + reduced	yes	no	low	high without manure	3,051	1,882	1,655	1,633
	full + reduced	yes	no	high	high without manure	3,172	1,956	1,720	1,697
subtotal [ha]	full + reduced					43,286	26,696	23,481	23,167
Areas covered by individual agricultural measures [ha]	no	no	yes	low	medium	0	0	0	0
	no	no	yes	high	medium	0	0	0	0
	no	no	no	low	medium	0	0	0	0
	no	no	no	high	medium	0	0	0	0
	no	yes	yes	low	high with manure	14	12	13	13
	no	yes	yes	high	high with manure	1	1	1	.
	no	yes	no	low	high without manure	33	28	30	.
	no	yes	no	high	high without manure	7	6	6	.
subtotal [ha]	no					54	46	50	49
total [ha]	no + full + reduced					43,340	26,743	23,531	23,216

Source: 1995-1999: Grüner Bericht 2015, Tab.5.2.17. 2000-2017: Grüner Bericht 2018, Tab. 5.2.2.9

						WEM			
activity	tillage	Greening	Manure	crop residues	input	2020	2030	2040	2050
Areas covered by individual agricultural measures [ha]	full + reduced	no	yes	low	medium	1,713	2,184	2,102	2,021
	full + reduced	no	yes	high	medium	2,185	2,786	2,682	2,578
	full + reduced	no	no	low	medium	1,187	1,514	1,457	1,401
	full + reduced	no	no	high	medium	1,242	1,583	1,524	1,465
	full + reduced	yes	yes	low	high with manure	4,631	5,904	5,684	5,464
	full + reduced	yes	yes	high	high with manure	7,658	9,763	9,399	9,036
	full + reduced	yes	no	low	high without manure	1,533	1,954	1,881	1,808
	full + reduced	yes	no	high	high without manure	1,593	2,031	1,955	1,880
subtotal [ha]	full + reduced					21,741	27,717	26,686	25,654
Areas covered by individual agricultural measures [ha]	no	no	yes	low	medium	0	0	0	0
	no	no	yes	high	medium	0	0	0	0
	no	no	no	low	medium	0	0	0	0
	no	no	no	high	medium	0	0	0	0
	no	yes	yes	low	high with manure	13	13	12	12
	no	yes	yes	high	high with manure	1	1	1	0
	no	yes	no	low	high without manure	24	23	22	22
	no	yes	no	high	high without manure	5	5	5	5
subtotal [ha]	no					43	41	40	39
total [ha]	no + full + reduced					21,784	27,758	26,725	25,692

Source: own calculations.

						WEM-sens-3			
activity	tillage	Greening	Manure	crop residues	input	2020	2030	2040	2050
Areas covered by individual agricultural measures [ha]	full + reduced	no	yes	low	medium	1,725	2,229	2,189	2,150
	full + reduced	no	yes	high	medium	2,200	2,844	2,793	2,742
	full + reduced	no	no	low	medium	1,195	1,545	1,518	1,490
	full + reduced	no	no	high	medium	1,251	1,616	1,587	1,559
	full + reduced	yes	yes	low	high with manure	4,663	6,027	5,919	5,812
	full + reduced	yes	yes	high	high with manure	7,711	9,966	9,788	9,610
	full + reduced	yes	no	low	high without manure	1,543	1,995	1,959	1,923
	full + reduced	yes	no	high	high without manure	1,604	2,073	2,036	1,999
subtotal [ha]	full + reduced					21,891	28,295	27,790	27,285
Areas covered by individual agricultural measures [ha]	no	no	yes	low	medium	0	0	0	0
	no	no	yes	high	medium	0	0	0	0
	no	no	no	low	medium	0	0	0	0
	no	no	no	high	medium	0	0	0	0
	no	yes	yes	low	high with manure	13	13	13	13
	no	yes	yes	high	high with manure	1	1	1	1
	no	yes	no	low	high without manure	24	24	24	24
	no	yes	no	high	high without manure	5	5	5	5
subtotal [ha]	no					43	43	42	42
total [ha]	no + full + reduced					21,935	28,337	27,832	27,326

Source: own calculations.

Table 24: Reduzierte Fläche der ÖPUL-Maßnahme Umweltgerechte Bewirtschaftung für Acker und Grünland (UBAG)

activity	tillage	Greening	Manure	crop residues	input	observed 2010	2015	2016	2017
	full + reduced	no	yes	low	medium	67,213	58,067	59,336	58,479
	full + reduced	no	yes	high	medium	51,000	44,061	45,023	44,373
Areas covered by individual agricultural measures [ha]	full + reduced	no	no	low	medium	192,716	166,494	170,131	
	full + reduced	no	no	high	medium	163,801	141,513	144,605	142,516
	full + reduced	yes	yes	low	high with manure	91,769	79,282	81,014	79,844
	full + reduced	yes	yes	high	high with manure	36,959	31,930	32,627	32,156
	full + reduced	yes	no	low	high without manure	132,343	114,336	116,833	115,146
	full + reduced	yes	no	high	high without manure	21,466	18,545	18,950	18,676
subtotal [ha]	full + reduced					757,266	654,227	668,520	658,862
	no	no	yes	low	medium	0	0	0	0
	no	no	yes	high	medium	0	0	0	0
Areas covered by individual agricultural measures [ha]	no	no	no	low	medium	0		0	0
	no	no	no	high	medium	0	0	0	0
	no	yes	yes	low	high with manure	3,128	2,660	2,877	2,846
	no	yes	yes	high	high with manure	345	293	317	314
	no	yes	no	low	high without manure	12,711	10,808	11,688	11,564
	no	yes	no	high	high without manure	850	723	782	774
subtotal [ha]	no					17,035	14,484	15,664	15,498
total [ha]	no + full + reduced					774,301	668,712	684,184	674,360

Source: Grüner Bericht 2018, Tab. 5.2.2.9. (2007-2014): davon Ackerland (ha) (minus Überschneidungsfläche mit Verzicht). Ab Submission 2017 (Zahl für 2015) heißt die Maßnahme "Umweltgerechte und biodiversitätsfördernde Bewirtschaftung"

						WEM			
activity	tillage	Greening	Manure	crop residues	input	2020	2030	2040	2050
Areas covered by individual agricultural measures [ha]	full + reduced	no	yes	low	medium	57,387	50,270	48,933	47,596
	full + reduced	no	yes	high	medium	43,544	38,144	37,130	36,115
	full + reduced	no	no	low	medium	0	0	0	0
	full + reduced	no	no	high	medium	139,853	122,510	119,251	115,993
	full + reduced	yes	yes	low	high with manure	78,352	68,635	66,810	64,985
	full + reduced	yes	yes	high	high with manure	31,555	27,642	26,907	26,172
	full + reduced	yes	no	low	high without manure	112,995	98,982	96,349	93,717
	full + reduced	yes	no	high	high without manure	18,327	16,054	15,627	15,201
subtotal [ha]	full + reduced					646,555	566,373	551,310	536,247
Areas covered by individual agricultural measures [ha]	no	no	yes	low	medium	0	0	0	0
	no	no	yes	high	medium	0	0	0	0
	no	no	no	low	medium	0	0	0	0
	no	no	no	high	medium	0	0	0	0
	no	yes	yes	low	high with manure	2,907	2,752	2,672	2,591
	no	yes	yes	high	high with manure	321	303	295	286
	no	yes	no	low	high without manure	11,813	11,181	10,856	10,526
	no	yes	no	high	high without manure	790	748	726	704
subtotal [ha]	no					15,832	14,984	14,549	14,106
total [ha]	no + full + reduced					664,670	583,357	567,805	552,246

Source: own calculations.

						WEM-sens-3			
activity	tillage	Greening	Manure	crop residues	input	2020	2030	2040	2050
	full + reduced	no	yes	low	medium	57,445	52,163	52,009	51,854
	full + reduced	no	yes	high	medium	43,588	39,581	39,463	39,346
Areas covered by individual agricultural measures [ha]	full + reduced	no	no	low	medium	166,993	151,640	151,190	150,740
	full + reduced	no	no	high	medium	139,995	127,124	126,747	126,370
	full + reduced	yes	yes	low	high with manure	78,432	71,221	71,009	70,798
	full + reduced	yes	yes	high	high with manure	31,587	28,683	28,598	28,513
	full + reduced	yes	no	low	high without manure	113,109	102,710	102,405	102,101
	full + reduced	yes	no	high	high without manure	18,346	16,659	16,610	16,560
subtotal [ha]	full + reduced					649,495	589,782	588,032	586,282
	no	no	yes	low	medium	0	0	0	0
	no	no	yes	high	medium	0	0	0	0
Areas covered by individual agricultural measures [ha]	no	no	no	low	medium	0	0	0	0
	no	no	no	high	medium	0	0	0	0
	no	yes	yes	low	high with manure	2,907	2,860	2,839	2,816
	no	yes	yes	high	high with manure	321	315	313	311
	no	yes	no	low	high without manure	11,813	11,620	11,534	11,443
	no	yes	no	high	high without manure	790	777	772	766
subtotal [ha]	no					15,832	15,573	15,458	15,335
total [ha]	no + full + reduced					665,327	605,356	603,490	601,617

Source: own calculations.

Table 25: ÖPUL-Maßnahme Mulch- und Direktsaat

activity	tillage	Greening	Manure	crop residues	input	observed 2010	2015	2016	2017
Areas covered by individual agricultural measures [ha]	full + reduced	no	yes	low	medium	0	0	0	0
	full + reduced	no	yes	high	medium	0	0	0	0
	full + reduced	no	no	low	medium	0	0	0	0
	full + reduced	no	no	high	medium	0	0	0	0
	full + reduced	yes	yes	low	high with manure	22,678	19,283	20,854	20,632
	full + reduced	yes	yes	high	high with manure	1,359	1,156	1,250	1,236
	full + reduced	yes	no	low	high without manure	10,638	9,045	9,782	9,678
	full + reduced	yes	no	high	high without manure	1,071	911	985	974
subtotal [ha]	full + reduced					35,746	30,395	32,871	32,520
Areas covered by individual agricultural measures [ha]	no	no	yes	low	medium	0	0	0	0
	no	no	yes	high	medium	0	0	0	0
	no	no	no	low	medium	0	0	0	0
	no	no	no	high	medium	0	0	0	0
	no	yes	yes	low	high with manure	5,576	4,741	5,128	5,073
	no	yes	yes	high	high with manure	334	284	307	304
	no	yes	no	low	high without manure	2,616	2,224	2,405	2,380
	no	yes	no	high	high without manure	263	224	242	240
subtotal [ha]	no					8,789	7,474	8,082	7,996
total [ha]	no + full + reduced					44,535	37,868	40,953	40,517

Source:1995-1999: Grüner Bericht 2015, Tab.5.2.17. 2000-2017: Grüner Bericht 2018, Tab. 5.2.2.9.

						WEM			
activity	tillage	Greening	Manure	crop residues	input	2020	2030	2040	2050
Areas covered by individual agricultural measures [ha]	full + reduced	no	yes	low	medium	0	0	0	0
	full + reduced	no	yes	high	medium	0	0	0	0
	full + reduced	no	no	low	medium	0	0	0	0
	full + reduced	no	no	high	medium	0	0	0	0
	full + reduced	yes	yes	low	high with manure	20,120	19,340	18,835	18,329
	full + reduced	yes	yes	high	high with manure	1,206	1,159	1,129	1,098
	full + reduced	yes	no	low	high without manure	9,438	9,072	8,835	8,598
	full + reduced	yes	no	high	high without manure	950	913	889	866
subtotal [ha]	full + reduced					31,714	30,485	29,688	28,891
Areas covered by individual agricultural measures [ha]	no	no	yes	low	medium	0	0	0	0
	no	no	yes	high	medium	0	0	0	0
	no	no	no	low	medium	0	0	0	0
	no	no	no	high	medium	0	0	0	0
	no	yes	yes	low	high with manure	4,947	4,755	4,631	4,507
	no	yes	yes	high	high with manure	296	285	278	270
	no	yes	no	low	high without manure	2,321	2,231	2,172	2,114
	no	yes	no	high	high without manure	234	225	219	213
subtotal [ha]	no					7,798	7,496	7,300	7,104
total [ha]	no + full + reduced					39,512	37,981	36,988	35,995

Source: own calculations.

						WEM-sens-3			
activity	tillage	Greening	Manure	crop residues	input	2020	2030	2040	2050
Areas covered by individual agricultural measures [ha]	full + reduced	no	yes	low	medium	0	0	0	0
	full + reduced	no	yes	high	medium	0	0	0	0
	full + reduced	no	no	low	medium	0	0	0	0
	full + reduced	no	no	high	medium	0	0	0	0
	full + reduced	yes	yes	low	high with manure	20,193	19,864	19,727	19,590
	full + reduced	yes	yes	high	high with manure	1,210	1,190	1,182	1,174
	full + reduced	yes	no	low	high without manure	9,472	9,318	9,254	9,189
	full + reduced	yes	no	high	high without manure	954	938	932	925
subtotal [ha]	full + reduced					31,829	31,310	31,095	30,879
Areas covered by individual agricultural measures [ha]	no	no	yes	low	medium	0	0	0	0
	no	no	yes	high	medium	0	0	0	0
	no	no	no	low	medium	0	0	0	0
	no	no	no	high	medium	0	0	0	0
	no	yes	yes	low	high with manure	4,965	4,884	4,851	4,817
	no	yes	yes	high	high with manure	298	293	291	289
	no	yes	no	low	high without manure	2,329	2,291	2,275	2,260
	no	yes	no	high	high without manure	234	231	229	227
subtotal [ha]	no					7,826	7,699	7,646	7,593
total [ha]	no + full + reduced					39,656	39,009	38,740	38,471

Source: own calculations.

Table 26: Einjährige Ackerfläche biologisch bewirtschaftet

						observed			
activity	tillage	Greening	Manure	crop residues	input	2010	2015	2016	2017
Areas covered by individual agricultural measures [ha]	full + reduced	no	yes	low	medium	9,764	10,245	10,839	12,029
	full + reduced	no	yes	high	medium	9,435	9,899	10,474	11,624
	full + reduced	no	no	low	medium	34,816	36,530	38,650	42,894
	full + reduced	no	no	high	medium	33,106	34,737	36,752	40,788
	full + reduced	yes	yes	low	high with manure	24,429	25,632	27,119	30,097
	full + reduced	yes	yes	high	high with manure	22,877	24,004	25,396	28,185
	full + reduced	yes	no	low	high without manure	37,768	39,628	41,927	46,531
	full + reduced	yes	no	high	high without manure	11,607	12,178	12,885	14,300
subtotal [ha]	full + reduced					183,802	192,853	204,041	226,448
Areas covered by individual agricultural measures [ha]	no	no	yes	low	medium	0	0	0	0
	no	no	yes	high	medium	0	0	0	0
	no	no	no	low	medium	0	0	0	0
	no	no	no	high	medium	0	0	0	0
	no	yes	yes	low	high with manure	226	192	208	206
	no	yes	yes	high	high with manure	21	18	19	19
	no	yes	no	low	high without manure	1,402	1,193	1,290	1,276
	no	yes	no	high	high without manure	161	137	148	147
subtotal [ha]	no					1,811	1,540	1,665	1,647
total [ha]	no + full + reduced					185,613	194,393	205,706	228,095

Source: 1990-1994: Bio-Ackerfläche errechnet aus Bio-Gesamt-Fläche minus Bio-GL-Fläche, ab 1995-1998 und 2000: Quelle: GB 2015, Tab. 5.2.17: ÖPUL-Bio-Ackerflächen. 1999: Quelle. GB 2004, Tab. 3.1.9; ab 2000-2017: Quelle: Grüner Bericht 2018, Tab. 2.4.1.)

activity	tillage	Greening	Manure	crop residues	input	WEM 2020	WEM 2030	WEM 2040	WEM 2050
Areas covered by individual agricultural measures [ha]	full + reduced	no	yes	low	medium	11,997	11,990	11,874	11,759
	full + reduced	no	yes	high	medium	11,592	11,585	11,474	11,363
	full + reduced	no	no	low	medium	42,777	42,753	42,341	41,930
	full + reduced	no	no	high	medium	40,677	40,654	40,262	39,871
	full + reduced	yes	yes	low	high with manure	30,015	29,998	29,709	29,420
	full + reduced	yes	yes	high	high with manure	28,109	28,093	27,822	27,552
	full + reduced	yes	no	low	high without manure	46,405	46,378	45,932	45,486
	full + reduced	yes	no	high	high without manure	14,261	14,253	14,116	13,979
subtotal [ha]	full + reduced					225,833	225,703	223,531	221,359
Areas covered by individual agricultural measures [ha]	no	no	yes	low	medium	0	0	0	0
	no	no	yes	high	medium	0	0	0	0
	no	no	no	low	medium	0	0	0	0
	no	no	no	high	medium	0	0	0	0
	no	yes	yes	low	high with manure	213	202	196	190
	no	yes	yes	high	high with manure	20	19	18	18
	no	yes	no	low	high without manure	1,324	1,253	1,217	1,180
	no	yes	no	high	high without manure	152	144	140	136
subtotal [ha]	no					1,710	1,618	1,571	1,524
total [ha]	no + full + reduced					227,543	227,322	225,103	222,883

Source: own calculations.

						WEM-sens-3			
activity	tillage	Greening	Manure	crop residues	input	2020	2030	2040	2050
	full + reduced	no	yes	low	medium	11,989	11,889	11,840	11,791
	full + reduced	no	yes	high	medium	11,585	11,488	11,441	11,393
Areas covered by individual agricultural measures [ha]	full + reduced	no	no	low	medium	42,751	42,394	42,218	42,043
	full + reduced	no	no	high	medium	40,652	40,312	40,145	39,978
	full + reduced	yes	yes	low	high with manure	29,996	29,746	29,623	29,500
	full + reduced	yes	yes	high	high with manure	28,091	27,857	27,741	27,626
	full + reduced	yes	no	low	high without manure	46,376	45,989	45,798	45,608
	full + reduced	yes	no	high	high without manure	14,252	14,133	14,075	14,016
subtotal [ha]	full + reduced					225,693	223,808	222,881	221,955
	no	no	yes	low	medium	0	0	0	0
	no	no	yes	high	medium	0	0	0	0
Areas covered by individual agricultural measures [ha]	no	no	no	low	medium	0	0	0	0
	no	no	no	high	medium	0	0	0	0
	no	yes	yes	low	high with manure	213	210	208	207
	no	yes	yes	high	high with manure	20	19	19	19
	no	yes	no	low	high without manure	1,324	1,303	1,293	1,283
	no	yes	no	high	high without manure	152	150	149	148
subtotal [ha]	no					1,710	1,682	1,670	1,656
total [ha]	no + full + reduced					227,403	225,490	224,551	223,611

Source: own calculations.

Table 27: Einjährige Ackerfläche ohne klimarelevante Maßnahmen

						observed			
activity	tillage	Greening	Manure	crop residues	input	2010	2015	2016	2017
Areas covered by individual agricultural measures [ha]	full + reduced	no	yes	low	medium	77,191	103,874	91,955	84,352
	full + reduced	no	yes	high	medium	78,672	105,868	93,720	85,971
	full + reduced	no	no	low	medium	32,915	44,293	39,211	35,969
	full + reduced	no	no	high	medium	52,503	70,652	62,545	57,374
	full + reduced	yes	yes	low	high with manure	20,927	28,161	24,930	22,869
	full + reduced	yes	yes	high	high with manure	828	1,114	986	904
	full + reduced	yes	no	low	high without manure	7,037	9,469	8,382	7,689
	full + reduced	yes	no	high	high without manure	667	898	795	729
subtotal [ha]	full + reduced					270,740	364,330	322,524	295,858
Areas covered by individual agricultural measures [ha]	no	no	yes	low	medium			0	0
	no	no	yes	high	medium			0	0
	no	no	no	low	medium			0	0
	no	no	no	high	medium			0	0
	no	yes	yes	low	high with manure			0	0
	no	yes	yes	high	high with manure			0	0
	no	yes	no	low	high without manure			0	0
	no	yes	no	high	high without manure			0	0
subtotal [ha]	no					0	0	0	0
total [ha]						270,740	364,330	322,524	295,858
Flächen mit Begrünung [ha]						502,800	458,042	466,825	471,226

						WEM			
activity	tillage	Greening	Manure	crop residues	input	2020	2030	2040	2050
	full + reduced	no	yes	low	medium	79,162	100,921	97,165	93,409
	full + reduced	no	yes	high	medium	80,682	102,858	99,030	95,202
Areas covered by individual agricultural measures [ha]	full + reduced	no	no	low	medium	33,756	43,034	41,432	39,831
	full + reduced	no	no	high	medium	53,844	68,643	66,089	63,534
	full + reduced	yes	yes	low	high with manure	21,462	27,361	26,342	25,324
	full + reduced	yes	yes	high	high with manure	849	1,082	1,042	1,001
	full + reduced	yes	no	low	high without manure	7,216	9,200	8,857	8,515
	full + reduced	yes	no	high	high without manure	685	873	840	808
subtotal [ha]	full + reduced					277,654	353,971	340,797	327,624
	no	no	yes	low	medium	0	0	0	0
	no	no	yes	high	medium	0	0	0	0
Areas covered by individual agricultural measures [ha]	no	no	no	low	medium	0	0	0	0
	no	no	no	high	medium	0	0	0	0
	no	yes	yes	low	high with manure	0	0	0	0
	no	yes	yes	high	high with manure	0	0	0	0
	no	yes	no	low	high without manure	0	0	0	0
	no	yes	no	high	high without manure	0	0	0	0
subtotal [ha]	no					0	0	0	0
total [ha]						277,654	353,971	340,797	327,624
Flächen mit Begrünung [ha]						455,833	436,180	421,960	407,740

Source: own calculations.

						WEM-sens-3			
activity	tillage	Greening	Manure	crop residues	input	2020	2030	2040	2050
Areas covered by individual agricultural measures [ha]	full + reduced	no	yes	low	medium	79,709	103,024	101,185	99,346
	full + reduced	no	yes	high	medium	81,239	105,001	103,127	101,253
	full + reduced	no	no	low	medium	33,989	43,930	43,146	42,362
	full + reduced	no	no	high	medium	54,216	70,074	68,823	67,572
	full + reduced	yes	yes	low	high with manure	21,610	27,931	27,432	26,934
	full + reduced	yes	yes	high	high with manure	855	1,105	1,085	1,065
	full + reduced	yes	no	low	high without manure	7,266	9,391	9,224	9,056
	full + reduced	yes	no	high	high without manure	689	891	875	859
subtotal [ha]	full + reduced					279,573	361,346	354,897	348,448
Areas covered by individual agricultural measures [ha]	no	no	yes	low	medium	0	0	0	0
	no	no	yes	high	medium	0	0	0	0
	no	no	no	low	medium	0	0	0	0
	no	no	no	high	medium	0	0	0	0
	no	yes	yes	low	high with manure	0	0	0	0
	no	yes	yes	high	high with manure	0	0	0	0
	no	yes	no	low	high without manure	0	0	0	0
	no	yes	no	high	high without manure	0	0	0	0
subtotal [ha]	no					0	0	0	0
total [ha]						279,573	361,346	354,897	348,448
Flächen mit Begrünung [ha]						460,539	459,060	456,522	453,983

Source: own calculations.

Table 28: Perennial cropland

	observed				WEM				WEM-sens-3			
	2010	2015	2016	2017	2020	2030	2040	2050	2020	2030	2040	2050
vineyards [ha]	45,480	46,277	46,756	46,756	46,179	44,643	43,252	41,860	46,218	44,890	43,925	42,961
Orchards (plus tree nurseries) [ha]	16,671	17,589	17,663	17,663	17,916	14,458	13,232	12,006	18,934	18,528	18,144	17,759
House and kitchen gardens [ha]	2,576	1,355	1,019	1,019	1,019	1,014	1,009	1,004	1,019	1,014	1,009	1,004
Energieholz [ha]	2,330	2,359	2,421	2,421	2,421	2,409	2,397	2,386	2,421	2,409	2,397	2,386
Christmas tree cultures [ha]	2,002	2,499	2,445	2,445	2,463	2,275	2,171	2,067	2,504	2,471	2,433	2,394

Appendix II: Parameter assumptions

Table 29: Crop yields of organic versus conventional production

		organic in % ….	
		of average yields	of conventional yields
common wheat	dt/ha	0.62	0.59
durum wheat	dt/ha	0.58	0.63
rye	dt/ha	0.66	0.53
winter barley	dt/ha	0.59	0.57
spring barley	dt/ha	0.65	0.62
oats	dt/ha	0.79	0.67
Mixed cereals and triticale	dt/ha	0.74	0.64
grain maize	dt/ha	0.66	0.64
grain pea	dt/ha	0.67	0.51
field bean	dt/ha	0.91	0.73
soy	dt/ha	0.82	0.78
oilseed rape	dt/ha	0.52	0.49
sunflower	dt/ha	0.76	0.75
Oil pumpkin seeds	dt/ha	0.84	0.80
Potato food	dt/ha	0.50	0.45
sugar beet	dt/ha	0.79	0.77

Source:

Table 30: Revenue markup of organic products compared to average revenues

	2012	2013	2014	2015	2016	5-year average
common wheat	1.50	1.75	1.84	1.89	2.28	1.85
durum wheat	1.51	1.82	1.48	1.54	2.34	1.74
rye	1.13	1.51	1.43	1.46	1.62	1.43
winter barley	1.38	1.66	1.62	1.66	1.76	1.61
spring barley	1.24	1.59	1.74	1.67	1.86	1.62
oats	1.20	1.16	1.18	1.15	1.17	1.17
grain maize	1.87	2.03	1.82	1.91	2.06	1.94
Potato food	1.79	2.07	2.17	2.22	2.30	2.11
vigour	2.51	2.16	2.03	1.80	1.73	2.05
sugar beets	1.79	1.86	2.47	2.46	2.52	2.22
grapes	1.01	1.03	1.00	1.15	1.13	1.06
Wine	0.94	0.92	0.76	0.84	1.07	0.91
Milk to dairy	1.10	1.09	1.11	1.17	1.25	1.14
Eggs M	1.73	1.70	1.77	1.86	1.92	1.80

Source: own calculations based on LBG (various years); Statistik Austria (LFW Erzeugerpreise).

Table 31: Crop yields dt/ha

	2007/09	2011/13	2015/17	2020	2030	2050
Wheat and spelt	51.33	51.23	56.07	55.75	58.77	64.81
Soft wheat and spelt	51.89	51.57	56.79	56.25	59.19	65.07
durum wheat	41.71	44.23	46.57	48.31	52.49	60.86
Rye and winter mead cereals	39.94	42.80	44.14	45.18	48.90	56.34
rye	39.77	42.66	43.72	44.81	48.40	55.58
Winter mead cereals without triticale	42.96	44.84	49.49	48.82	52.48	59.81
barley	46.68	50.51	57.63	57.55	61.94	68.60
Oats and summer mixed cereals	37.30	39.56	38.85	39.36	40.43	42.53
oats	37.37	39.69	38.69	39.56	41.19	44.39
summer meslin	36.88	38.86	40.14	39.24	40.66	43.54
Grain maize (incl. CCM)	108.20	100.40	99.17	103.78	105.53	108.69
Other cereals	50.79	48.92	51.40	51.91	53.92	57.94
triticale	52.73	50.05	54.67	55.13	58.51	65.27
millet, buckwheat, canary seed etc.	40.00	43.36	38.49	40.93	41.24	41.85
Commercial plants	170.79	175.97	162.36	178.40	185.54	199.84
Oilseeds and oilfruits (including seeds)	24.93	24.35	23.83	25.35	26.42	28.56
Rapeseed and colza seed	30.34	31.26	31.47	34.94	37.65	41.78
Winter rape for oil production	30.39	31.29	31.48	34.91	37.54	41.54
Summer rape and turnip rape	20.19	22.66	20.66	22.83	24.02	25.72
Sunflowers for oil production	26.57	24.84	25.41	25.83	26.05	26.49
soybeans	27.92	25.48	28.20	28.59	30.11	32.97
Other oilseeds	5.34	6.04	6.84	5.87	5.92	5.96
Oil pumpkin dried seeds	5.09	5.91	6.82	5.83	6.01	6.33
grain peas	21.14	22.99	24.41	24.41	24.41	24.41
field beans	23.11	24.85	23.58	23.58	23.58	23.58
sugar beets	683.25	685.26	713.43	744.35	784.35	859.42
Other industrial crops	20.58	23.13	20.41	22.53	23.71	25.92
hops	16.72	17.62	16.47	16.47	16.47	16.47
Other commercial plants[1]	20.84	23.42	20.58	20.58	20.58	20.58
Other leguminous plants[2]	20.84	23.42	20.58	21.91	22.36	23.27
Feed maize (silage and green maize)	474.80	452.27	452.22	455.80	465.59	484.37
Fodder roots and roots[3]	594.39	562.06	556.37	601.95	619.33	640.43
Fodder beet, other chopped fodder crops	594.39	562.06	556.37	601.86	619.14	640.07
Other fodder plants	73.27	70.48	76.39	78.51	81.18	84.61
Red clover incl. other types of clover	68.57	63.04	62.94	63.04	63.04	63.04
clover grass	76.73	70.06	72.66	72.66	72.66	72.66
alfalfa	65.77	63.44	61.66	63.44	63.44	63.44
Meadows onemähdig	37.56	36.25	36.84	36.84	36.84	36.84
litter meadows	35.95	30.37	32.98	32.98	32.98	32.98
Meadows moremähdig	75.49	72.92	79.72	79.72	79.72	79.72
fresh vegetables	370.71	408.90	349.74	379.06	373.46	362.26
Early and medium early table potatoes	278.55	276.53	267.41	267.41	267.41	267.41
late potatoes	369.42	369.60	353.13	377.64	389.59	413.48
Fruits (incl. strawberries)	536.17	430.14	316.21	412.48	400.44	376.35
fresh fruit	536.17	430.14	316.21	412.48	400.44	376.35
Wine	59.07	55.99	48.55	48.55	48.55	48.55
spelt	27.02	27.62	30.70	30.70	30.70	30.70
Pineapple-Strawberry-intensive	.	102.30	101.52	101.52	101.52	101.52

Source: own calculations based on Statistik Austria and own assumptions[1]) E.g. medicinal, aromatic and aromatic plants; –[2]) Sweet lupines, lentils, chickpeas, wieners and others; –[3]) Including fodder beet.

Table 32: Price projections for the European Union

Commodity	2015	2016	2017	2018	2019	2020	2025	2027
				€				
Wheat	167	170	171	164	167	171	179	184
Maize	158	166	155	167	174	176	182	184
Other coarse grains	149	139	133	134	138	140	151	157
Rice	596	609	588	578	584	591	653	672
Distiller's dry grains	261	214	224	235	244	250	262	265
OILSEEDS	382	401	396	388	401	405	435	452
Soybean	386	414	378	361	379	381	413	435
Other oilseeds	378	388	414	415	422	429	458	470
Protein meals	273	269	263	268	278	286	314	325
Vegetable oils	718	777	789	780	775	781	845	868
Molasses	186	170	158	169	180	187	193	196
White sugar (tq)	428	443	359	389	408	413	446	459
High fructose corn syrup	608	467	363	374	388	392	424	437
Sugar beet	28	27	22	24	25	26	29	29
Beef and veal (cwe)	3,772	3,675	3,750	3,499	3,417	3,430	3,419	3,499
Pigmeat (cwe)	1,396	1,460	1,653	1,499	1,511	1,588	1,653	1,745
Poultry meat (rtc)	1,875	1,779	1,804	1,732	1,699	1,712	1,758	1,750
Sheepmeat(cwe)	5,097	4,953	5,000	5,123	4,689	4,739	4,836	4,906
Milk	306	283	343	319	306	330	385	396
Butter (pw)	3,023	3,244	5,000	4,149	3,886	3,998	4,270	4,379
Cheese (pw)	3,096	2,860	3,400	3,139	3,368	3,464	3,935	4,094
Skim milk powder (pw)	1,862	1,789	1,800	1,791	1,967	2,032	2,383	2,538
Whole milk powder (pw)	2,395	2,365	2,975	2,753	2,907	2,948	3,351	3,515
Whey powder (pw)	755	708	900	1,090	797	817	1,066	1,177
Casein (pw)	5,728	5,213	6,600	6,770	7,226	7,504	8,235	8,670
Ethanol	56	51	55	56	57	58	64	66
Biodiesel	72	79	81	79	79	79	82	83
Fish	2,641	2,881	2,983	2,956	3,110	3,146	3,472	3,614
Fish from aquaculture	3,116	3,160	3,084	3,265	3,422	3,366	3,713	3,778
Fish meal	1,404	1,357	1,214	1,274	1,301	1,299	1,458	1,526
Fish oil	1,714	1,622	1,372	1,498	1,638	1,667	1,752	1,797
cotton	1,385	1,598	1,370	1,188	1,068	1,077	1,169	1,181
roots and tubers	173	283	535	539	578	580	630	639
Oil (world market)	52	44	55	64	67	68	74	76
Fertilizer (world market)	317	238	224	247	256	262	277	283

Source: OECD-FAO Agricultural Outlook (Edition 2018); data extracted on 23 Jul 2018 08:53 UTC (GMT) from OECD iLibrary

Appendix III: Stakeholder consultation documents

Online-Formular für Ihre Meinung

https://goo.gl/forms/6ElGyIpzxaNV3goY2

Rückmeldung erbeten bis: Montag, 10. Sept. 14:00 Uhr!

Allfällige Rückfragen bitte an: franz.sinabell@wifo.ac.at

Annahme 1: Ackerflächen in Österreich

	Ackerfläche in ha					
Bundesland	1999	2013	2016	% p.a.[1])	**2025[2])**	**2050[2])**
Burgenland	157,246	152,248	152,145	– 0.19	**149,500**	**142,400**
Kärnten	66,877	62,769	61,307	– 0.51	**58,500**	**51,500**
Niederösterreich	700,367	692,805	682,487	– 0.15	**673,200**	**648,100**
Oberösterreich	293,222	292,272	290,147	– 0.06	**288,500**	**284,100**
Salzburg	6,869	5,983	5,534	– 1.26	**4,900**	**3,600**
Steiermark	149,662	139,027	136,408	– 0.54	**129,900**	**113,300**
Tirol	12,035	9,340	8,667	– 1.91	**7,300**	**4,500**
Vorarlberg	3,108	3,218	2,939	– 0.33	**2,900**	**2,600**
Wien	5,889	6,395	4,848	– 1.14	**4,400**	**3,300**
Österreich	1,395,274	1,364,057	1,344,481	– 0.22	**1,318,300**	**1,248,400**
Trend lt. 1999/2013 Österreich				– 0.16	1,337,900	1,284,900
Trend lt. 1999/2013 Summe Bundesländer					1,338,920	

Source: Statistik Austria, Statcube, abgerufen 24-08-2018.

Hinweis: [1]) jährliche Änderungsrate 1999 bis 2016; diese Rate wird verwendet für 2025 und 2050.

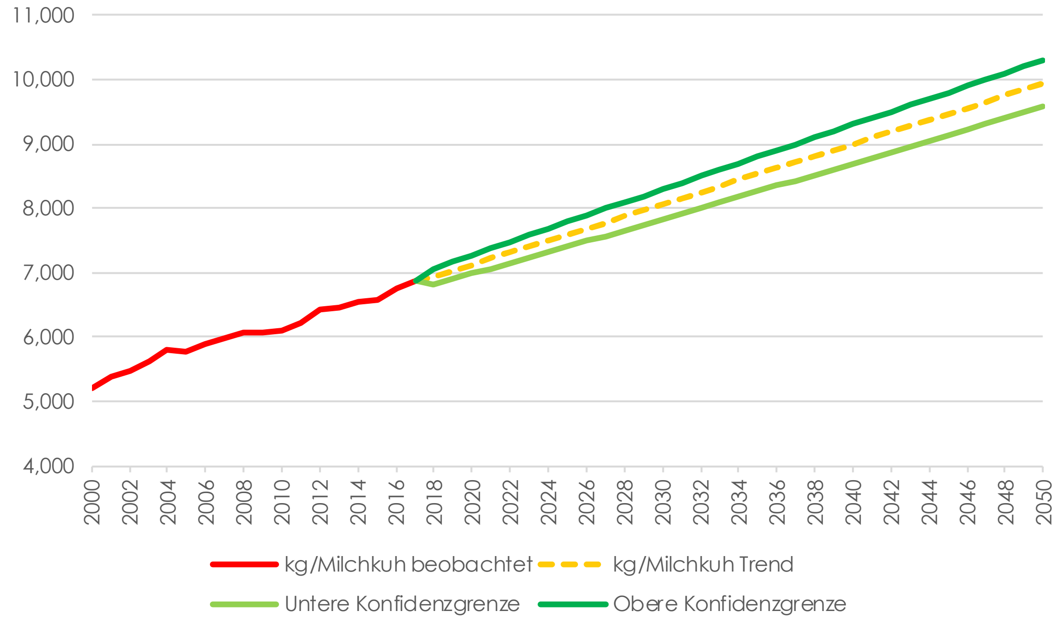
Annahme 2: Beobachtete und erwartete Erträge je Hektar im Bundesmittel (dt je ha)

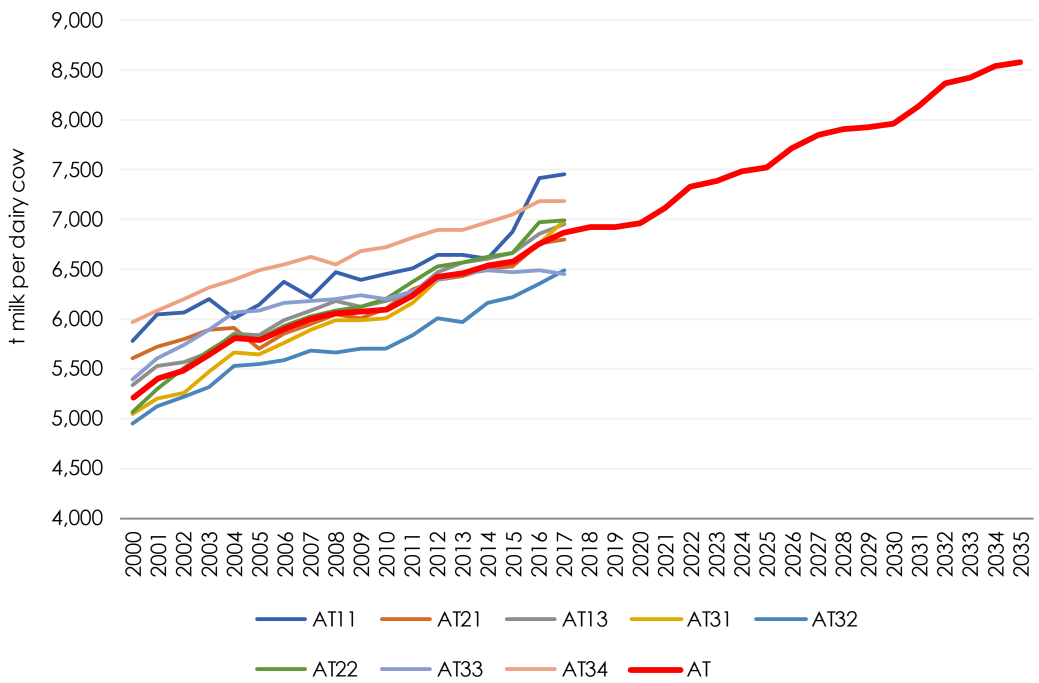
	2007/09	2011/13	2015/17	2020	2025	2030	2035	2040	2045	2050	Note
Weizen und Spelz	51.3	51.2	56.1	55.7	57.3	58.8	60.3	61.8	63.3	64.8	
Weichweizen und Spelz	51.9	51.6	56.8	56.2	57.7	59.2	60.7	62.1	63.6	65.1	
Hartweizen	41.7	44.2	46.6	48.3	50.4	52.5	54.6	56.7	58.8	60.9	
Roggen und Wintermenggetreide	39.9	42.8	44.1	45.2	47.0	48.9	50.8	52.6	54.5	56.3	
Roggen	39.8	42.7	43.7	44.8	46.6	48.4	50.2	52.0	53.8	55.6	
Wintermenggetreide ohne Triticale	43.0	44.8	49.5	48.8	50.6	52.5	54.3	56.1	58.0	59.8	
Gerste	46.7	50.5	57.6	57.6	59.8	61.9	63.9	65.6	67.2	68.6	mod
Hafer und Sommermenggetreide	37.3	39.6	38.8	39.4	39.9	40.4	41.0	41.5	42.0	42.5	mod
Hafer	37.4	39.7	38.7	39.6	40.4	41.2	42.0	42.8	43.6	44.4	mod
Sommermenggetreide	36.9	38.9	40.1	39.2	39.9	40.7	41.4	42.1	42.8	43.5	mod
Körnermais (inkl. CCM)	108.2	100.4	99.2	103.8	104.7	105.5	106.4	107.2	107.9	108.7	mod
Sonstiges Getreide	50.8	48.9	51.4	51.9	52.9	53.9	54.9	55.9	56.9	57.9	
Triticale	52.7	50.1	54.7	55.1	56.8	58.5	60.2	61.9	63.6	65.3	
Hirse, Buchweizen, Kanariensaat etc.	40.0	43.4	38.5	40.9	41.1	41.2	41.4	41.5	41.7	41.9	
HANDELSGEWÄCHSE	170.8	176.0	162.4	178.4	182.0	185.5	189.1	192.7	196.3	199.8	
Ölsaaten und Ölfrüchte (einschl. Saatgut	24.9	24.4	23.8	25.3	25.9	26.4	27.0	27.5	28.0	28.6	
Raps und Rübsensamen	30.3	31.3	31.5	34.9	36.4	37.7	38.8	39.9	40.9	41.8	mod
Winterraps zur Ölgewinnung	30.4	31.3	31.5	34.9	36.3	37.5	38.7	39.8	40.7	41.5	mod
Sommerraps und Rübsen	20.2	22.7	20.7	22.8	23.5	24.0	24.5	25.0	25.4	25.7	mod
Sonnenblumen zur Ölgewinnung	26.6	24.8	25.4	25.8	25.9	26.1	26.2	26.3	26.4	26.5	mod
Sojabohnen	27.9	25.5	28.2	28.6	29.4	30.1	30.8	31.6	32.3	33.0	mod
Übrige Ölsaaten	5.3	6.0	6.8	5.9	5.9	5.9	5.9	6.0	6.0	6.0	mod
Ölkürbis getrocknete Kerne	5.1	5.9	6.8	5.8	5.9	6.0	6.1	6.2	6.3	6.3	mod
Körnererbsen	21.1	23.0	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	mod
Ackerbohnen	23.1	24.9	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	mod
Zuckerrüben	683.3	685.3	713.4	744.3	764.6	784.4	803.7	822.7	841.3	859.4	mod
Sonstige Handelsgewächse	20.6	23.1	20.4	22.5	23.1	23.7	24.3	24.8	25.4	25.9	mod
Hopfen	16.7	17.6	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	mod
Andere Handelsgewächse (Heil-, Gewürz	20.8	23.4	20.6	20.6	20.6	20.6	20.6	20.6	20.6	20.6	mod
Andere Hülsenfrüchte (Süßlupinen, Linse	20.8	23.4	20.6	21.9	22.1	22.4	22.6	22.8	23.0	23.3	
Futtermais (Silo- und Grünmais)	474.8	452.3	452.2	455.8	460.7	465.6	470.4	475.1	479.8	484.4	mod
Futterhackfrüchte (einschließlich Futterr	594.4	562.1	556.4	601.9	611.2	619.3	626.3	632.2	636.9	640.4	mod
Futterrüben und sonst. Futterhackfrüchte	594.4	562.1	556.4	601.9	611.1	619.1	626.1	631.9	636.5	640.1	mod
Sonstige Futterpflanzen	73.3	70.5	76.4	78.5	79.9	81.2	82.3	83.2	84.0	84.6	mod
Rotklee inkl. sonstige Kleearten	68.6	63.0	62.9	63.0	63.0	63.0	63.0	63.0	63.0	63.0	mod
Kleegras	76.7	70.1	72.7	72.7	72.7	72.7	72.7	72.7	72.7	72.7	mod
Luzerne	65.8	63.4	61.7	63.4	63.4	63.4	63.4	63.4	63.4	63.4	mod
Egart	73.2	67.9	70.2	72.3	73.0	73.6	74.3	74.9	75.5	76.2	
Wiesen einmähdig	37.6	36.2	36.8	36.8	36.8	36.8	36.8	36.8	36.8	36.8	mod
Streuwiesen	36.0	30.4	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	mod
Wiesen mehrmähdig	75.5	72.9	79.7	79.7	79.7	79.7	79.7	79.7	79.7	79.7	mod
Frischgemüse	370.7	408.9	349.7	379.1	376.3	373.5	370.7	367.9	365.1	362.3	
Frühe- und Mittelfrühe Speisekartoffeln	278.6	276.5	267.4	267.4	267.4	267.4	267.4	267.4	267.4	267.4	mod
Spätkartoffeln	369.4	369.6	353.1	377.6	383.6	389.6	395.6	401.5	407.5	413.5	
OBST (einschl. Erdbeeren)	536.2	430.1	316.2	412.5	406.5	400.4	394.4	388.4	382.4	376.3	
Frischobst	536.2	430.1	316.2	412.5	406.5	400.4	394.4	388.4	382.4	376.3	
WEIN	59.1	56.0	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6	mod
Weißwein (ertragsfähige Fläche)	56.1	54.9	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	
Rotwein (ertragsfähige Fläche)	64.7	58.1	46.8	46.8	46.8	46.8	46.8	46.8	46.8	46.8	
Dinkel	27.0	27.6	30.7	30.7	30.7	30.7	30.7	30.7	30.7	30.7	mod
Ananas-Erdbeeren-intensiv <27>		102.3	101.5	101.5	101.5	101.5	101.5	101.5	101.5	101.5	mod

Q: Statistik Austria; eigene Annahmen: Trend-Entwicklung außer wenn „mod" in letzter Spalte.

Hinweis: Die Erträge sind über alle Aktivitäten und Qualitäten hinweg gemittelt.

Annahme 3: Beobachtete und erwartete Milchleistung je Milchkuh in kg/Jahr





Q: STATISTIK AUSTRIA, AgrarMarkt Austria (AMA), Landeslandwirtschaftskammern.

Annahme 4: Leistungskennzahlen tierische Produktion

Kennzahl	2018	2020	2030	2040	2050
Verkaufte **Ferkel** je Sau	21				
Ferkelproduktion: Bestandsergänzungsrate	38%				
Schweinemast Ausschlachtung	80%				
Schweinmast Mastanfangsgewicht	31,5kg				
Schweinemast Mastendgewicht	120 kg				
Schlachtgewicht	96 kg				
Futterverwertung 1 zu	2,9				
Sojaextraktionsschrot 44% (88%TM) pro Schwein	43,2kg				
Legehühner: Legeleistung Stk/AH und Jahr[1)]	280				
Futterverbrauch Produktionsphase g/Tag	120				
Futterverbrauch kg/AH und Jahr	40,95				
Masthuhn Futterverwertung 1 zu	1,71				
Masthuhn Tageszunahme g/Tier	58,1				
Masthuhn: Gewicht in kg je 100 bezahlte Tiere	207.7				
Gesamtverluste in %	5				
Milcherzeugung: Abgangsquote	26,7%				
Milcherzeugung: Erhaltungsbedarf MJ NEL/Tag	39,6				
Milcherzeugung: Leistungsbedarf MJNEL je kg Milch	3,2				
Stiermast Endgewicht kg	727				
Stiermast Zunahme je Tag in g	1240				
Stiermast Zuwachs je Tier kg	617				
Stiermast Energiebedarf gesamt MJME	45460				
Stiermast SojaExtr.Schrot 44%XP in MJME	6756				

Q: idb.awi.bmlfuw.gv.at/ und www.stmelf.bayern.de/idb/

Annahmen: [1)] Verteilung Eier XL:L:M:S=6:51:38:5.

Annahme 5: Erlös je Mengeneinheit bio versus konventionell

		2011	2012	2013	2014	2015	2016	Mittelwert 5 Jahre
Weichweizen	Euro/100kg	1.58	1.50	1.75	1.84	1.89	2.28	1.85
Hartweizen	Euro/100kg	0.71	1.51	1.82	1.48	1.54	2.34	1.74
Roggen	Euro/100kg	1.26	1.13	1.51	1.43	1.46	1.62	1.43
Wintergerste	Euro/100kg	1.31	1.38	1.66	1.62	1.66	1.76	1.61
Sommergerste	Euro/100kg	1.34	1.24	1.59	1.74	1.67	1.86	1.62
Hafer	Euro/100kg	1.26	1.20	1.16	1.18	1.15	1.17	1.17
Körnermais	Euro/100kg	1.62	1.87	2.03	1.82	1.91	2.06	1.94
Speise Erdäpfel	Euro/100kg	1.78	1.79	2.07	2.17	2.22	2.30	2.11
Stärke	Euro/100kg	3.27	2.51	2.16	2.03	1.80	1.73	2.05
Zuckerrüben	Euro/100kg	1.73	1.79	1.86	2.47	2.46	2.52	2.22
Trauben	Euro/kg	1.11	1.01	1.03	1.00	1.15	1.13	1.06
Milch an Molkerei	Euro/100kg	1.09	1.10	1.09	1.11	1.17	1.25	1.14
Rindfleisch	Euro/100kg							
Kalbfleisch	Euro/100kg							
Schweinefleisch	Euro/100kg							
Geflügelfleisch	Euro/100kg							
Eier M		1.85	1.73	1.70	1.77	1.86	1.92	1.80

Interpretation: für Bio-Weichweizen betrug der Erlös 1,85 mal so viel wie für konventionellen Weizen gemittelt über den Zeitraum 2011 bis 2016.

Anmerkung: Keine geeigneten Zeitreihen für tierische Produkte (außer Milch) bekannt. Mitteilungen und Hinweise sind willkommen und erwünscht: franz.sinabell@wifo.ac.at

Annahme 6: Erträge der Bioproduktion verglichen mit konventioneller Produktion

Ackerfrucht	bio durch konv
Weichweizen	0.64
Roggen	0.61
Wintergerste	0.59
Sommergerste	0.67
Hafer	0.68
Triticale	0.69
Mais	0.64
Dinkel	0.77
Erdäpfel	0.51
Zuckerrüben	0.73
Oil pumpkin	0.78
Ackererbse	0.57
Ackerbohne	0.71
Soyabohne	0.93

Q: Brückler et al., 2018. DOI: https://doi.org/10.1515/boku-2017-0018

Interpretation: Im Bundesdurchschnitt ist der bio-Ertrag 64% des Ertrags konventioneller Produktion.

Annahme 7: Agrarpolitische Instrumente – Zahlungen an die LW (nominell) im Szenario „with existing measures (WEM)"

	WEM 2015			WEM 2018		
	2020	2030	2050	2020	2030	2050
CAP 1st pillar						
livestock premia	no	no	no	no	no	no
protein crop premium				no	no	no
regional direct payments	yes	yes	yes	yes	yes	yes
greening (CAP reform 2013)	yes	yes	yes	no	no	no
conditionality				yes	yes	yes
volume direct payments				664.8	664.8	664.8
regional distribution like 2020				yes	yes	yes
CAP 2nd pillar						
volume mio Euro p.a. (EU+AT)	1090	1090	1090	1090	960	960
compensatory payments mio Eur p.a				260	222	222
agri-env. payments total mio Eur p.a.	472	472	472	426		
organic farming sheme mio Eur p.a.	112	112	112	116	99	99
other agri-environmental premia	330	330	330	310	265	265
organic premium grassland Eur/ha	70-225	70-225	70-225	70-225	60-180	60-180
organic premium cropland Eur/ha	230-450	230-450	230-450	230-450	200-400	200-400
organic premium perm. crops Eur/ha	< 700	< 700	< 700	< 700	< 700	< 700
ban of agri-chemicals	60	60	60	60	60	60
UBAG/UBB arable land Euro per ha	15-45	15-45	15-45	15-45		
UBAG/UBB grassland Euro ja ha	15-45	15-45	15-45	15-45		

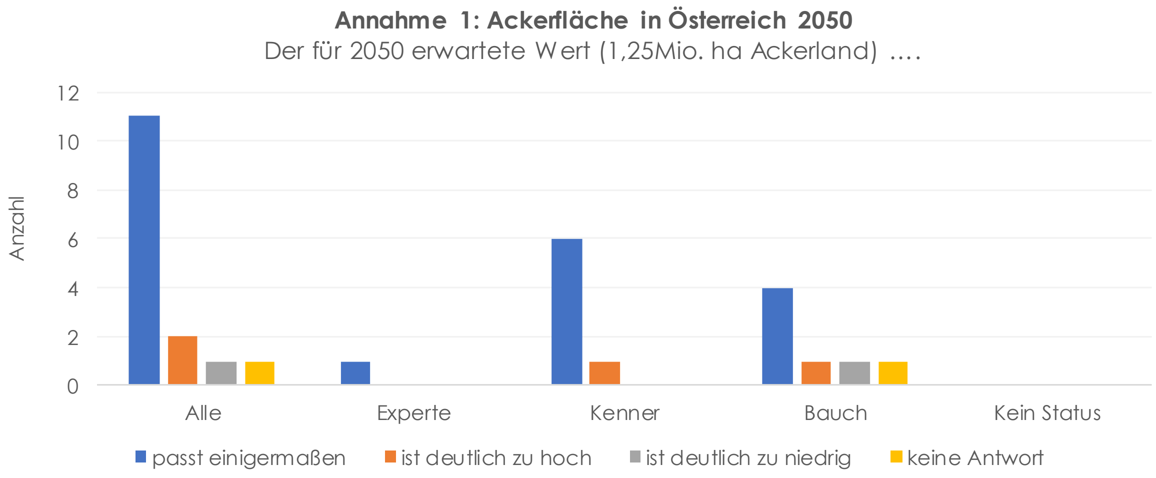
Quelle: Sinabell, et al., 2015 (grau hinterlegt) und eigene Annahmen (hellblau hinterlegt) basierend auf eigene Annahmen und BMNT 2018 (2. Fachdialog GAP nach 2020).

Appendix IV: Survey Results

Annahme 1: Ackerflächen in Österreich 2050

Der für 2050 erwartete Wert (1,25Mio. ha Ackerland) ….

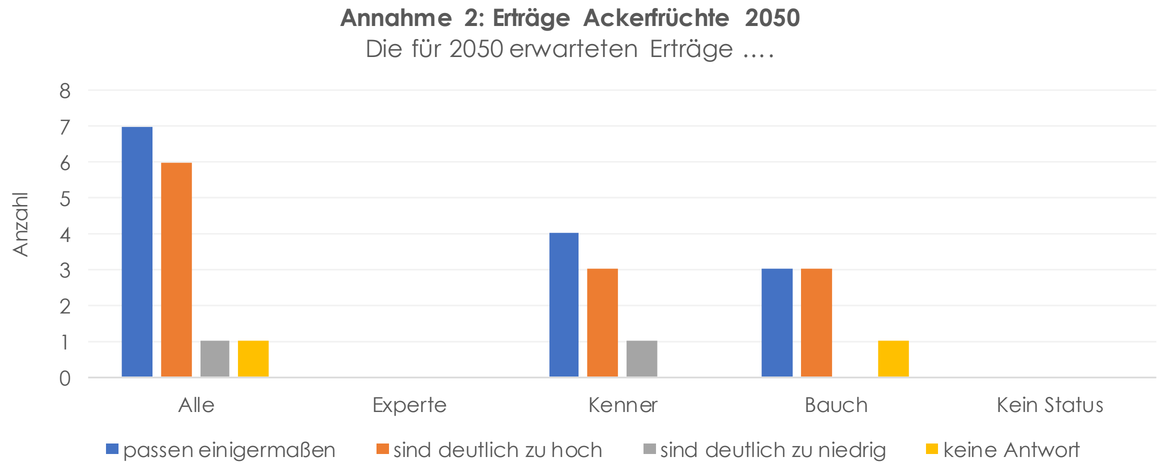
	Alle	Experte	Kenner	Bauch	Kein Status	gewichtet
passt einigermaßen	11	1	6	4	0	19
ist deutlich zu hoch	2	0	1	1	0	3
ist deutlich zu niedrig	1	0	0	1	0	1
keine Antwort	1	0	0	1	0	1
Gesamt	15	1	7	7	0	



Annahme 2: Erwartete Erträge je Hektar in Österreich (dt je ha) 2050

Die für 2050 erwarteten Erträge ….

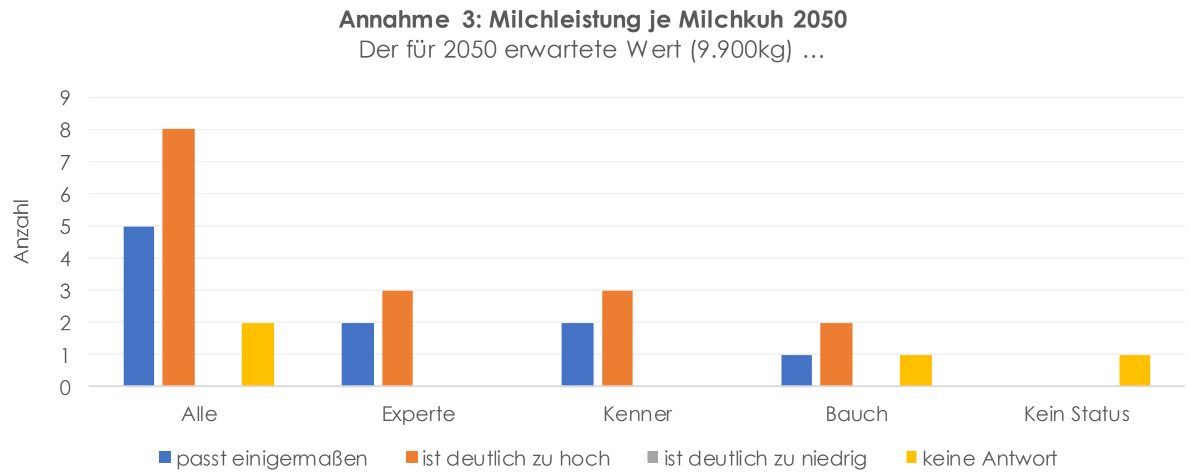
	Alle	Experte	Kenner	Bauch	Kein Status	gewichtet
passen einigermaßen	7	0	4	3	0	11
sind deutlich zu hoch	6	0	3	3	0	9
sind deutlich zu niedrig	1	0	1	0	0	2
keine Antwort	1	0	0	1	0	1
Gesamt	15	0	8	7	0	



Annahme 3: Milchleistung je Milchkuh in Österreich 2050

Der für 2050 erwartete Wert (9.900kg) …

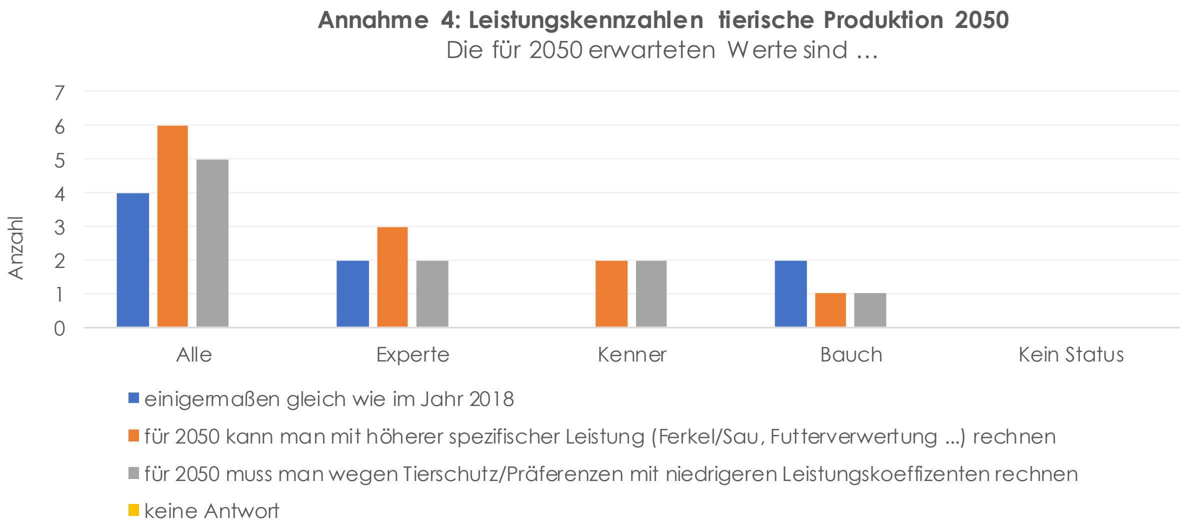
	Alle	Experte	Kenner	Bauch	Kein Status	gewichtet
passt einigermaßen	5	2	2	1	0	11
ist deutlich zu hoch	8	3	3	2	0	17
ist deutlich zu niedrig	0	0	0	0	0	0
keine Antwort	2	0	0	1	1	1
Gesamt	15	5	5	4	1	



Annahme 4: Leistungskennzahlen tierische Produktion in Österreich 2050

Die für 2050 erwarteten Werte sind …

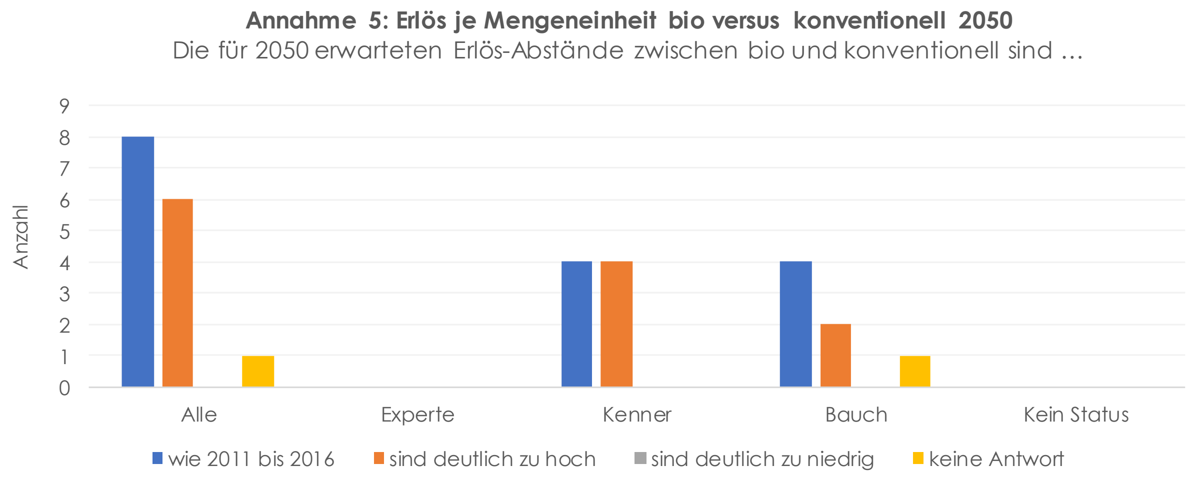
	Alle	Experte	Kenner	Bauch	Kein Status	gewichtet
einigermaßen gleich wie im Jahr 2018	4	2	0	2	0	8
für 2050 kann man mit höherer spezifischer Leistung (Ferkel/Sau, Futterverwertung ...) rechnen	6	3	2	1	0	14
für 2050 muss man wegen Tierschutz/ Präferenzen mit niedrigeren Leistungs-koeffizenten rechnen	5	2	2	1	0	11
keine Antwort	0	0	0	0	0	0
Gesamt	15	7	4	4	0	



Annahme 5: Erlös je Mengeneinheit bio versus konventionell in Österreich 2050

Die für 2050 erwarteten Erlös-Abstände zwischen bio und konventionell sind …

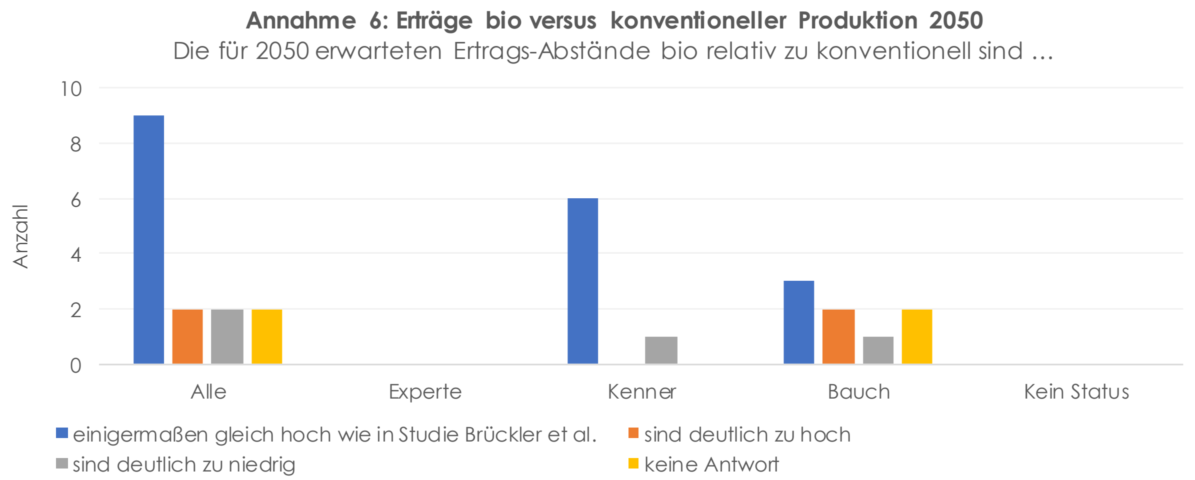
	Alle	Experte	Kenner	Bauch	Kein Status	gewichtet
wie 2011 bis 2016	8	0	4	4	0	12
sind deutlich zu hoch	6	0	4	2	0	10
sind deutlich zu niedrig	0	0	0	0	0	0
keine Antwort	1	0	0	1	0	1
Gesamt	15	0	8	7	0	



Annahme 6: Erträge der Bioproduktion verglichen mit der konventionellen Produktion in Österreich 2050

Die für 2050 erwarteten Ertrags-Abstände bio relativ zu konventionell sind …

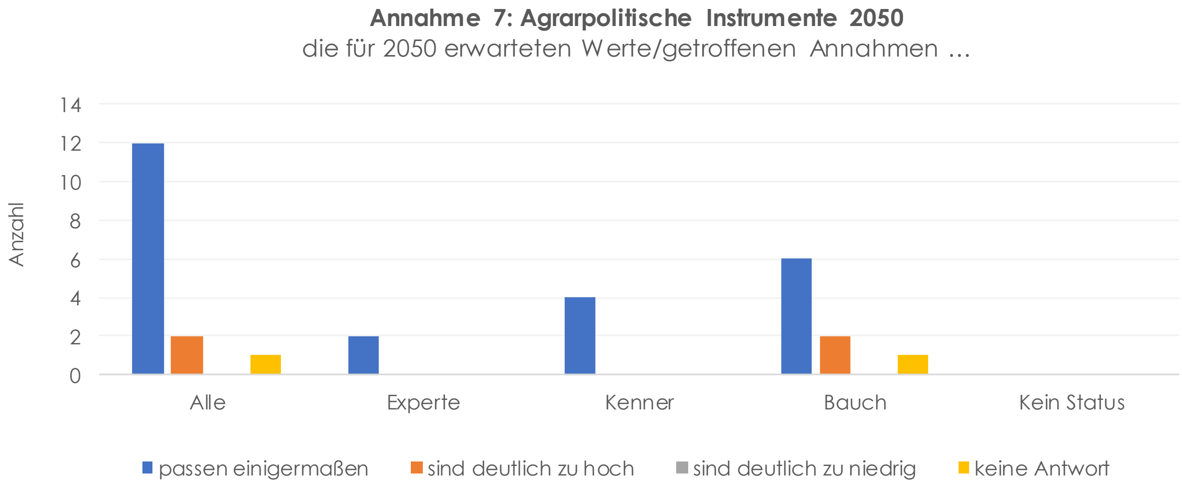
	Alle	Experte	Kenner	Bauch	Kein Status	gewichtet
einigermaßen gleich hoch wie bei Brückler et al.	9	0	6	3	0	15
sind deutlich zu hoch	2	0	0	2	0	2
sind deutlich zu niedrig	2	0	1	1	0	3
keine Antwort	2	0	0	2	0	2
Gesamt	15	0	7	8	0	



Annahme 7: Agrarpolitische Instrumente in Österreich 2050

Die für 2050 erwarteten Werte/getroffenen Annahmen …

	Alle	Experte	Kenner	Bauch	Kein Status	gewichtet
passen einigermaßen	12	2	4	6	0	20
sind deutlich zu hoch	2	0	0	2	0	2
sind deutlich zu niedrig	0	0	0	0	0	0
keine Antwort	1	0	0	1	0	1
Gesamt	15	2	4	9	0	



Appendix V: Survey

Landwirtschaft 2050

Hier geht es um Annahmen für Szenarien in Österreich. Zweck der Untersuchung ist die Quantifizierung von Emissionen aus der Landwirtschaft. Methode der Untersuchung ist das Agrar- und Forst-Sektormodell PASMA. Durchgeführt wird die Studie von WIFO und INWE (BOKU) im Auftrag des Umweltbundesamtes.

Grundlage zur Beantwortung sind Annahmen des Dokuments "Szenarien-Unterlagen.doc". Rückfragen an: franz.sinabell@wifo.ac.at. Sie werden über die Ergebnisse der Studie nach Freigabe durch die Auftraggeber informiert.

Wir sammeln Daten, die einzelnen Personen zuordenbar sind. Wir verarbeiten die Daten, speichern Sie als Unterlage für die Projektabwicklung. Die Projektunterlagen werden unbefristet archiviert. Das vorliegende Formular mit darin enthaltenen Angaben wird mit Projektabschluss gelöscht. Wir treten an die teilnehmenden Personen unter Nutzung persönlicher Angaben wie E-mail und Telefonnummer erneut heran. Solche projekt-bezogene Kontaktaufnahmen sind befristet mit der Laufzeit des Projektes (Ende: Februar 2019).

* Erforderlich

E-Mail-Adresse *

Ihre E-Mail-Adresse

Ich stimme den oben angeführten Konditionen zur Datenverwendung zu

- ◯ Ja
- ◯ Nein

WEITER

Landwirtschaft 2050

Fragen zu den Annahmen der Szenarien

Bitte verwenden Sie das Dokument "Szenarien-Unterlage.docx".

Annahme 1: Ackerfläche in Österreich 2050

- ○ der für 2050 erwartete Wert (1,25 Mio. ha Ackerland) passt einigermaßen
- ○ der für 2050 erwartete Wert (1,25 Mio. ha Ackerland) ist deutlich zu HOCH
- ○ der für 2050 erwartete Wert (1,25 Mio. ha Ackerland) ist deutlich zu NIEDRIG

Annahme 1 Ackerfläche: Expert/inn/en-Status

- ○ ich kenne mich mit der österreichischen Landwirtschaft und dem Ackerbau sehr gut aus
- ○ ich kenne mich in Agrarfragen generell gut aus
- ○ diese Frage kann ich nur "aus dem Bauch" heraus beantworten

Annahme 1 Ackerfläche: meine Kommentare sind:

Meine Antwort

Annahme 2: Erträge Ackerfrüchte 2050

- ◯ die für 2050 erwarteten Erträge passen einigermaßen
- ◯ die für 2050 erwarteten Erträge sind deutlich zu HOCH
- ◯ die für 2050 erwarteten Erträge sind deutlich zu NIEDRIG

Annahme 2 Erträge: Expert/inn/en-Status

- ◯ ich kenne mich mit der österreichischen Landwirtschaft und dem Ackerbau sehr gut aus
- ◯ ich kenne mich in Agrarfragen generell gut aus
- ◯ diese Frage kann ich nur "aus dem Bauch" heraus beantworten

Annahme 2 Erträge: meine Kommentare sind:

Meine Antwort

Annahme 3: Milchleistung je Milchkuh 2050

- ◯ der für 2050 erwartete Wert (9.900 kg) passt einigermaßen
- ◯ der für 2050 erwartete Wert (9.900 kg) ist deutlich zu HOCH
- ◯ der für 2050 erwartete Wert (9.900 kg) ist deutlich zu NIEDRIG

Annahme 3 Milchleistung je Milchkuh: Expert/inn/en-Status

- ◯ ich kenne mich mit der österreichischen Landwirtschaft und der Milchwirtschaft sehr gut aus
- ◯ ich kenne mich in Agrarfragen generell gut aus
- ◯ diese Frage kann ich nur "aus dem Bauch" heraus beantworten

Annahme 3 Milchleistung je Milchkuh: meine Kommentare sind:

Meine Antwort

Annahme 4: Leistungskennzahlen tierische Produktion 2050

- ◯ die für 2050 erwarteten Werte sind einigermaßen gleich wie im Jahr 2018
- ◯ für 2050 kann man mit HÖHERE spezifischer Leistung (Ferkel/Sau, Futterverwertung ...) rechnen
- ◯ die für 2050 muss man wegen Tierschutz/Präferenzen mit NIEDRIGEREN Leistungskoeffizenten rechnen

Annahme 4 Leistungskennzahlen tierische Produktion: Expert/inn/en-Status

- ◯ ich kenne mich mit der österreichischen Landwirtschaft und der Viehwirtschaft sehr gut aus
- ◯ ich kenne mich in Agrarfragen generell gut aus
- ◯ diese Frage kann ich nur "aus dem Bauch" heraus beantworten

Annahme 4 Leistungskennzahlen tierische Produktion: meine Kommentare sind:

Meine Antwort

Annahme 5: Erlös je Mengeneinheit bio versus konventionell 2050

- ○ die für 2050 erwarteten Abstände zwischen bio und konventionell sind so wie 2011 bis 2016
- ○ die für 2050 erwarteten Erlös-Abstände von bio versus konventionell sind deutlich zu HOCH
- ○ die für 2050 erwarteten Erlös-Abstände von bio versus sind deutlich zu NIEDRIG

Annahme 5 Erlöse bio versus konventionell: Expert/inn/en-Status

- ○ ich kenne mich mit der österreichischen Landwirtschaft und der biologischen Landwirtschaft sehr gut aus
- ○ ich kenne mich in Agrarfragen generell gut aus
- ○ diese Frage kann ich nur "aus dem Bauch" heraus beantworten

Annahme 5 Erlöse bio versus konventionell: meine Kommentare sind:

Meine Antwort

Annahme 6: Erträge der Bioproduktion verglichen mit der konventionellen Produktion 2050

- ○ die für 2050 erwarteten Abstände sind einigermaßen gleich hoch wie in der Studie von Brückler et al.
- ○ die für 2050 erwarteten Bio-Erträge relativ zu konventionell sind deutlich zu HOCH
- ○ die für 2050 erwarteten Bio-Erträge relativ zu konventionell sind deutlich zu NIEDRIG

Annahme 6 Erträge bio versus konventionell: Expert/inn/en-Status

- ○ ich kenne mich mit der österreichischen Landwirtschaft und der biologischen Landwirtschaft sehr gut aus
- ○ ich kenne mich in Agrarfragen generell gut aus
- ○ diese Frage kann ich nur "aus dem Bauch" heraus beantworten

Annahme 6 Erträge bio versus konventionell: meine Kommentare sind:

Meine Antwort

Annahme 7: Agrarpolitische Instrumente 2050

- ○ die für 2050 erwarteten Werte/getroffenen Annahmen im HELLBLAUEN Bereich passen einigermaßen
- ○ die für 2050 erwarteten Werte sind deutlich zu HOCH
- ○ die für 2050 erwarteten Werte sind deutlich zu NIEDRIG

Annahme 7 Agrarpolitische Instrumente: Expert/inn/en-Status

- ○ ich kenne mich mit der europäischen und österreichischen Agrarpolitik sehr gut aus
- ○ ich kenne mich in Agrarfragen generell gut aus
- ○ diese Frage kann ich nur "aus dem Bauch" heraus beantworten

Annahme 7 Agrarpolitische Instrumente: meine Kommentare sind:

Meine Antwort

Kopie meiner Antworten an mich senden

ZURÜCK SENDEN

Geben Sie niemals Passwörter über Google Formulare weiter.