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Report

CAP Strategic Plans shadow assessment of environmental needs

Germany

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1. INTRODUCTION

Science is unequivocal on the need to move fast to sustainable farming; the future Common Agricultural Policy (CAP) legislative texts as agreed among the co-legislators in June 2021 recognise that greater environmental and climate ambition is required and have made this an explicit requirement for Member States.

A major feature of the future CAP involves a fundamental change in the delivery approach towards one in which all CAP support (both Pillar 1 and Pillar 2) is focused on performance, delivering results against a set of EU objectives considering national and regionally identified needs. The so-called CAP strategic plans will be at the heart of this new model and could likely, if used at their full potential, help support a transition towards sustainable farming across the EU. However, given the significant flexibilities, which Member States used under the current CAP (for Pillar 1 greening payments) to maintain the status quo instead of increasing environmental performance, some doubts remain as to the final level of environmental ambition in the future CAP strategic plans.

A noticeable difference between the CAP in 2013 and what was recently agreed upon for the future CAP is that, unlike under the current greening regime, Member States will have to justify their intervention logic and implementation choices on the basis of needs and pre-established objectives to achieve. This can potentially boost environmental ambition since the previous lack of justification provided by the Member States regarding their greening implementation choices was indeed identified as one of the main reasons leading to very limited environmental and climate impacts[1].

Another major difference between the current and future CAP and is that the latter is being implemented in the context of the Green Deal, the most ambitious environmental narrative to date that sets out a strategy for the EU with climate and the environment at its centre. As a first step towards achieving this, a suite of new policies, notably the Farm to Fork Strategy and the Biodiversity Strategy, is envisaged. Agriculture and food are key sectors for the delivery of the objectives on the table and the CAP is the most important EU policy mechanism to deliver sweeping agricultural change, with the capacity to significantly impact agricultural practices. Even if in the legislative texts as agreed among the co-legislators the link made between the Green Deal objectives and the CAP strategic plans remain

[1] https://ieep.eu/publications/cap-greening-evaluation-published

relatively weak and not legally binding, these plans can still be harnessed as an effective mechanism to meet them.

It remains unclear exactly how these evaluations of needs will guide Member States' intervention logics since they are still drafting their plans[2] and the European Commission has not explicitly stated how it will evaluate these national assessments and use them for its own approval process in 2021 and 2022.

Focus of the report

This report aims at 1) providing German and EU stakeholders and decision-makers with evidence-based material to inform Germany's CAP strategic plan intervention logic, and 2) providing a reference point for the evaluation of the German government's own needs assessment in their CAP strategic plan. Similar reports have been drafted for other EU Member States, including France, Spain and Hungary.

This report begins with an evidence-based evaluation of the state of the environment and climate in Germany. This evaluation looks at past trends, future outlook, and relevant policy objectives/targets in five key areas: climate, biodiversity, water, soil, and air quality. Then, the report introduces a list of needs in the farming sector based on that evaluation. The report then moves to priority actions, followed by suggestions for intervention measures and insights into harmful measures.

Finally, the report outlines the Green Deal objectives that relate to the needs and actions identified in the report.

[2] See annex 1

2. STATE OF THE ENVIRONMENT

2.1 Climate

2.1.1 Mitigation

Past trends and outlook

The main sources of emissions in German agriculture are methane from livestock production, nitrous oxide from fertiliser use, and losses of carbon from stocks in drained peatlands. The first two are accounted for in the agriculture inventory and the latter under the Land Use, Land Use Change and Forestry (LULUCF) sector. For agricultural emissions, the main share of emissions comes from methane (51.2% in 2018) associated with livestock (enteric fermentation) and their manures, while nitrous oxide (N_2O) emissions from fertiliser use accounted for 44.2% of total emissions in 2018 (UBA, 2020). Emissions from agricultural soils which are accounted for under the LULUCF sector are high in Germany since 40% of the Utilized Agricultural Area (UAA) is drained land, linked to arable, field crop production and intensively farmed pastures (BMEL, 2019a). Farming on drained peatland soils in Germany is responsible for 37% of all German agricultural emissions (GMC & DVL, 2020). Emissions from feed imports are not included in the national inventory, but given the size of German livestock sectors, these are also significant.

Total GHG emissions emitted by the German agriculture sector[3] have decreased between 1990 and 2019 by 19.2% (Thuenen, 2021). Between 2005 and 2015 there was an increase in emissions, followed by another decrease so that the 2019 levels are only slightly lower than in 2005 (Thuenen, 2021). Reductions since 1990 have largely resulted from the decline in animal numbers in east Germany after the country's reunification. Increased nitrogen fertilization (mainly digestate) then led to an increase in nitrous oxide emissions from the mid-2000s, while the use of manure in biogas plants contributed to a reduction in methane emissions (Thuenen, 2021). These in turn are linked to the funding for biogas under renewable energy policies, and later, the abolition of milk quotas.

Relevant policy objectives/targets

By 2030, Germany aims to reduce greenhouse gas emissions by at least 55% across all sectors. Under the Effort Sharing Regulation, Germany's allocated

[3] This does not include CO_2 or CH_4 emissions from drained peatlands but does include N20 emissions from cultivated peatlands.

emission reduction target is set at minus 38 per cent by 2030 (compared to 2005 levels). Particularly for ammonia and methane emissions, efforts need to be strengthened to meet the reduction commitments for 2030, since a high risk of non-compliance has been projected (EC, 2020). The Climate Protection Programme 2030 sets the target to reduce annual emissions in and LULUCF by 14 mtCO_2eq by 2030 compared to 2014 (a reduction of 19.7%: from 72 mtCO_2eq in 2014 to 58mt CO_2eq in 2030) (BMEL, n.d.). This target covers both agriculture and LULUCF together and is not split by the federal states *a priori*, but rather through the governance framework where regular conferences between the federal agricultural ministry and the 16 federal state ministers.

2.1.2 Adaptation

Past trends and outlook

In Germany, a significant part of the yield losses in the past 15 years has occurred due to extreme weather events, in particular droughts. About one-fifth of the damage was caused by hail and about one-sixth by storms, heavy rain or flooding (BLE, 2021a).

The years 2018 and 2019 were the driest since weather records began. Also, in 2020 Germany had exceptionally little rainfall in large parts of the country. The experience of these past years has shown the impact on reduced quality and quantity of harvested products. The yield losses are already threatening the livelihoods of farmers in certain places (BMEL, 2020a). Farmers have especially been affected in areas hit by droughts (e.g., north-east Germany, such as Brandenburg, Saxony, or parts of Bavaria) and by hail events and frosts (for example, vineyards and orchards in Rheinland-Pfalz, Baden-Württemberg), which led to significant crop shortfalls (UBA, 2021a).

Further negative effects of temperature change are expected, although to a varying extent for different types of agriculture. The average annual temperatures increase is projected to lead to vegetation periods that are about three weeks longer by 2050 (BLE, 2021b). For arable agriculture, a yield increase could occur for certain crops (e.g., maize and wheat), while a yield decrease is expected for winter wheat, for example. Increased heat stress and disease risks are projected to impact the livestock sector (EC, 2020). The damage linked to diseases and pests could be increased by mild winters, which could lead to earlier pest infestations or several generations of pests per season.

Relevant policy objectives/targets

The German National Arable Farming Strategy 2035 sets out several qualitative targets. These include the adaptation of crop growing systems, the extension of irrigation capacity and the expansion of monitoring programs (BMEL, 2020b). The German Adaptation Action Plan does not set specific objectives for agriculture, only key actions for agriculture: 1) Improvements of monitoring, data providing and information exchange; 2) further education measures and knowledge transfer for agricultural consultants, soil users; 3) research on yield development and effects of different adaptation practices; 4) integration of adaptation into rural development programmes; and 5) protection of peatlands (BMU, 2011).

Table 1: State of climate overview table

CLIMATE * **	Past trends and outlook		Prospects of meeting policy objectives/targets under the assumption of unchanged policy	
	Past trends (10-15 years)	Outlook to 2030	2025	2030
Mitigation				
Adaptation				

** Evaluation made by the author from the information above*
*** Colour code: red = deteriorating trends/not on track; yellow = trends show a mixed picture/ partially on track; green: improving trends/on track.*

2.2 Biodiversity

2.2.1 Common species farmland bird index and wild pollinators

Past trends and outlook

The population status of farmland birds continues to be of concern. **From 2000 to 2016 the farmland bird index in Germany decreased from 100 to 84.4**, although there was a gradual increase since its lowest level in 2014 of below 80 (Eurostat, 2021 a). Certain species show particularly worrying trends - the populations of Grey Partridge (a non-migratory farmland bird) and Northern Lapwing declined by nearly 90% between 1992 and 2016. The population decline of Black-tailed Godwit, Common Snipe and Whinchat that all breed in wet meadows and pastures was similar. Formerly common farmland birds are now so

rare, that abundance declines also have led to a contraction in their range (Gerlach et al., 2019).

A study from 2017 (Hallmann et al., 2017) documents a dramatic **decline in average airborne insect biomass of 76% (up to 82% in midsummer) over the past 27 years** for protected nature areas in Germany. The authors posited that intensive agriculture was likely to be negatively affecting populations of insects in German nature reserves. A subsequent study of insects in grasslands in Germany showed a 67%, 78% and 34% decline in biomass, abundance and number of species respectively, in less than one decade (2008 to 2017) (Seibold et al., 2019). The declines were strongest in landscapes where agricultural land cover is high. The latest German red list of bees published in February 2011, **indicates that nearly 50% of the 557 assessed bee species are endangered and over 40% of species show a long-term negative population trend**.

Relevant policy objectives/targets

There are no quantified national targets specifically for farmland birds in Germany. However, the National Biodiversity Strategy aims to promote and maintain common biodiversity and landscape quality, including agricultural land, to enhance and protect bird populations.

Regarding wild pollinators, there are no specific targets at the national level, however, there has been significant progress in the last few years to boost insect conservation in Germany. In 2019 the German Cabinet adopted the Action Programme for Insect Conservation, the most comprehensive package of measures for the protection of insects and their diversity in Germany so far. This Action Programme sets out several key measures, namely the conservation and restoration of habitats with particular relevance for insects, additional funding of 100 million euros for insect conservation, the mitigation of pressures such as pesticides and light pollution, among others. In June 2018, BMU published a call for project proposals aimed at the conservation of insects, their diversity and habitats. An insect protection law (Insektenschutzgesetz) and amendments to the Plant Protection application Ordinance were published in June 2021. The Insect protection act ("Insektenschutzgesetz") describes legislative changes of the Federal Nature Conservation Act (19/28182) and is not an individual law. It includes of most relevance to agriculture: 1) Increase the special framework plan for insect protection in the Joint Task for Agricultural Structure and Coastal Protection (GAK) by 65 million euros to 150 million euros/year to compensate for management restrictions in agriculture. ; 2) Encouragement for federal states to offer further voluntary agreements to promote biodiversity and sustainable management practices ; 3) limitation of pesticides on species-rich grassland, grassland orchards and dry stone walls; 4) no plant protection products within

10ms of waterbodies (or 5m if greened); 5) glyphosate reduction until 2023 and ban after 2024.[4]

At the L*ä*nder level, a particularly notable example is Bavaria, which in 2019 introduced a suite of laws aiming at tackling pollinator decline, covering, inter alia, riparian buffer strips, a new target of 30% organic farmland by 2030, expansion of the biotope network to at least 15% of open land are by 2030, various rules to protect permanent grasslands such as late mowing on 10% of grassland area, a blanket ban on herbicides and prohibition of use of all pesticides in certain areas such as nature reserves (Bavarian State Ministry for the Environment and Consumer Protection, n.d.).

2.2.2 Protected species and habitats

Past trends and outlook

The most recent state of nature report for Germany (BfN and BMU, 2020) presents an increasingly negative trend in the conservation status of habitat types and species protected by the EU Nature Directives, most notably those associated with agricultural landscapes. Of the Annex I habitat assessments, 30% are in favourable conservation status, 32% are unfavourable-inadequate and 37% are in unfavourable-bad conservation status. Of the assessments of the species of Community Importance protected by the Habitats Directive, 25% are in favourable conservation status, while 30% are in unfavourable-inadequate and 33% in unfavourable-bad. Overall, 50% of the species assessments and 54% of habitat assessments show a stable, improved or improving conservation trend, while 34% of species and 41% of habitat assessments have a deteriorating trend. (Niggli et al., 2019; BMEL, 2019b).

Evaluation reports on the implementation and impacts of the CAP 2014-2020 in Germany (UBA, 2019; Schoof et al., 2019a) show that the semi-natural grassland area is rapidly decreasing in Germany due to intensification (Schoof et al., 2019 b; BfN, 2014). Pressures driving the losses have included: 1) conversion from grassland to arable for biogas production, stimulated by renewable energy policy; 2) intensified fertilisation, more frequent mowing and increased silage maize production to support more intensified dairy production; 3) structural change where remaining farms increase area under cultivation and increase crop cultures instead of grassland use for higher revenues (Schoof et al., 2019 b; BfN, 2014). The area of High Nature Value (HNV) farmland decreased from 13.1% in 2009 to 11.4% in 2017. The decline took place predominantly on currently used farmland

[4] https://www.bundesregierung.de/breg-de/aktuelles/insekten-schuetzen-1852558

(grassland, cropland and fallow land) with moderate natural value, while the proportion of structurally rich landscape elements has declined to a much lesser extent and has not declined since 2013 (Benzler and Fuchs, 2018). Overall, different regional trends can be observed. In some federal states, such as Brandenburg, Mecklenburg-Western Pomerania, Lower Saxony and Saarland, the HNV value continues to fall, while in others it remains stable (such as in Thuringia) or even increases (such as in Bavaria and Hesse) (LIKI, 2021).[5]

In relation to trends on genetic diversity, the national indicator report for the national Strategy on Biodiversity (German Government, 2019) shows that the share of endangered native farm species (like horses, cattle, sheep and goats) was high, with around 70%. However, the share of particularly endangered species continuously declines. The assessment includes in total 77 species.

Relevant policy objectives/targets

The German national Biodiversity Strategy contains multiple targets in line with the EU Birds and Habitats Directives and Biodiversity Strategy 2020. The new national Biodiversity Strategy for the post-2020 period is currently being developed. The most relevant targets at the national level for protected species and habitats related to agriculture are:

- By 2020, biodiversity in agricultural ecosystems has increased significantly. By 2015, the populations of species that are typical for agricultural landscapes are secured and improving.

- By 2015, the area accounted for by agricultural biotopes of high nature conservation value (high-grade pasture, meadow orchards) has been increased by at least 10% compared with 2005. By 2010 the proportion of near-natural landscapes features has increased by 5%.

- By 2010, the decline in endangered habitat types has been halted. Thereafter, those biotope types which are under threat of complete destruction or severely endangered according to the Red Lists will increase again in terms of their area and number, degradations have been halted, and regeneration has begun.

- Exceedance of critical loads for nitrogen inputs (eutrophication) onto nitrogen-sensitive ecosystems will be reduced by 35% between 2005 and

[5] There is currently an infringement procedure against Germany for deterioration of grasslands (see https://ec.europa.eu/commission/presscorner/detail/en/inf_19_4251), and in 2020 NABU filed a complaint over the loss of the Grey Partridge (https://www.nabu.de/news/2020/10/28749.html).

2030. The target for 2028 to 2032 is to achieve a five-year average reduction in nitrogen surplus on agricultural land in the total N balance to 70 kilograms per hectare per annum.

- Regionally adapted crop varieties threatened by genetic erosion, so-called farmyard and field varieties, and endangered livestock species have been safeguarded by in-situ or on-farm and ex-situ conservation.

14 of the 16 German Länder have developed their own biodiversity action programmes. Progress on implementation is not known.

Table 2: **State of agricultural biodiversity overview table**

BIODIVERSITY * **	Past trends and outlook		Prospects of meeting policy objectives/targets under the assumption of unchanged policy	
	Past trends (10-15 years)	Outlook to 2030	2025	2030
Common species and pollinators				
EU Protected species and habitats				

** Evaluation made by the author from the information above*
*** Colour code: red = deteriorating trends/not on track; yellow = trends show a mixed picture/ partially on track; green: improving trends/on track.*

2.3 Water

2.3.1 Water quality

Past trends and outlook

The most significant impacts of agriculture on water in Germany are eutrophication of water bodies, pollutant inputs, in particular pesticides, and habitat alterations. Diffuse agriculture pollution is the most significant pressure on both surface and groundwater bodies.

According to the reported data under the WFD available on the EEA WISE[6] portal, 89% of surface water bodies fail good ecological status, and all surface waters fail good chemical status. 69% of surface water bodies are affected by significant diffuse pollution from agriculture. Nitrate levels in surface water are driving WFD failures in approximately 75% of surface waters, over double the EU average, according to EEA WISE data (EEA, n.d.).

Agriculture also impacts surface water bodies by physically altering the channel, bed and riparian area of the water body (54% of surface water bodies) and hydrologically altering the water bodies (at least 12% of surface water bodies).

Diffuse pollution and physical alterations are widespread throughout Germany, with the Elbe river basin as well as the Rhine and Weser reporting most water bodies with these pressures. Abstraction for irrigation purposes is reported most often in the Elbe river basins, in particular the Havel sub-basin, as well as the Ems, the Lower Rhine and Rhine delta. Transversal barriers (e.g., dams) and hydrological alterations due to agriculture are mostly reported in the Elbe river basin as well as the Oder.

According to CAPRI[7], high N surpluses (>60 kg/ha/year) are found all across Germany – with the highest surpluses found on areas of intensive arable production in the lowlands of northern Germany as well as regions of intensive livestock production of southern and south-west Germany.

The "good status" of groundwater and surface water required by the Water Framework Directive has not yet been achieved across the board in Germany (UBA, 2019). The deadline for the implementation of the Directive is in 2027. Pesticide pollution from agriculture is mostly diffused. Although many substances that are very harmful to water are no longer used, atrazine and its degradation product desethylatrazine, for example, still exceed the limit of 0.1 micrograms per litre in groundwater.

According to the Nitrates Directive, this unsatisfactory status is an obligation for the federal government to take more effective measures to achieve the desired goal (UBA, 2019). Germany has strengthened efforts to reduce and prevent water pollution by nitrates from agriculture, with the last update of the national fertiliser legislation published on 1 May 2020 (EC, 2020).

[7] Reported in EEA (2021) Water and agriculture: towards sustainable solutions.

Relevant policy objectives/targets

In October 2013, the European Commission initiated warning procedures for inadequate implementation of the EU Nitrates Directive and in October 2016 filed a complaint with the European Court of Justice (ECJ). The ECJ found that Germany had breached its obligations. The revision of the 2017 fertiliser legislation has become necessary, which was then re-published in May 2020 (UBA, 2019). The government's goal is to reduce the nitrogen surplus in the overall balance in the years 2028 to 2032 to an average of 70 kilograms per hectare of agricultural land. If the current trend continues, however, the target will be missed (UBA, 2021e).

Key political documents such as the National Sustainability Strategy or the Programme of Measures for Climate Protection mention 70 kg N/ha as a target value for the year 2030. However, there are no sector-specific reduction obligations e.g for agriculture at federal and Länder level that would enable the federal targets to be met.

2.3.2 Water quantity

Past trends and outlook

Germany generally is a water-rich country. At the same time, water withdrawals for agricultural irrigation in Germany so far have been low at around 0.3 billion m^3 (UBA, 2020).

As a share of the total water withdrawal volume, agriculture only is responsible for approximately 1.3%. A total of 451,800 hectares of agricultural land were irrigated in Germany in 2015. More than half is located in the north-eastern Lower Saxony. Intensive irrigation regions are also located in other federal states, but with significantly smaller irrigated areas (>20,000 ha North Rhine-Westphalia, Bavaria, Brandenburg, Baden-Württemberg, Hesse, Mecklenburg-Western Pomerania and Rhineland-Palatinate). While water abstraction for agriculture is not a particularly significant issue at the national level, irrigation is very present in some areas of Germany, such as Lower Saxony, and is reported as significant pressure on the majority of water bodies in certain catchments.

Also in the coming years, water stress is generally not to be expected across the board, while negative water balances could occur in some areas in Germany[8] (EC, 2020). The expansion of additional irrigation capacities is planned as a response

[8] For example, the need for irrigation for wheat will increase sharply by 2040, especially in north-eastern Lower Saxony, Mecklenburg-Western Pomerania and Brandenburg, as well as in Rhineland-Palatinate (Schimmelpfennig et al. 2018)

to increasing temperatures and their effect on agricultural production. The need for irrigation increase will vary from region to region and is dependent on the type of agricultural production. For example, fruit and vegetable production has been irrigated more than many arable crops. Further, increased irrigation, even where efficient, should not compromise the good quantitative status of water bodies.

Relevant policy objectives/targets

In the future, more users than today will compete for a resource that is becoming scarcer which raises the question of fair distribution, while all sectors will have to conserve and efficiently use water resources. For the German agriculture sector water reuse is currently being discussed. This is already common practice in many southern European countries (UBA, 2020).

Table 3: State of water overview table

WATER * **	Past trends and outlook		Prospects of meeting policy objectives/targets under the assumption of unchanged policy	
	Past trends (10-15 years)	Outlook to 2030	2025	2030
Water quantity				
Water quality				

** Evaluation made by the author from the information above*
*** Colour code: red = deteriorating trends/not on track; yellow = trends show a mixed picture/ partially on track; green: improving trends/on track.*

2.4 Soil

2.4.1 Soil Organic Matter (SOM)

Past trends and outlook

A total of approximately 2.5 billion tonnes of carbon are stored in the upper metre of agricultural soils in Germany, which is more than twice as much as is currently stored in all trees (including deadwood) in the country's forests (Jacobs et al., 2018).

In the past 10 years, the total organic carbon content in mineral soils in arable land in Germany as well as the mean organic content in kg has remained relatively stable (DG AGRI, 2018). However, intensive cropping can lead to a decrease in soil organic carbon stocks (BMEL, 2019c) and future projections indicate reductions in SOM on arable land up to 2030.

Importantly, drained and cultivated peatlands are affected by a huge loss of soil organic carbon. In Germany, about 90 percent of peatland soils are used for agriculture and forestry. Besides the loss of SOM, drainage also impacts surface water bodies through discharges of excess flows, sediments and pollutants from farmed land.

The outlook into the future projects a decline. The first "Soil Condition Survey Agriculture" published by the Thünen Institute in 2018 shows that an average of 0.21 tonnes of organic carbon per hectare of arable land and year could be lost in the topsoil in Germany over the next 10 years if management practices remain unchanged.

Relevant policy objectives/targets

The national Arable Farming Strategy for 2035 sets the target for a stable humus balance to be preserved and safeguarded through the mixture and incorporation of organic residual substances. The goal is to achieve a humus balance in all arable land by 2030 (BMEL, 2020b). The amended Climate Change Act sets, for the first time, binding targets for the LULUCF sector, which also include a target for the conservation and expansion of natural sinks such as forests and peatlands, for example through rewetting. According to this, by 2030 emissions are to be reduced by 5 million tonnes of CO_2 equivalent annually through rewetting and by 20 million tonnes of CO_2 through the strengthening of forest sinks (BMU, 2021).

Bavaria, for example, introduced a **Climate Protection Programme** in 2008 (KliP, 2050), which was relaunched in 2015. The KliP 2050 contains a package of eleven key measures, including the promotion of natural CO_2 storage, such as through rewetting of peatland bogs throughout Bavaria (BSfUuV, n. d.).

2.4.2 Loss of soil biodiversity

Past trends and outlook

Soil organisms have been researched relatively little so far. The available documentation via the nationwide Red Lists of Animals, Plants and Fungi,

however, shows a negative trend.[9] Especially in the area of soil organisms, the risk of species disappearing before they have even been discovered and described is high. For plants, the Red List of Ferns and Flowering Plants of Germany also shows that the threat has further increased.[10] Particularly endangered are species that are specialised in agricultural land (BfN, 2021).

Relevant policy objectives/targets

In the national Biodiversity Strategy from 2007, the German government formulated the goal of "significantly increasing biodiversity in agricultural ecosystems by 2015" (BMU, 2007, p. 47). However, the strategy has so far given insufficient consideration to soil biology. In the fields of action, only goals are set that indirectly protect soil organisms; for example, the reduction of substance inputs. However, the objective of nature conservation and species protection as well as the planned extensification of agriculture and forestry will also contribute to the protection of soil organisms (UBA, 2021d).

The national Arable Farming Strategy for 2035 sets the target to increase the range of crops to at least five different ones for each arable farm by 2030. This includes catch crops, under-sowing and mixed cultivation. Crop rotation and higher crop diversity are expected to have a positive effect on soil biodiversity. Current practices vary markedly from farm to farm. Some farms only grow two or three crops while others are already growing several (BMEL, 2020b).

2.4.3 Soil erosion

Past trends and outlook

In Germany, the risk of soil erosion both by water and by wind is still limited compared to other Member States. In 2016, the share of agricultural land at risk of soil erosion by water was 1.4%, well below the EU-27 average of 7% (EC, 2020). The cultivation of row crops in combination with a low proportion of grassland leads to higher erosion risk in sloping areas that are intensively farmed.

Erosion from wind is mostly relevant for the lowlands in the northern part of Germany. Especially the sandy and peaty soils in these regions have a medium to

[9] 37 % of earthworm species, 22 % of isopod species, 24 % of the millipede species, 7 % of the centipede species, 35 % of the ground beetle species and 25 % of the large fungi are listed as endangered.

[10] Also for vascular plants that are anchored in the soil by their roots or whose seeds survive in the soil, the Red List of Ferns and Flowering Plants of Germany shows that the threat to their diversity has further increased: 28% of the species are endangered, 2% (65 species) have already disappeared completely

very high erodibility across the board (BGR, 2014). Southern Germany as well as the low mountain ranges are more commonly affected by erosion from water. For soil erosion from water, heavy precipitation is the key triggering factor.

For both erosion by water and wind, trends in Germany point towards an increasing occurrence. This is due to ever larger field and farm sizes[11], a lack of erosion protection (e.g., no soil cover in winter) and a rise in extreme weather events such as prolonged dry periods or heavy rainfall (BMU, 2020). Particularly for the northeast and west of Germany an increase in precipitation intensity and therefore a higher risk of water erosion for the period 2011 to 2040 is expected (UBA, 2020).

Table 4: State of soil overview table

SOIL * **	Past trends and outlook		Prospects of meeting policy objectives/targets under the assumption of unchanged policy	
	Past trends (10-15 years)	Outlook to 2030	2025	2030
Soil organic matter				
Soil biodiversity				
Soil erosion				

** Evaluation made by the author from the information above*
*** Colour code: red = deteriorating trends/not on track; yellow = trends show a mixed picture/ partially on track; green: improving trends/on track*

2.5 Air

Past trends and outlook

Germany continued to exceed the ammonia (NH_3) emission ceiling in 2017 in the context of the National Emission reduction Commitments Directive (NEC Directive) and was the largest NH_3 emitter in the EU (EEA, 2019). Around 95

[11] In Germany, the number of farms with less than 100 hectares of UAA is decreasing (between 2010 and 2020: -18%), while the number of farms with 100 hectares is increasing (between 2010 and 2020: +12%). Farms with more than 100 hectares manage 60 percent of the UAA in Germany, whereby there are very large regional differences. Overall, the average farm size in the north-east of Germany is up to 270 ha, far above the sizes in the rest of Germany (35-70 ha).

percent of ammonia emissions in Germany come from agriculture, mainly from livestock farming (manure and slurry management) with about 50 percent stemming from cattle farming and 20 percent from intensive rearing of pigs (UBA, 2014). Although to a lesser extent, mineral fertilisers also make a significant contribution (BMEL, 2020b).

Total direct PM2.5 emissions in Germany fell by about 25 percent between 2005 and 2016, however, PM2.5 emissions from agriculture have increased slightly since then (BMU, 2019). Secondary formation of PM2.5 from NH_3 is the main cause of these emissions from agriculture in Germany.

Relevant policy objectives/targets

The NEC Directive requires Member States to produce and update national air pollution control programmes (NAPCP) specifying measures that will contribute effectively to the achievement of the air quality objectives. In 2019, Germany prepared its first NAPCP. Germany has committed itself to reduce ammonia emissions by 29 percent for 2030 onwards compared to 2005, and for PM2.5 - by 43 percent. There is currently no legislation, which specifically addresses methane (CH_4) emissions and thus a reduction target in Germany and the EU.

Table 5: State of air overview table

AIR * **	Past trends and outlook		Prospects of meeting policy objectives/targets under the assumption of unchanged policy	
	Past trends (10-15 years)	Outlook to 2030	2025	2030
Ammonia concentration				

** Evaluation made by the author from the information above*
*** Colour code: red = deteriorating trends/not on track; yellow = trends show a mixed picture/ partially on track; green: improving trends/on track.*

3. SUMMARY OF THE NEEDS PER ISSUE: CLIMATE, BIODIVERSITY, WATER, SOIL

3.1 Climate

Mitigation: There is a need for further reduction of GHG emissions from agriculture in Germany, particularly by reducing methane emissions, nitrous oxide emissions and CO_2 emissions from drained peatlands.

Adaptation: There is a need to adapt agriculture to projected extreme weather events, in particular increased risks of droughts, flash floods, hail and wind storms and pest/disease occurrence. Water efficiency in farming and flood prevention and protection should be scaled up in affected regions. Regional differences need to be taken into account. The following specific needs occur for the German agricultural sector:

- Crop production systems need to become more resilient and sustainable.
- In order to maintain agricultural production, agriculture and horticulture irrigation needs will have to be addressed, while avoiding conflicts with other water uses.
- Reduce farm animal suffering from increased heat stress - considering animal welfare, animal health and climate protection in a holistic manner.
- Reduce risk of soil erosion due to increased rainfall erosivity and increasing field sizes, where erosion-prone crops are grown on sloping land in areas with increasing occurrence of intense rainfall events.

3.2 Biodiversity

Protected species & habitats: In order to halt the ongoing biodiversity loss associated with agricultural landscapes and current farming practices there is a need to:

- Increase landscape diversity through appropriate breeding and feeding habitat for relevant species (e.g., landscape features);
- Reduce pesticide use;
- Reduce nitrogen critical loads;

- Halt the widespread deterioration of protected species-rich grassland habitats in Natura 2000 sites (with habitats showing both negative trend and poor conservation status), due to unsustainable agricultural practices inside nature protection areas.

Farmland birds: To improve farmland bird trends conservation policies in Germany should aim at halting the declines in ground-nesting, often insectivorous, farmland birds and need to consider species adaptation to environmental and climate change, e.g., in better-protected area connectivity and management (Kamp et al., 2021), as well as by improving habitat quality in agricultural landscapes.

Wild pollinators: The main focus needs to be on implementation i.e., of the binding requirements under the insect protection act. Key needs important for wild pollinators conservation in agricultural landscapes are:

- Protection and restoration of insect habitats in order to provide breeding areas for pollinators (these can also provide co-benefits for other species, as above);
- Reductions in fertilizer use;
- More guidance on environmentally and ecologically compatible application of pesticides and reductions in deposition of pesticides and other harmful substances in insect habitats, mitigation of light pollution.

3.3 Water

Water quantity: According to the climate forecast calculations of the German Meteorological Service, the next five years will be dry (BMEL, 2020) which results in a need to adapt to a negative water balance, which is expected for some regions. Consequently, there is a need to:

- Efficiently use future water resources for irrigation to avoid regional conflicts with the public drinking water supply;
- Avoid over-abstraction and maintain good quantitative status of water bodies.

Water quality: Nitrate surpluses and pesticide pollution remain key pressures for water bodies in Germany.

Efforts need to be increased to reduce the pressures on water bodies from nitrogen and phosphorous inputs as well as from pesticide contamination.

3.4 Soil

Soil biodiversity: The diversity of soil life in Germany is primarily threatened by intensive forms of agriculture (BMEL, 2020). At the same time, the diversity and vulnerability of soil life and biodiversity are not yet fully explored. The following needs can be derived from current knowledge:

- Reduce the use of agrochemicals (pesticides and synthetic fertilisers)
- Reduce soil compaction, especially subsoil compaction which leads to loss of soil structure and soil health, and thus loss of soil biodiversity

Loss of soil organic matter: While the mean SOC content in arable land has been relatively stable over the last years, the use of peatland for agriculture leads to a significant loss of SOC. In addition, there is a potential to increase carbon sequestration through improved soil management. The needs are therefore to:

- Protect of carbon-rich soils through rewetting and restoration of peatlands and wetlands;
- Build up soil organic matter on mineral soils and protection of permanent grasslands.

Soil erosion: There is a need to reduce water and wind erosion in Germany, with a particular focus on certain regions which are at high risk through:

- Promotion of soil conservation practices;
- Protection of permanent grassland;
- Increasing the presence of landscape features.

Erosion by water remains an issue mainly in upland regions such as in Bavaria, Rheinland-Pfalz and Saarland, while erosion from wind is more predominant in the lowlands and coastal areas in the northern part of the country (EC, 2020).

3.5 Air

Air pollution: There is a need to reduce ammonia emissions in the livestock sector (especially cattle, but also pigs), and reduce emissions from nitrogen fertilisers.

Table 6: Summary of the information from Sections 2 and 3 on the past trends and outlook and associated needs for each environmental issue

Theme	Past trends and outlook	Policy objectives/targets	Needs
CLIMATE			
Mitigation	• Methane from livestock, nitrous oxide from fertiliser use, and losses of carbon from stocks in drained peatlands are key sources • GHG emissions have decreased between 1990 and 2019 by 19.2%, largely due to decrease in animal numbers after reunification; 2019 emission levels are comparable to 2005 levels • Further decrease is expected due to efficiency improvements; but peatland drainage remains a very problematic and difficult to address issue without significant regional impacts on the type of production practiced	The Climate Protection Programme 2030 sets the target to reduce annual emissions in agriculture by 14 $mtCO_2eq$ by 2030, a reduction of 19.7% from 72$mtCO_2eq$ in 2014	Further reduction of GHG emissions from agriculture, particularly by reducing methane emissions, nitrous oxide emissions and emissions from drained peatlands.
Adaptation	• Significant part of the yield losses in the past 15 years have occurred due extreme weather events, in particular droughts • Further negative effects are expected through droughts, other extreme events, on arable sector and livestock sector (e.g., heat stress and disease risks) • Increased risk of pests and diseases in arable sector	• The German National Arable Farming Strategy 2035 sets out several qualitative targets include the adaptation of crop growing systems, the extension of irrigation capacity and the expansion of monitoring programs. • The German Adaptation Action Plan (2011) includes key actions for agriculture e.g., further education measures and knowledge transfer on yield development and effects of different adaptation practices.	• More resilient and sustainable crop production systems • Irrigation needs will have to be addressed, while avoiding conflicts with other water uses • Reduce farm animal suffering from increased heat stress • Reduce risk of soil erosion

BIODIVERSITY			
Protected species and habitats	• Increasingly negative trend in the conservation status of habitat types and species protected by the EU Nature Directives, most notably those associated with agricultural landscapes. • Overall, 34% of species and 41% of habitat assessments have a deteriorating trend. There is a decline in HNV farmland and a rapidly decline of semi-natural grassland in recent years.	• The German national Biodiversity Strategy contains multiple targets in line with the EU Birds and Habitats Directives and Biodiversity Strategy 2020. • Action Programme for Insect Conservation allocates additional funding out conservation and restoration of habitats for insects. • Amendment to the Nature Protection Law makes some further provisions for insect protection, including limitation of pesticides in species-rich grassland, orchards and dry-stone walls.	• Increase landscape diversity and habitat for species • Reduce pesticide use • Reduce nitrogen critical loads Halt the widespread deterioration of protected species-rich grassland habitats
Common species: Farm bird index	• The population status of farmland birds continues to be of concern. From 2000 to 2016 the farmland bird index in Germany decreased from 100 to 84.4, which shows a gradual increase since its lowest level in 2014 of below 80.	There are no national targets focused specifically on farmland bird conservation in Germany. However, the National Biodiversity Strategy aims to promote and maintain common biodiversity and landscape quality, including agricultural land, to enhance and protect bird populations.	• Improve connectivity and management of protected areas • Increasing and improving habitat quality in agricultural landscapes
Wild pollinators	• There is a strong decline in average airborne insect biomass of 76% (up to 82% in midsummer) over the past 27 years for protected nature areas in Germany.	• There are no specific targets for wild pollinators at the national level, however, the 2019 an Action Programme and the new Insectenschutzgesetz (amending nature protection law) includes measures targeting insect populations.	• Protection and restoration of insect habitats • Reduce the use of agrochemicals (pesticides and synthetic fertilisers) • More guidance on environmentally and ecologically compatible application of pesticides

WATER			
Water quantity	• Water withdrawals for agricultural irrigation in Germany so far have been low but with intensive irrigation regions in Lower Saxony. In the coming years, water stress is generally not to be expected across the board, while negative water balances could occur in some areas, especially in the north-east of Germany.	• For the German agriculture sector, water re-use is currently being discussed.	• Efficiently use future water resources for irrigation to avoid regional conflicts with the public drinking water supply.
Water quality	• The most significant impacts of agriculture are eutrophication of water bodies, pollutant inputs and habitat alterations with diffuse agriculture pollution as the most significant pressure on both surface and groundwater bodies). In Germany, 36% of groundwater bodies and 100% of surface water bodies are failing good chemical status	• The National Sustainability Strategy, the Programme of Measures for Climate Protection and the revised fertiliser legislation mention 70 kg N/ha as a target value for the year 2030. However, there are no sector-specific reduction obligations e.g., for agriculture at federal and Länder level.	• Reduce the pressures on water bodies from nitrogen and phosphorous inputs as well as from pesticide contamination
SOIL			
Loss of soil biodiversity	• Soil organisms have been researched relatively little so far. There is no systematic monitoring of the state and condition of agricultural land in Germany.	• The national Biodiversity Strategy has given insufficient consideration to soil biology. There are only targets which indirect affects soil biodiversity e.g., reduced substance inputs.	• Reduce the use of agrochemicals (pesticides and synthetic fertilisers) • Reduce soil compaction, especially subsoil compaction
Loss of soil organic matter	• Intensive cropping can lead to a decrease in soil organic carbon stocks and future projections indicate reductions in SOM on arable land up to 2030. An average of 0.21 tonnes of organic carbon per hectare of arable land and year could be lost in the	• The national Arable Farming Strategy for 2035 sets to achieve a humus balance in all arable land by 2030. The amended Climate Change Act set the target to reduce peatland emissions by 5 million tonnes of CO_2 equivalent annually through	• Increase protection of carbon-rich soils through rewetting and restoration of peatlands and wetlands • Build up soil organic matter on mineral soils and ensure better protection of permanent grasslands

	topsoil in Germany over the next 10 years if management practices remain unchanged. In Germany, about 90 percent of peatland soils are used for agriculture and forestry. • Importantly, drained and cultivated peatlands continue to be affected by a huge loss of soil organic carbon.	rewetting by 2030. Some federal states have regional targets or measures relevant for soil carbon.	
Soil erosion	• The risk of soil erosion both by water and by wind is still limited, with 1.4% of UAA under risk, but is expected to increase due to increasing field and farm sizes, lack of erosion protection (e.g., no soil cover in winter) and a rise in extreme weather events particularly for the north-east and west of Germany.	• The Federal Soil Protection Act regulates the prevention of hazards as well as precautionary measures against harmful effects on soil including soil erosion in Germany.	• Promotion of soil conservation practices • Protection of permanent grassland

4. LIST OF MOST RELEVANT MANAGEMENT PRACTICES RESPONDING TO THE NEEDS

4.1 Climate mitigation and adaptation

- Farming practices that reduce methane emissions are reduction in livestock numbers, improved manure management and storage. Furthermore, effective measures to reduce methane emissions include the use of feed additives in combination with modified feed management in livestock farming.

- CO_2 emissions can be reduced by rewetting peatlands. Whilst this can lead to a short-term increase in methane, this is outweighed by CO_2 savings (Günther et al., 2020). Further, some practices can mitigate the CH_4 emissions, such as mowing and biomass removal before raising the water table, and avoiding inundation or creating shallow lakes.

- Nitrogen emissions can be reduced by improving the efficiency of fertiliser use (improved nutrient planning, use of legumes) and reducing livestock density in most intensive livestock regions.

- Increasing resilience of crop production can be achieved through improved crop rotations and sustainable soil management practices that maintain soil fertility and productivity and protect from soil compaction and erosion, as well as investment in efficient irrigation.

4.2 Biodiversity

Effective measures to protect and promote biodiversity in Germany are mainly related to the reduction of pesticides, fertilizers and the promotion of landscape elements. In extensive and high nature value farmland maintenance of extensive grassland (meadows and pastures) management and orchard grasslands are important. Key practices to improve conditions for biodiversity in intensive arable and livestock systems are improved crop rotations with minimum five crops to break pest/disease cycles and reduce reliance on pesticides, fallow land, field strips with flowering mixtures and alfalfa fields biological pest control. Organic farms have a much higher share of grassland and a lower management intensity than conventional producers and are therefore of great importance for the promotion of biodiversity.

4.3 Water

Two groups of measures are key for reducing pressures on water: measures to increase resource use efficiency and measures to improve soil, crop and livestock management. Increasing resource use efficiency reduces nitrogen surplus with the most important practices being: reduced and improved organic and inorganic fertilisation (e.g., through nutrient planning, precision farming or avoidance of fertiliser use in risk areas), improved manure management (e.g., improved storage capacity). In addition, soil conservation measures (e.g., low or no tillage, mulching) reduce the risk of soil erosion and nitrate leaching, improved grassland management and crop rotation reduce nitrogen demand (e.g., by including N-fixing crops). Promoting integrated pest management, favouring sustainable biological, physical, and other non-chemical methods, and wider crop rotations help to improve water quality and minimise risks to human health and the environment.

Water abstraction for agricultural use plays a minor role in Germany. Nevertheless, the promotion of water-efficient equipment, improved infrastructure (e.g., lining of canals, repair leaking pipes) and appropriate irrigation scheduling is important in regions where irrigation is already taking place or will become more important due to increasing droughts.

4.4 Soil

Soil health and soil quality in Germany are mainly threatened by land use changes, intensive agriculture including simplified crop production and arable farming on slopes. Many measures address all considered soil needs (protection of soil biodiversity, conservation and improvement of soil organic matter and prevention of soil erosion) simultaneously. These key practices include soil conservation measures (e.g., low or no tillage, mulching), wider crop rotations, intercropping, promotion and maintenance of grassland and promotion of landscape features and buffer strips. Organic farming is seen as a central agricultural system for promoting sustainable agriculture, which strengthens humus formation when best practice of broad crop rotations of up to 11 crops including clover grass is applied (typical would be 6 to 7), thus contributing to improved soil structure, biological activity and erosion control. With regard to the protection of soil biodiversity, the reduced use of pesticides plays a major role.

Peatland protection including reduced drainage/rewetting and adapted cropping systems such as paludiculture and extensive grassland management are central to the protection of peatlands in Germany. In addition, on mineral soils improving the balance of removals to returns of organic matter is important, e.g., through

organic fertilization (compost and manure), leaving harvest residues on the field, and expanding crop rotations (e.g., with clover grasses, legumes, deep rooting crops).

Effective measures to reduce soil erosion are permanent soil cover, the cultivation of catch crops that freeze overwinter, reduced tillage, prohibition of row crops on slopes above a certain degree and mulch seeding with a minimum soil cover. The reduction of field traffic, especially in unfavourable (wet) conditions that reduce the infiltration capacity of the soils, helps to prevent soil compaction, and thus also soil erosion. On sloping land, grassland strips and landscape elements reduce the risk of erosion.

4.5 Air

Reducing stocking densities is an effective ammonia reduction measure (Oeko Institute, 2020). Some Länder, especially in the northwest and south-east, have high livestock density, where the scope and need for action are high.

Table 7: Summary table – Example of measures

Measures	Agricultural practices	CLIMATE		WATER		BIODIVERSITY		SOIL			AIR	Safeguards/ Comments	Targeting
		Mitigation	Adaptation	Quantity	Quality	Common species	Protected area species	Loss of soil biodiversity	Loss of SOM	Soil erosion	Ammonia pollution		
Land management	**Improved crop rotation**	X	X	X	X	X	X	X	X	X		Should be genuine rotation over years and not "crop diversification"	Arable land
	Inclusion of legumes in crop rotation	X	X						X			In the case of alfalfa, it should be long rotation cycles	Id.
	Switch from intensive row crops (i.e., water, fertiliser, intensive or SOM-consuming crops)	X	X	X	X				X	X		Choice of crop has to be regionally specific, e.g., switching beets or maize to cereals or intercropping	Erosion and water scarcity areas
	Cover crops / Catch crops	X*	X	X	X				X	X		Mechanical destruction only	Arable land
	Mulching and leaving crop residues		X	X	X				X	X		Agronomic practice to be adapted to local conditions regarding the quantity of mulch and residues	Id.
	Reduced or no tillage	X*	X	X	X			X	X	X		Without herbicide application	Id.

Measures	Agricultural practices	CLIMATE		WATER		BIODIVERSITY		SOIL			AIR	Safeguards/ Comments	Targeting
		Mitigation	Adaptation	Quantity	Quality	Common species	Protected area species	Loss of soil biodiversity	Loss of SOM	Soil erosion	Ammonia pollution		
Land management	Landscape features, hedges, flowering strips	X	X	X	X	X	X	X	X	X		Not only preservation of existing features but also and more importantly creation of new features	Id.
	Conversion of arable land to grassland	X*	X	X	X	X	X	X	X	X		Should be permanent grassland, not simply including grass into the rotation	High erosion risk areas
	Field grass margins	X*	X	X	X	X	X	X	X	X			Id.
Biocontrol	Biological control of pests and diseases		X		X	X	X	X				Availability of biocontrol products should sharply increase	All crops
Organic farming	Conversion to and maintenance of organic farming		X	X	X	X	X	X	X	X	X	Regionalised actions plans should help to calibrate the speed and dimension of the area in transition each year so as to adjust to the demand. Knowledge transfer support is necessary.	All regions
Peatland rewetting	Rewetting and restoration	X*	X	X	X	X	X		X	X		Either land is taken out of production, or converted to paludiculture.	Peatlands

Measures	Agricultural practices	CLIMATE		WATER		BIODIVERSITY		SOIL			AIR	Safeguards/ Comments	Targeting
		Mitigation	Adaptation	Quantity	Quality	Common species	Protected area species	Loss of soil biodiversity	Loss of SOM	Soil erosion	Ammonia pollution		
Agroforestry	New agroforestry	X	X	X	X	X	X	X		X		Local trees species should be used	Arable areas with large field sizes.
	Landscape features (including hedgerows and woody field margins)	X		X	X	X	X	X	X	X		Local trees species should be used	Arable areas with large field sizes.
High nature-value farming	Conservation of typical orchards and extensive grasslands (e.g., reduced fertiliser, fewer cuts, later cuts)	X	X		X	X	X	X	X	X	X	Focus on reduced livestock densities would help to contain livestock numbers within climate-compatible boundaries and reduce pressure on farmland species.	All regions where HNV is still found.
Livestock management	Reducing max livestock density	X			X	X	X			X	X	Maximum livestock densities should be regionalised with a view to reflecting the real capacity of each region to feed their animals	Most intensive productions as first targets

Measures	Agricultural practices	CLIMATE		WATER		BIODIVERSITY		SOIL			AIR	Safeguards/ Comments	Targeting
		Mitigation	Adaptation	Quantity	Quality	Common species	Protected area species	Loss of soil biodiversity	Loss of SOM	Soil erosion	Ammonia pollution		
Livestock management	Improved livestock health management	X	X								X		All livestock
	Solid manure application from animals on straw				X			X	X	X	X	Agronomic practice to be regionalised according to local soil types, etc.	Mixed farms
	Improved grassland management (e.g., choice of grass varieties, grazing patterns)		X			X	X	X	X	X		Double objective: to further increase carbon capture and to regenerate biodiversity.	All grassland areas
Knowledge transfer	Operational groups and demonstration farms (EIP-Agri)	X	X	X	X	X	X	X	X	X	X	Should make the link between science and practice. Using digital means and dedicated social network would help accelerate the transition.	Build a dense network across the country for environmental issues
Advisory services	Targeted advice to farmers to accompany the agro-ecological transition	X	X	X	X	X	X	X	X	X	X	Avoid one-size-fits-all advice. An approach along natural regions should be promoted (by contrast with advice per production).	Young farmers and new installations

*** These are measures that mainly relate to the maintenance and improvement of Soil Organic Matter (SOM).**

No-go measure box

The box below highlights the measures to avoid as they will be counterproductive in achieving the identified needs.

Investments in farm infrastructure

Intensification has been historically promoted through investment measures in the CAP, such as support for new stables and increasingly large machinery, or also investments in biogas units. Many of the technical measures that have the highest mitigation potential according to calculations by the Ministry of Agriculture involve investments in technical measures (biogas digesters, also stables, manure storage, precision farming for improving efficiency) and tend to be geared towards larger producers (Lakners, 2017). Also, RDPs can also support investments indirectly, for example in Bavaria the agri-environment-climate measure supported the use of low-emission slurry application. On the other hand, more extensive or smaller producers tend to have weaker access to investments. In Baden Württemberg, until five years ago, for example, it was very difficult to apply for co-financing of stables for more extensive producers with sheep. While infrastructure and machinery investments can be very useful and can support climate (e.g., small scale biogas from wastes and residues like manure), biodiversity (e.g., adjusted mowers) and soil objectives (e.g., attachments for reduced tillage), these should be very carefully applied to avoid supporting further intensification and also the risk of locking-in unsustainable livestock production. This can be done by avoiding certain investments (e.g., not supporting payments for low-slurry application) Or by adding strict eligibility criteria, e.g., by reducing total stocking densities especially in ecologically sensitive areas and by improving crop rotations if the farms grow maize for feed (e.g., only fund biogas digesters if at the same time a crop rotation measure is taken up).

Ineffectiveness of Pillar 1 measures for biodiversity

Greening measures, in particular those of the EFA, were not sufficiently targeted at biodiversity, thereby missing the goal of halting and reversing the decline in biodiversity. A study by the UBA in 2021 concluded that the 'greening' measures overall were of 'limited environmental impact and high cost' (UBA, 2021f).

A study for the Federal Nature Protection Agency concluded the following regarding the EFA coverage in Germany: "At present, 50% of the EFA-obligation in Germany are covered by areas with catch crops or green cover and nitrogen-fixing crops. These are EFA-types with little value for biodiversity; however, they are beneficial for soil and water quality. In contrast, buffer and flower strips offer the chance to achieve a high ecological benefit on a comparably small area; In 2015, set-aside areas, landscape elements, field strips, buffer strips and strips along forest edges as EFA constituted about 2.8% of the arable land. A significant share of these areas has already been present before the introduction of EFA. This refers especially to landscape elements but also set-aside arable land. IACS data analysis of five federal states showed that the area of set-aside arable land increased by 25% compared to the area before the introduction of EFA and about 50% of EFA set-aside arable land and strips were already set-aside before 2015. Hence, with the EFA-obligation the share of ecologically valuable area was enhanced by around 1% of the arable land. Further species-rich arable areas (e.g., extensive cereal cultivation without fertiliser use and harvesting) are currently not defined as EFA and are thus not implemented via this obligation." (Nitsch et al., 2017, p. 153).

Calculation of erosion risk classes

Regarding GAEC 5 on minimum practices for minimising erosion, this is implemented based on the erosion risk maps based on the calculation of erosion risk classes. Each federal state in Germany prepares their own erosion risk maps and GAEC 5 applies to the risk erosion classed CC-Water 1, CC-Water 2 and CC-Wind 1. There are inconsistencies between the calculations carried out in the different federal states, in terms of which factors are considered in the calculations. This leads to an uneven playing field in terms of requirements and in some states, the risk classes are too narrowly defined.

5. INTERVENTION MECHANISMS – EXAMPLES (NEW GREEN ARCHITECTURE)

The following examples illustrate how different CAP instruments (such as *eco-schemes*, agri-environment and climate measures) could be used to fund the different measures listed in section 4. Only one example is given per category of need, therefore, it is not an exhaustive list. Further, different interventions can fulfil multiple goals, for example, the preservation or restoration of extensive permanent grassland can contribute to climate mitigation, biodiversity and water quality at the same time.

	Practices	Corresponding instruments Pillar 1	Corresponding instruments Pillar 2			
Corresponding needs in the national context		**Eco-schemes**	**Environmental climate and other management commitments**	**Natural or other area-specific constraints**	**Cooperation (EIP-AGRI OGs)**	**Knowledge and information**
CLIMATE						
Climate mitigation	Land management	Maintain permanent grassland (eco-conditionality)	Converting arable land into permanent pasture, focused on risk areas for erosion	No or reduced tillage on arable land	Weed control	Alternatives to pesticides including glyphosate
Peatland rewetting	Rewetting and restoration of peatlands	Result-based payments for emissions savings and biodiversity gains	Compensate income loss for rewetted/restored areas		Experience sharing and developing supply chains around new paludiculture crops	Reduction of CH4 emissions following rewetting, paludiculture crops

Climate adaptation	Agroforestry	Compensate income loss for areas planted with trees	Planting hedges and/or trees	Indigenous species	Exchange of good practices	Piloting new agroforestry systems and economic models
BIODIVERSITY						
Biodiversity protection and restoration	Restoration of landscape biodiversity	Eco-schemes for landscape features	Establishment and management of biodiversity areas including landscape features (additional area)		Biodiversity needs	
	Pesticide reduction – biocontrol	IPM as an eco-conditionality criteria Biocontrol as an eco-scheme	Zero chemical pesticides	Flowers strips, landscape features	Test fields, demonstration farms network	Systemic approach to farm management, insect biology, biocontrol solutions
WATER						
Water quality (nitrates)	Organic farming	Converting arable farms	Whole farm approach preferred in the long term	Option reduced or no tillage	Converting farms to organic	Eco-intensification Weed control in no tillage organic

SOIL						
Soil protection and regeneration	Ambitious crop rotation	5-year crop rotation, including legumes	5+ crop rotations, with mulching, reduced tillage and greater inclusion of legumes/deep rooting crops	Option reduced tillage	Exchange of good practices	Intercropping systems compatible with mechanised operations
AIR						
Air quality	Manure management Livestock management	Eco-conditionality to align with the measures in NEC Directive plan	Link animal numbers to pastured land, fix a maximum and a minimum ceiling	Animal welfare	Extensive livestock farming	Animal husbandry, animal diseases prevention, "one health"

6. ALIGNMENT BETWEEN RECOMMENDED MEASURES AND THE GREEN DEAL

The management practices described in section 4 and the examples of intervention mechanisms given in section 5 have been chosen because their impact will help achieve the headline targets of the Green Deal (see box 1 below as a reminder).

Box 1: Green Deal headlines targets

Climate law

Legally binding target of net zero greenhouse gas emissions by 2050 (2030 reduction target of 55 %, at least, compared to 1990 levels)

Farm to Fork

- *Reduce by 50% the overall use and risk of synthetic chemical pesticides and the use of more hazardous pesticides by 50% by 2030*
- *Reduce nutrient losses by at least 50%, while ensuring that there is no deterioration in soil fertility. This will reduce the use of fertilisers by at least 20% by 2030*
- *Reduce by 50% sales of antimicrobials for farmed animals and in aquaculture by 2030*
- *At least 25% of the EU's agricultural land under organic farming by 2030*

Biodiversity strategy

At least 10% of agricultural area is under high diversity landscape features

Measures have multiple goals and impacts. For example, maintaining permanent grassland will help keep carbon in the soil and help fulfil the carbon neutrality target by 2050. Furthermore, this measure positively impacts biodiversity on the condition that they are extensively managed, both in terms of inputs and other management practices including stocking densities and grazing or mowing regimes. As another example, biocontrol reduces pesticide use while also fostering new governance approaches on the farms, in line with the SDGs and the EU Green Deal objectives.

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Annex 1

Ex-ante analysis	SWOT analysis	Assessment of needs	Public/ stakeholder consultation	Final intervention strategy	First draft	Strategic environmental assessment	Second draft submitted to the EC	Approval of the CAP CSP
May 2020	**Nov 2020**	**Nov 2020**	**May 2021**	**May 2021**	**Currently being drafted**			
Link	Link	Link	Federal Ministry of Food and Agriculture Notice on public participation in the Strategic Environmental Assessment	Working paper on the strategic statement on the GAP strategic plan Working paper on general chapters of the CAP strategic plan (risk management, green architecture, sector-related interventions) Working paper on intervention profiles Working paper on intervention strategies for the ten specific lines in graphic representation Working paper on financial assessments of the environmental performance of the CAP				

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