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Report

Environment and climate assessment of Poland's CAP Strategic Plan

Institute for European Environmental Policy

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EXECUTIVE SUMMARY

The food system of the European Union (EU) has considerable impacts on the climate and environment. European food systems are responsible for an estimated 30% of the continent's greenhouse gas emissions. Agriculture is also the main pressure on biodiversity (through chemical-synthetic pesticides use, landscape simplification and the loss of habitats), and is a significant contributor to soil degradation and reductions in water quality and availability. The ecological transition of agri-food systems is therefore necessary and urgent.

The EU Common Agricultural Policy (CAP), which supports agricultural production through different instruments ('interventions'), is the main funding opportunity for the transition of the block's agri-food systems. Created 60 years ago, the CAP is one of the oldest policies of the EU, and today receives around 30% of the total EU budget. The latest reform of this policy has introduced a new structure ('delivery model') that came into force in Member States at the start of 2023. It includes a set of ten specific objectives: one cross-cutting on knowledge and innovation, three economic, three social, and — the specific focus of this report — three environmental and climate-related: climate action, the protection of natural resources and the conservation of biodiversity. Member States must submit a National Strategic Plan presenting, among other things: the country's needs for each specific objective, the interventions they plan to implement to address these needs, and the budget allocated to these interventions. This new structure was proposed to: a) shift to a performance- and results-based approach, b) give more flexibility to Member States to adapt CAP support to local conditions and needs, and c) increase CAP's impact in terms of sustainability.

This report is part of a series of assessments of CAP Strategic Plans, in Member States with large agriculture sectors and where the potential for addressing national and EU climate and environmental challenges is high. The assessments cover the Strategic Plans' likely contribution to climate mitigation and adaptation, natural resources, and biodiversity protection, in this case for Poland.

Overall, the Polish Strategic Plan appears insufficient to respond to the country's needs in relation to environment and climate challenges. The largest share of Poland's CAP support continues to go to basic income support payments and there is still significant funding going to coupled support, both of which are not sufficiently conditioned on sustainable practices. The transfer of more than 1.5 billion euros from Pillar II to Pillar I, as well as the large number of interventions that could benefit the environment and climate but which impacts are limited due to small budgets, further illustrate the lack of priority given to environment, climate and rural development in the Plan. Nevertheless, the Plan contains some

interesting interventions and improvements which could be built upon. The new environmental and climate commitment promoting perennial flower strips (I 8.7), for instance, can be of a great value, especially in agricultural landscapes dominated by industrial agriculture. Other measures also have the potential to improve the environment and climate, but their effectiveness is likely to be limited by small budgets and ill-defined implementation parameters.

To improve the potential impact of CAP spending, the report proposes two sets of recommendations. The first set focuses on potential amendments to Poland's Plan in the current period:

- Address gaps in the in the intervention logic, in particular concerning peatland restoration, climate adaptation and biodiversity.
- Strengthen GAEC requirements. GAEC 2 should also be implemented as soon as possible, without waiting until 2025.
- Evaluate the impact of the derogations granted to farmers in 2023 for GAEC standards 7 and 8, with a view to avoiding further derogations that would damage biodiversity and the environment.
- Review the eco-scheme on carbon farming and nutrient management (I 4.2) after one year (as planned) to make the adoption of the most beneficial practices attractive to farmers.
- Make the eco-scheme on water retention on permanent grasslands (I 4.5) applicable everywhere and the payment proportional to the flooding time (without the twelve-day limit).
- Include measures supporting grassland restoration (including the conversion of arable land into grasslands on flooded areas), wetland buffer zones restoration and creation, the rewetting of peatlands in agricultural use, the transition from current farming systems towards paludiculture and biodiversity in arable land.
- Adjust the area targeted by environmental and climate commitments in Natura 2000 to reflect the needs identified in Prioritised Action Framework.
- Strengthen interventions supporting biodiversity on arable lands (including support for landscape features).
- Step up support for organic farming. This could be accompanied by promotional campaigns to explain the environmental benefits of such systems to consumers.

- Improve the targeting of some interventions to address specific regional issues (e.g. soil erosion or droughts).

- Include innovative interventions such as result-based payments or bonuses and collective approaches that could be beneficial for the preservation of natural resources and biodiversity, as well as accompanying training and advice.

- Increase the budgets for eco-schemes, environmental and climate commitments, environmental and climate investments and cross-cutting measures, with a corresponding decrease in basic income support and coupled support. This recommendation could also be implemented at the EU level.

- Fund additional studies and research to evaluate the potential impacts of the Strategic Plan and its interventions on environmental and climate action (in particular regarding their climate mitigation potential). This recommendation could also be implemented at the EU level.

The second set focuses on recommendations for the next CAP and for other related policies:

- Introduce environmental and climate ring-fencing for cross-cutting measures, all sectoral interventions and investments in the next EU regulation, to ensure a minimal share of the budget be spenton projects contributing to these objectives.

- Biodiversity- and climate-proof the CAP Strategic Plans and their interventions to include additional safeguards where needed, as Poland seems to have done for many interventions (e.g. on afforestation).

- Improve transparency, including by publishing a complete version of all CAP Plans, providing the output targets and budgets for all interventions.

- Accompany changes in the production systems by changes in other parts of the food systems, for instance by developing a food systems strategy.

INTRODUCTION

The European Union (EU) food system has considerable impacts on the climate and environment. In particular, research shows that European food systems are responsible for 30% of the continent's greenhouse gas (hereafter, GHG) emissions (2021). Agriculture is also the main pressure on biodiversity (through pesticide use, landscape simplification and the destruction of habitats), and is a significant contributor to soil degradation and reductions in water quality and availability. To try and address these issues, the European Commission developed new strategies in the framework of the European Green Deal: The Farm to Fork Strategy which aims to make food systems fair, healthy and environmentally friendly, and the Biodiversity Strategy which aims to put Europe's biodiversity on the path to recovery by 2030. Both include targets related to agriculture (e.g. on area under organic farming, pesticide and fertiliser reduction). The Common Agricultural Policy (CAP)—which supports agricultural production in the EU through a system of interventions (previously known as measures)—is the main funding source the EU has for implementing the Farm to Fork targets and the transition of agri-food systems.

Created sixty years ago, the CAP is one of the oldest policies of the EU, and today benefits from around 30% of the total EU budget. Historically, the policy focused on increasing productivity and competitiveness as well as ensuring food production, fair income for farmers and reasonable prices for consumers. This helped maintain farming in places where it would have otherwise disappeared, but also contributed to the intensification and specialisation of agriculture, with negative impacts on the environment and climate. However, since the end of the twentieth century, environmental and climate aspects have been gradually integrated.

In 2018, the European Commission proposed a new structure for the CAP that came into force in Member States at the start of 2023. It includes a set of ten specific objectives: one cross-cutting on knowledge and innovation, three economic, three social, and three that are environment and climate related: climate action (specific objective 4), the protection of natural resources (specific objective 5) and the conservation of biodiversity (specific objective 6). It is also based on a 'new delivery model' where Member States must submit a National Strategic Plan (also referred to in this report as: CAP Strategic Plan, Strategic Plan or the Plan) presenting, among other things: the country's needs for each specific objective, the interventions they plan to implement to address these needs, and the budget allocated to these interventions. These Plans must be approved by the European Commission to ensure that Member States will contribute to the EU wide objectives. This new structure was proposed to: a) shift to a performance-

and results-based approach; b) give more flexibility to Member States to adapt CAP support to local conditions and needs, and c) increase the CAP's impact in terms of sustainability. To assess performance, The European Commission requires Member States to set targets for a set of 'result indicators' (hereafter designated by R.[number]) linked to the different objectives.

This report is part of a series of assessments of CAP Strategic Plans, in Member States with large agriculture sectors and where the potential for addressing national and EU climate and environmental challenges is high. The assessments cover the Strategic Plans' likely contribution to climate mitigation and adaptation, natural resources, and biodiversity protection, in this case for Poland. Poland accounts for 9% of the total EU agricultural area and 13.7% of EU farms (1.4 million farms in 2016 of which 92% benefit from CAP support) (European Commission). Compared to the EU average, a relatively high share of the Polish population works in agriculture (12%, compared to 5% at the EU level), the sector being dominated by small family farms (out of 1.5 million farms, some 55% are below 5 ha) (European Commission, 2019). Poland produced 5.3% of the of the total value of EU crop production and 7.7% of the value of EU animal production in 2017 (European Commission, 2019). That same year, cereals, milk and pigs and poultry production were the most important sectors in terms of production value in the country (ibid.).

Poland's CAP Strategic Plan was approved by the European Commission on 31 August 2021. This assessment focuses on interventions targeting agriculture (not forestry) and is structured in five sections. First, it presents the general priorities set out by Poland in its Strategic Plan and the planned allocation of funding in order to estimate the amount of funding targeting environmental and climate objectives. The three following sections explore the interventions proposed to contribute to climate mitigation and adaptation (section 2, specific objective 4), natural resource protection, in particular water and soil (section 3, objective 5) and the conservation and restoration of biodiversity (section 4, objective 6). Then, the report presents the cross-cutting interventions that could contribute jointly to the three environmental objectives, i.e. those supporting cooperation, knowledge exchange and dissemination and advisory services, as well as innovative approaches. Finally, the conclusion summarises the results and proposes key recommendations to improve the environmental and climate contribution of the Strategic Plan.

1. GENERAL OVERVIEW OF THE CAP STRATEGIC PLAN'S PRIORITIES: WHERE DOES THE MONEY GO TO ENVIRONMENTAL AND CLIMATE ACTION?

The Polish Strategic Plan emphasises the following priorities: the sustainable development of Polish farms and of the processing sector, the improvement of living and working conditions in small rural areas, the diffusion of sustainable management practices that are climate-friendly and protect water, soil and air and biodiversity, the production and use of sustainable energy and the development of innovative solutions, including digital solutions, to remove barriers to rural and agricultural development. In addition, the Plan mentions that specific attention should be given to providing opportunities to all, including accessibility for persons with disabilities and equal opportunities for women and men (Ministry of Agriculture and Rural Development of Poland, 2022).

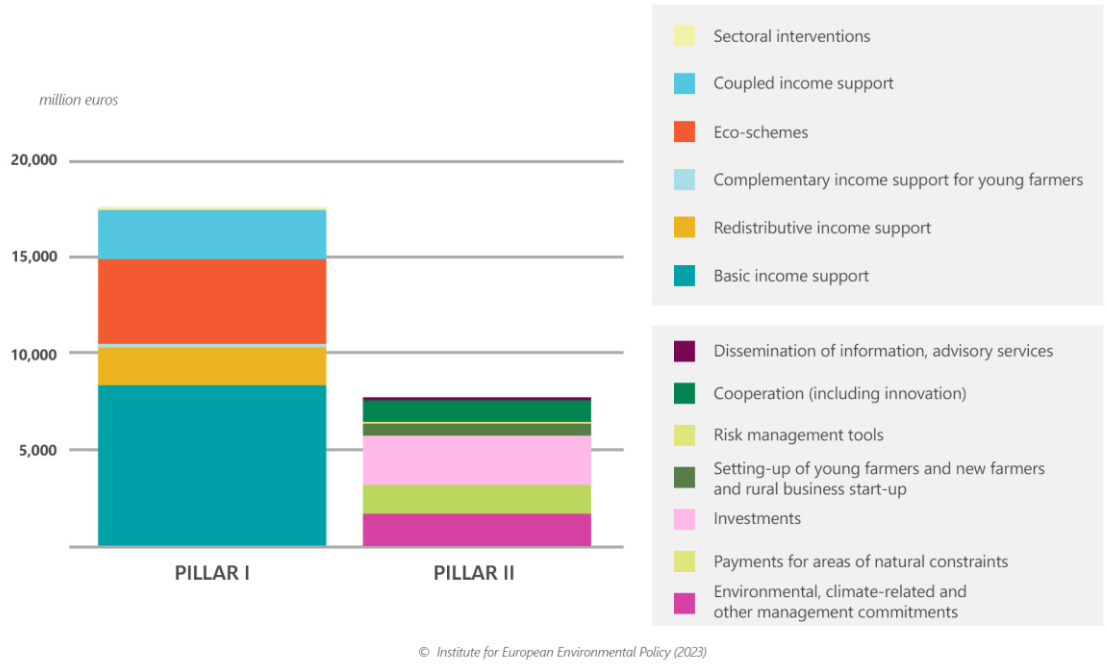
Beyond these claims, an analysis of Poland's CAP budget allocation sheds initial light on the priority given to the different objectives in the Plan.

The CAP budget in Poland will be about 25 billion euros, out of which around 22 billion euros comes from the EU and 3 billion comes from national co-funding (European Commission, 2022). CAP funding is divided between two funds, the European Agricultural Guarantee Fund (EAGF, also referred to as 'Pillar I) and the European Agricultural Fund for Rural Development (EAFRD, also referred to as Pillar II)[1]. Historically, the EAGF has focused on funding interventions related to income support, while the EAFRD is used to target rural development as well as environmental and climate objectives. However, interventions focusing on climate and environmental aspects have been gradually integrated in Pillar I since 2014, first through the 'greening' payment and now through the introduction of the 'eco-scheme'.

Chart 1 shows below the allocation of Poland's CAP budget to different Pillar I and Pillar II interventions. Overall, for the upcoming period (from 2023 on) around 70% of the total CAP budget will go to Pillar I. This proportion is similar to the EU average, with around 75% of the total EU funding going to Pillar I. Poland is also planning to transfer more than 1.5 billion euros from Pillar II to Pillar I, cutting Pillar II's budget by almost 30% and suggesting a willingness to prioritise income support and other economic objectives.

[1] National funding is only required to co-finance EAFRD, not EAGF expenditure.

Chart 1: Budget allocation for interventions in Pillar I and Pillar II (total public contribution, whole period)



Source: Public version of the Polish Plan, available here.

To guarantee a minimum budget ('ringfencing') for interventions benefiting public goods in all countries, the EU CAP Regulation states that all Member States must dedicate at least 25% of the funding for direct payments to eco-schemes and at least 35% of Pillar II funding to environmental, climate, organic and animal welfare commitments[2]. In the case of Pillar II, this ringfencing covers the following interventions: environmental, climate and other management commitments (formerly called agri-environmental and climate measures), compensation payments for area-specific disadvantages in relation to the Water Directive Framework and EU nature directives (in particular Natura 2000 areas), investments targeting these objectives, as well as 50% of the payments for areas of natural constraints (hereafter, ANC).

After transfers from Pillar II to I, Poland allocated the minimum of 25% of direct payments' budget to eco-schemes, i.e. around 4.3 billion euros of which about 32% is spent on improving animal welfare and 68% on meeting environmental and climate objectives. For Pillar II, it exceeded the minimum, allocating 43.4% of

[2] See the CAP Strategic Plans Regulation, articles 93 and 97. However, Members states are allowed, to a certain extent, to decrease their contribution to eco-schemes under certain conditions, for instance in the first years of implementation to fund other interventions, or if the environmental, climate, organic and animal welfare contribution of Pilar II exceeds 30%.

Pillar II to environmental, climate, organic and animal welfare objectives, i.e. around 2 billion euros, of which about 33% goes to investments, 22% to environmental, climate and other management commitments and 20% to ANC payments.

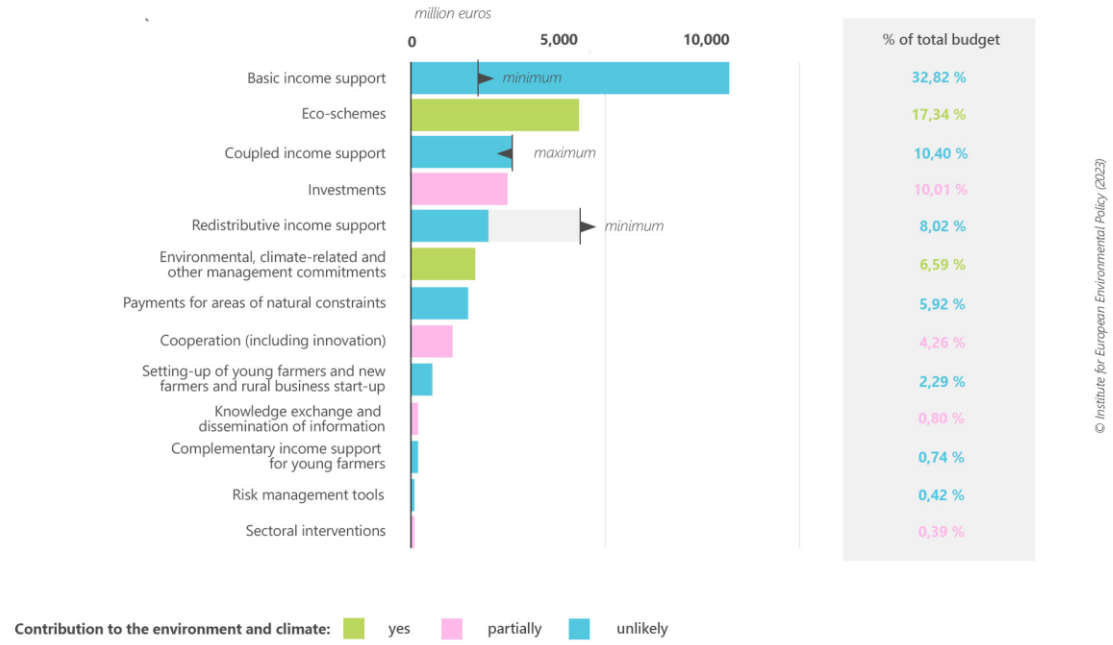
Looking at the detailed allocation of the CAP budget[3] to the different types of interventions (see Chart 2 below), basic income support, which aims to support farmers' income, remains the most funded instrument, with a budget of 8.2 billion euros (32.8% of the total CAP budget in 2024-2028). This is almost twice the eco-scheme budget and five times the budget for Pillar II environmental and climate commitments. Moreover, the share of direct payments' dedicated to basic income support is planned to increase compared to the previous CAP (from 39.9% in 2015-2020 to 47.4% in the new period) (European Commission; Ministry of Agriculture and Rural Development of Poland, 2022). Similarly, the share of the direct payments' budget allocated to coupled income support is set to increase from 14.4% in 2015-2020 to 15% in 2024-2028, reaching a total budget of 2.6 billion euros over the new CAP period. The budget for interventions contributing to green objectives (environment, climate, and animal welfare) is 5.1 billion euros i.e. 20.5% of the total CAP budget. This includes Pillar I eco-schemes focusing on environmental and climate objectives (not animal welfare, see box 1 below), 15% of the sectoral interventions targeting the fruit and vegetable sector, as well as Pillar II environmental, climate and other commitments and investments targeting environmental and climate action[4]. For comparison, we estimate that around 16 billion euros contribute to the economic objectives of the CAP, corresponding to around 64% of the total CAP budget[5]. This suggests that CAP funding will remain focused on economic objectives in Poland for the upcoming period.

[3] These estimations are based on a translated version of the Polish CSP published here.

[4] These include support for afforestation on agricultural land (AND 10.11), for the establishment of trees in arable fields (AND 10.12), for the establishment of agroforestry systems (AND 10.13), for enhancing the biodiversity of private forests (AND 10.14), for renewable energy production and energy efficiency improvements (AND 10.2), and for investments contributing to environmental and climate objectives (AND 10.4).

[5] We estimate that the following interventions contribute to economic objectives: All Pillar I interventions except the eco-schemes and 15% of the sectoral interventions for fruits and vegetables, as well as payment for area of natural constraints, risk management tools and investments that are not focusing on rural areas, environmental and climate objectives and animal welfare. Redistributive income support, complementary income support for young farmers and payment for areas with natural constraints also contribute to social and rural development objectives, but we included them as they support the income of specific farmers' populations.

Chart 2: Budget allocated to different interventions (total public contribution, whole period)



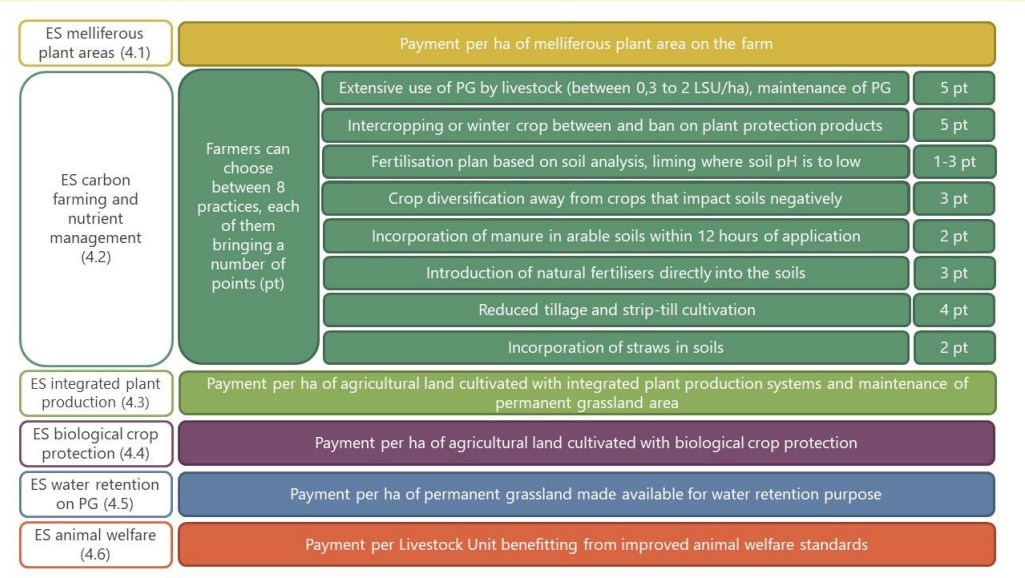
Source: Public version of the Polish Plan, available here.

The Plan associates each intervention[6] with one or more specific objectives. For example, the investment aid contributing to environmental action (intervention I. 10.4) is linked to the specific objectives on climate, resources and biodiversity. However, not all investments will contribute to all three environmental objectives and the Plan does not provide details on the share of this intervention's budget contributing to each. It is therefore challenging to correctly estimate the budget allocated to each of the environmental and climate specific objectives. Furthermore, while the allocation of budget and, when available, the output area targeted under each intervention, provide an indication of the priorities set in the Plan, they do not give information about the potential effectiveness of the interventions that are funded under each. Therefore, in the next sections, we explore the environmental and climate objectives and discuss the potential contribution of Poland's related interventions. We will focus mostly on the main interventions contributing to environmental and climate action (e.g. eco-schemes in Pillar I, environment and climate commitments from Pillar II), as well as on those that could potentially be harmful (e.g. coupled income support for cattle).

[6] For Pillar II, these were referred to as 'measures' in the previous CAP. The term interventions now covers both Pillar I and Pillar II schemes or instruments.

Box 1: The Polish eco-schemes

Poland proposes six different eco-schemes, including five targeting environmental and climate action. The sixth one focuses on animal welfare. Three of them focus on a specific practice (e.g. the retention of water on permanent grassland), while the other two target several beneficial practices, therefore being more systemic. They can be combined on a given farm.



Source: Authors, based on the Plan

Specific eco-schemes

The first eco-scheme (I 4.1) targets the creation of areas with honey plants that provide long-term, diverse and safe feeding grounds for honeybees and wild pollinators, therefore focusing partly on biodiversity. It has a small budget of €39m, representing 0.23% of the direct payments' budget, and targets an area of 30,000 ha annually, corresponding to 0.21% of Poland's utilised agricultural area (UAA).

The eco-scheme 'I 4.5' aims to compensate farmers accepting temporary (12 days) flooding on permanent grasslands that are already supported by some environmental and climate commitments or eco-schemes, in areas where flooding occurs. It does not require any action by farmers: farmers express their willingness to participate in the eco-scheme, and, the following year, the Agricultural Agency checks (based on Sentinel images) whether the parcel has been flooded for 12 days in a row. If so,

the farmer gets a subsidy. If not, there are no consequences. As such, farmers can drain the water after 12 days and still receive the payment. This eco-scheme already took effect in 2022. It also benefits from a small budget of €97m, representing 0.56% of the direct payments' budget and targets an area of 315,000 ha annually, corresponding to 2.17% of the Polish UAA and about 9.8% of the permanent grassland area.

The eco-scheme 'I 4.4' on biological plant protection supports the use of plant protection products containing micro-organisms as active substances, therefore decreasing the use of more harmful plant protection methods and providing benefits for biodiversity. However, chemical protection will still be authorised as a last resort when it is not possible to eliminate pathogens with microbiological preparations, thus reducing potential benefits. The verification and control processes, based on the presentation of proof of purchase of organic products and the registration of practices, do not otherwise guarantee the use of non-chemical alternatives. This intervention benefits from a small budget of €2.2m, representing 0.01% of the direct payments' budget and targets an area of 5,000 ha annually, corresponding to 0.03% of the Polish UAA.

Systemic eco-schemes

The eco-scheme 'I 4.2' aims to promote carbon farming and nutrient management in Polish farms. It is based on a point system in which farmers can choose amongst different practices, each of them bringing a certain number of points reflecting the environmental and climate contribution of the practice. The following practices are supported: extensive use of grassland with livestock, use of winter catch crops, development and compliance with a fertilisation plan and adequate liming, crop diversity (with a particular focus on favouring crops that have a positive impact on soil organic matter), incorporation of manure in arable soils, use of liquid natural fertilisers directly introduced in the soil, reduced tillage[7] and incorporation of straws in soils. To receive a payment, farmers have to obtain at least the number of points that they would have received if they had applied the highest-scoring practice on 25% of their agricultural area. The potential impacts of this eco-scheme will depend on the choices made by the farmers. They might choose the practices that

[7] The eco-scheme does not support zero tillage due to the excessive negative consequences of the use of herbicides attached to this practice.

are the easiest or cheapest to implement, even though they bring less environmental and climate benefits than others (e.g. than the extensive use of permanent grassland). In the case of arable farms in particular, farmers are likely to implement "easy" practices (e.g. the use of a fertilisation plan, which is already mandatory for all farms larger than 100 ha or the incorporation of straw into the soil). Moreover, the Plan does not clearly explain if farmers can get paid beyond the minimum threshold fixed. If, as it seems to be, this is not the case, the eco-scheme does not encourage farmers to adopt these practices beyond a minimum level, thus reducing the potential benefits. This intervention benefits from a substantial budget of €2.8bn, representing 16% of the direct payments' budget and targets an area of 10.0 million ha annually, corresponding to 69.3% of the Polish UAA. However, these 10.0 million ha seem to include the total UAA of the farms engaged, rather than the real area of implementation of the practices.

Finally, the eco-scheme 'I 4.3' supports farms whose production is certified in accordance with integrated production methods and requires farmers to maintain all their permanent grassland for the year. Integrated production methods combine several agricultural practices such as integrated pest management, mandatory use of alternative to plant protection methods, use of varieties resistant to diseases, pests or water shortages, use of certified seed, optimised fertilisation, creation of biodiversity rich landscape features (e.g. mounds for bumblebees) and flower strips etc. However, it still allows the use of chemical plant protection products. This intervention benefits from a budget of €40.5m, representing 0.23% of the direct payments' budget and targets an area of 29,800 ha annually, corresponding to 0.21% of the Polish UAA.

2. CONTRIBUTION TO CLIMATE MITIGATION AND ADAPTATION

This section focuses on the standards of Good Agricultural and Environmental Conditions[8], hereafter GAEC standards, and the interventions in Poland's Strategic Plan that contribute to reducing GHG emissions, carbon storage and climate adaptation.

2.1 GHG emissions' reduction

2.1.1 State of play in Poland and resulting needs

According to data officially reported by Poland, annual GHG emissions from agriculture are 32,7 million tonnes of CO_2 equivalent ($MtCO_2e$) (Ministry of Climate and Environment of Poland, 2021), which represent 8% of total net national emissions, a proportion significantly lower than the EU average of 13% (European Commission, 2020). Polish agriculture produces CO_2, but to a negligible extent, emissions from the sector representing only 0.35% of the total emissions of this gas in Poland[9]. It also produces methane (CH_4) and nitrous oxide (N_2O) which both have higher global warming potential than CO_2 (by around 25 and 300 times, respectively). Agriculture is the main source of N_2O emissions (80.1% of the total N_2O emissions in Poland in 2019). Nitrous oxide emissions from soils, in particular, represents around two thirds of total N_2O emissions in Poland and are directly related to the amount of nitrogen introduced into the soil in the form of mineral fertilisers, natural fertilisers (inc. by grazing animals) or plant residues (Ministry of Agriculture and Rural Development of Poland, 2022). In addition, manure management (e.g. storage) is responsible for 12.7% of Polish nitrous oxide emissions. Agriculture also accounted for 30.7% of national methane emissions in 2019, due to enteric fermentation (28.1% of Polish methane emissions) and manure management (2.6%). Emissions from enteric fermentation decreased since 1990, mainly due to a decline in livestock populations in the 1990s. However, emissions from agricultural soils, enteric fermentation and manure management all increased between 2013 and 2018 (European Commission, 2020).

[8] The standards of Good Agricultural and Environmental Conditions (GAECs) are defined in the framework of the CAP's baseline, known as 'conditionality'. In order to ensure that all agricultural land is maintained in good agricultural and environmental condition, Member States shall define these minimum requirements on the basis of Annex III of Regulation (EU) No 2021/2115.

[9] These emissions mainly come from the use of fertilising lime, urea and other carbon-containing fertilisers.

Poland's National Energy and Climate Plan (NECP), independent of the current and planned policies and measures, projects an increase by some 5% of agricultural emissions by 2040, with increased emissions from soil and manure. Therefore, the country needs to act now to maintain its relatively low agricultural GHG emissions and contain potential increases of emissions from agricultural soils (e.g. fertilisation) and manure management. Reducing the use of fertilisers or improving manure and slurry management would be the most efficient way to reach these objectives.

2.1.2 Planned interventions

Beyond the GAEC standard which bans burning arable crops[10], Poland mentions five interventions contributing to reducing GHG emissions from agriculture. They include two eco-schemes, sectoral interventions for the fruit and vegetables sector and two investment aids.

The eco-scheme 'I 4.2' supports several agricultural practices that can reduce GHG emissions on farms (see box 1). First, it supports improvements in fertiliser management, by requiring farmers to develop and comply with a fertilisation plan based on a soil analysis on arable and permanent grassland and with the help of fertilisation decision support systems. The results of the soil analysis will be used to develop the fertilisation plan, indicating the quantities of nitrogen (N), phosphorus (P), potassium (K), magnesium (Mg) and calcium (Ca) to be used in fertilisers on a given agricultural parcel. The acidity of the soil will also be analysed, and a liming treatment will be supported with an additional payment where the pH is below or equal to 5.5, once every 4 years. Optimising the use of fertilisers can contribute directly to reducing fertiliser consumption, and therefore GHG emissions. However, many farmers are already implementing this practice. Large farms (more than 100 hectares (ha)) in particular, are required to have a fertilisation plan. The eco-scheme adds an obligation for soil testing, but many large farms already do such tests. This support will thus provide additional benefits only if small farms also adopt this practice. Furthermore, it is not clear to what extent the implementation of fertilisation plans will lead to fertiliser use reductions. In this regard, introducing a bonus in case of actual fertiliser use reduction could improve the effectiveness of the measure. Second, the eco-scheme supports the incorporation of manure in arable soils within twelve hours of application, which will reduce the amount of nitrous oxide emissions from agricultural soils. As for fertilisation plan, according to Polish experts, many farmers might already be implementing this practice. Third, it supports the

[10] Burning arable crops emits GHGs but remains little used at European level (Alliance Environment and Ricardo-AEA, 2018)

application of liquid natural fertilisers directly to the soil (e.g. by methods other than spraying). This contributes to a better use of nutrients available in natural fertilisers while reducing emissions of nitrous oxide, but might require the purchase of expensive machinery, that should therefore be supported by investment aids. However, while support for these practices may have positive effects in reducing GHG emissions, given the structure of this eco-scheme (see box 1), farmers could choose other practices that do not have an impact on GHG emissions, especially if they are easier to implement. Moreover, the eco-scheme does not seem to be encouraging farmers to adopt the targeted practices beyond a minimum level, thus reducing the potential benefits. Interestingly, after a year of implementation of the Strategic Plan, the implementation of the eco-scheme will be assessed, and the interventions will be reviewed to ensure that the objectives are met. Overall, the support of these three practices via the eco-scheme amounts to a substantial budget of 1.1 billion euros (6.1% of the direct payments' budget) and targets a large share of the Polish UAA (around 32.8%, mostly through the fertilisation plan and incorporation of manure). Yet, the area targeted for the use of liquid natural fertilisers by methods other than spraying is small (40,000 ha, 0.28% of the UAA), limiting the potential benefits brought by this practice.

Some sectoral interventions[11] (I 7.5) and investment aid (I 10.4), also target investments related to reducing GHG emissions. In particular, they support investments in systems contributing to the reduction of fertiliser use and greenhouse gases emissions, such as the purchase of machines and equipment for low-emission fertiliser application (e.g. direct soil application, application of fertilisers using digital solutions), equipment for storing natural fertilisers, air purification systems form livestock buildings, etc. While the investment aid (I 10.4) benefits from a budget of €217m (2.9% of Pillar II funding), the budget for sectoral interventions targeting environmental and climate action in the fruit and vegetable sector is not specified in the Plan.

The Plan also proposes interventions aiming at reducing CO_2 emissions from energy consumption, even if these emissions are relatively low in Poland. For instance, investment aid 'I 10.2' supports investments in new equipment for the production of energy from agricultural biogas (to the extent that it only covers the farm's own energy needs), installations producing energy from solar radiation (ibid.), energy storage and energy management systems or heat pump systems, and in systems for improving the energy efficiency of farm buildings (e.g. heat recovery systems).

[11] For fruit and vegetable producer organisations and their associations.

Poland also plans to use coupled income support for cows and young cattle in the next period, which could run counter to efforts to reduce emissions. The payments will be granted according to the number of eligible cows (females over 24 months) and young cattle (males and female below 24 months) up to a limit of 20 heads. These payments aim to counter the declining trend of the cattle population, which is particularly prevalent in farms with small herds, i.e. up to 20 animals[12]. However, these farms still strongly dominate cattle farms, accounting for most farms (about 84.3%). Thus, coupled support will contribute to maintaining cattle numbers, in contrast to climate objectives and the lack of measures to reduce Poland's livestock emissions. Some researchers have therefore highlighted the need to phase out this kind of support since they are not the best tool for income support and productivity while being negative for the climate (Peyraud and MacLeod, 2020). Nevertheless, maintaining livestock on small farms in areas that are specialising in crop production could provide other environmental benefits, e.g. maintaining closed nitrogen cycles.

In summary, the Plan generally focuses on reducing non-CO_2 emissions from agricultural soils, that is, mainly, from fertilisation and manure management practices and CO_2 emissions through renewable energy production and energy efficiency improvements. However, it fails to provide estimates on the mitigation potential of these measures.

Table 1 below presents the Strategic Plan's standards and interventions that are explicitly mentioned by Poland as contributing to specific objective 4 on climate, and more specifically to the need to reduce GHG emissions. Their main benefits and limitations are also discussed in the Table. The budget of each intervention is provided in the Annex.

[12] Indeed, between 2006 and 2019, the number of farms with herds of up to twenty animals decreased by almost 49% between 2006 and 2019 (Ministry of Agriculture and Rural Development of Poland, 2022). Accordingly, the share of animals in farms with fewer than twenty animals decreased from 65.2% to 35.5% in the same period.

Table 1: Potential impact of interventions on GHG emissions

Source of emissions	Standard or intervention (number)	Potential benefits and/or limitations
GHG emissions from crop and livestock systems	GAEC 3 ban on burning arable crops	- potential benefits for carbon storage and soil quality (in particular soil organic carbon) - introduction of this GAEC simply outlawed a practice that was not very much used, thus additional benefits of this GAEC are negligible
	Eco-scheme: Carbon farming and nutrient management (I 4.2)	- supports several types of agricultural practices, some of which can reduce GHG emissions on farms, including the development and compliance with a fertilisation plan, the incorporation of manure in arable soils within 12 hours of application, the use of liquid natural fertilisers by methods other than splashing and extensive ruminant systems on permanent grassland - total budget for these three practices of €1.3bn (7.7% of direct payments' budget) - small area targeted[13] for the use of liquid natural fertilisers by methods other than splashing (40,000 ha, 0.28% of the UAA) - relatively high stocking rate allowed on permanent grassland (maximum 2 livestock unit (LSU)/ ha) - farmers are allowed to choose between different practices and might focus on the easiest ones/ the ones with the lowest environmental and climate benefits; they might also choose practices that are not related to GHG emissions' reduction
	Eco-scheme: Retention of water on permanent grassland (I 4.5)	- supports water retention on permanent grassland in areas where flooding occurs, thus assumed, in the Plan, as reducing carbon dioxide emissions into the atmosphere (by reducing the decomposition of organic matter)

[13] Due to the implementation details of the eco-scheme, farmers can choose between various practices. The "area targeted" for each practice is thus complicated to estimate and the value provided in the Plan is a rough estimate from the Ministry.

		- due to implementation details (only 12 days of flooding required), the practice does not guarantee permanent ceasing of the decomposition of peat matter, thus will not reduce relevant GHG emission significantly - limited only to grasslands where some other interventions are implemented at the same time, thus reducing the mitigation potential significantly - relatively small budget of €97m (0.56% of Pillar I budget), small payment per ha that is not very attractive for farmers, and insufficient area targeted (315,000 ha every year, 2.2% of the UAA), thus reducing the mitigation potential of this intervention
	Sectoral interventions for fruits and vegetables: Action to protect the environment and mitigate climate change (I 7.5)	- supports investments for the environment and climate in fruit and vegetable producer organisations, including in systems contributing to the reduction of greenhouse gases emissions and in machinery or equipment for low-emission application of fertilisers - requires producer organisations to submit an independent expert opinion confirming that the planned investment will contribute to an improvement of at least 15% compared to the initial situation (i.e. in terms of emissions) - no indication on the budget for this intervention in the Plan - the targeted emissions are negligible compared to the total emissions of the agricultural sector
	Investments contributing to environmental and climate protection (I 10.4)	- supports investments for the environment and climate, including the purchase of machinery and equipment to reduce fertiliser use and emissions of greenhouse gases - budget of €217m, 2.9% of Pillar II funding - not clear how much of this total budget will aim to reduce GHG emissions, but according to result indicator R.16 only 1.12% of Polish farms will receive

		investment support for climate-related projects
GHG emissions from energy consumption	Investments in agricultural holdings in the field of renewable energy supply and energy efficiency improvement (I 10.2)	- supports investments in new equipment for the production of energy from agricultural biogas, installations producing energy from solar radiation, energy storage and energy management systems or heat pump systems, and in systems for improving the energy efficiency of farm buildings (e.g. heat recovery systems) - only supports investments in installations covering only the beneficiary's own energy needs, thus mitigating potential negative impacts (e.g. the industrialisation of biogas production on farms) - substantial budget of €268m, 3.5% of Pillar II budget
	Sectoral interventions for fruits and vegetables: Action to protect the environment and mitigate climate change (I 7.5)	- supports investments for the environment and climate in fruit and vegetable producer organisations, including in installations producing energy from renewable energy sources used for the purposes of the activities of the organisation - requires producer organisations to submit an independent expert opinion confirming that the planned investment will contribute to an improvement in the environment of at least 15% compared to the initial situation (i.e. in terms of emissions) - the targeted emissions are negligible compared to the total emissions of the agricultural sector

2.2 Carbon storage

2.2.1 State of play in Poland and resulting needs

According to data provided by the Ministry of Climate and Environment, the Land Use and Land-Use Change and Forestry (LULUCF) sector in Poland is a net carbon sink (Ministry of Climate and Environment of Poland, 2021). In 2019, it absorbed 15 million tonnes of CO_2 equivalent ($MtCO_2e$), thus compensating for 3.8% of total Polish GHG emissions. CO_2 removals principally happened in forest areas (-15 $MtCO_2$, 72.6% of the total net CO_2 removals in the LULUCF sector), and to a lesser

extent in cropland (-0.9 $MtCO_2$, 4.4%) and grassland (-0.1 $MtCO_2$, 0.5%). Overall, LULUCF carbon removals increased between 1988 and 2004 and then started to decrease (by 20.8% between 2003-2005 and 2012-2014, and by 25% between 2012-2014 and 2017-2019), mainly because of changes in forest growth. Regarding grassland, their share in the Polish UAA has been stable since 2000 (around 21-22%) but remains below the EU average of 31% (European Commission, 2020). As a result, Poland could increase its carbon removals in agricultural land by strengthening its support for agroforestry, the introduction of trees in the UAA, the conversion of arable fields into grassland, the creation of wetland buffer zones, and carbon farming practices on arable land and permanent crops (e.g. intermediary/interim crops, soil cover, etc.).

Nevertheless, the officially reported data presented above does not correctly include emission from peatlands drained for agricultural purposes. Peatlands cover 9.6% of Polish soils and their drainage for agriculture, forestry and peat extraction generates net GHG emissions. In Poland, it is estimated that around 1,110,500 ha of peatlands are in agricultural use and therefore need to be rewetted (Kotowski, 2021). As a result, Poland is one of the largest EU peatland emitters (Greifswald Mire Centre, 2020). A recent review by (Kotowski, 2021), estimates that CO_2 emissions from drained peatlands in agricultural use are around 23.5 million tonnes annually in Poland. Together with other GHG components, the global warming potential of drained peatland is estimated at 30.3 $MtCO_2e$ annually. As such, the Polish LULUCF sector would be a net emissions source, emitting around 15 million $MtCO_2e$ annually. These emissions can be significantly reduced by raising water levels near to the surface. According to estimates, rewetting just 4% of agricultural land in Poland would save up to 41% of agricultural greenhouse gas emissions (ibid.). Furthermore, healthy peatlands are not consistent with conventional agricultural land use. Maintaining agricultural production on peatland therefore requires a paradigm shift towards new agricultural systems, such as paludiculture[14], as mentioned in the draft of the Polish Wetland Strategy (General Directorate for Environment Protection, 2021b).

2.2.2 Planned interventions

The Polish Strategic Plan includes several standards and interventions that are targeting woody landscape features, afforestation and agroforestry could thus contribute to increase carbon storage in above-ground biomass.

[14] Paludiculture is defined as productive land use of wet peatlands that stops subsidence and minimises emissions.

First, the GAEC 8 standard requires farmers to maintain a minimum area of arable land under landscape features and fallow land, including in hedgerows and aligned trees. While this could help store carbon in agricultural landscapes, Poland has chosen to use the derogation for the year 2023[15], and to give exemptions to various types of farms (e.g. small farms and organic farms) thus significantly reducing the potential benefits for climate mitigation. Furthermore, the real area of non-productive features will be relatively small as a result of using weighting factors that are greater than one for most types of non-productive features. This was already the case with the green payment of the previous CAP. In addition, the list of landscape features included is limited in Poland.

Second, Poland offers three different kinds of investment aids to support afforestation (I 10.11), the establishment of trees in agricultural fields (I 10.12) and the establishment of agroforestry systems (I 10.13). These measures have the potential to increase carbon storage on agricultural land, but their contribution may be marginal because their budgets are quite small and they target a negligible area. Moreover, their interrelation with GAEC 8 is not clearly explained in the Plan, it is therefore possible that the support for the planting of trees in the fields (I 10.12) finances the compliance of some farmers with GAEC 8 rules. Third, Poland proposes two environmental and climate commitments for the maintenance and management of trees on agricultural land. The first one to compensate the cost of maintenance and management of afforested areas, trees and agroforestry on agricultural land (I 8.8). The second one targets the maintenance and management of traditional orchards (I 8.4). However, as with the investment aid (I 10.11-10.13), the budgets allocated to these interventions are low, making it impossible to commit a sufficient area to generate substantial benefits in terms of carbon storage. Indeed, taken together, all these interventions to foster carbon storage in trees represents only 0.42% of Pillar II budget. The potential impact of all tree-related measures also depends on future use of planted trees, i.e. benefits may be reversed in the future by tree harvesting.

The Plan also includes several standards and interventions aiming to increase carbon storage in agricultural soils. GAEC 1 and GAEC 9, for instance, both target the maintenance of permanent grassland and thus can contribute to carbon storage. GAEC 1 specifically aims to maintain the share of permanence grassland in the Polish UAA. However, again, Poland did not choose the most ambitious options. Indeed, Poland's definition of permanent grassland still allows

[15] In July 2022, the European Commission adopted a regulation to provide derogations from Regulation (EU) 2021/2115 of the European Parliament and of the Council as regards the application of the standards for good agricultural and environmental conditions of land (GAEC standards) 7 and 8 for claim year 2023.

ploughing, tilling and reseeding, thus reducing the potential benefits of maintaining permanent grassland. Moreover, Poland has no system for limiting the conversion of grassland before the threshold of 5% of the total existing area is reached.

As regards interventions, two eco-schemes might contribute to carbon storage in agricultural soils. The first one is the eco-scheme for carbon farming and nutrient management (I 4.2), that supports a variety of practices likely to increase soil organic matter and carbon in soils. They include extensive grassland management, the use of winter crops and intercrops, crop diversification, the incorporation of manure in arable soils, reduced tillage and the incorporation of straw in soils. The support for the extensive use of permanent grassland is interesting, as it includes a ban on ploughing grasslands that can contribute to carbon storage and provide co-benefits for biodiversity. However, it allows for a rather high stocking rates (up to 2 LSU/ha), thus reducing its potential environmental and climate benefits. More generally, as mentioned above, the effectiveness of this eco-scheme will ultimately depend on the practices chosen by farmers. They could choose practices that have low impact on carbon storage, especially if they are easier and cheaper to implement, at the expense of the most beneficial ones (e.g. the extensive use of permanent grassland). Interestingly though, as mentioned, the implementation of the eco-scheme will be assessed after a year. Overall, there is a substantial budget of 1.9 billion euros for these six practices via the eco-scheme (11.3% of the direct payments' budget) and the targeted coverage represents a large share of the Polish UAA (around 40.6%). The second eco-scheme that might improve carbon storage is the one targeting water retention on permanent grassland as it reduces the decomposition of organic matter. However, it is limited to grasslands where some other interventions are implemented at the same time (e.g. the eco-scheme on the extensive use of permanent grasslands), limiting adoption and thus the potential benefits for carbon mitigation.

The three environmental and climate commitments aiming to conserve valuable habitats and endangered species in Natura 200 sites (I 8.1) and outside of them (I 8.2) and to promote the extensive use of meadows and pastures in Natura 2000 sites (I 8.3) might also contribute to increasing carbon storage, even if this is not their main objective. Indeed, they require specific mowing and grazing management practices (e.g. rules on the mowing frequency or dates) that might be beneficial for carbon storage in soils. However, if mowing the meadow is impossible due to high water levels, the beneficiary is required to return the

support received for mowing in previous years of the contract, thus encouraging farmers to drain their land[16].

Finally, as regards the protection of peatlands and wetlands, Poland will only implement GAEC 2 on the protection of peatland and wetland in 2025, and its rules are not yet defined, it is therefore not possible to estimate its potential contribution to carbon storage. According to recent declarations of the Polish authorities, GAEC 2 might be interpreted only as a ban on ploughing organic soils covered by permanent grasslands in 2025, but will not prohibit the degradation of organic soils already ploughed and the continuation of their drainage[17]. Furthermore, the Plan does not include any intervention to support peatland rewetting and paludiculture, which runs counter to observed needs.

In total, Poland plans to have approximately 38% of its UAA under declared commitments to enhance carbon storage (target for R.14[18]), covering a wide variety of practices and types of land. However, most of this area is covered by the eco-scheme on carbon farming and nutrient management (I 4.2) and by the support for organic farming (I 8.11), whose impact on carbon storage remains unclear. The other relevant interventions have small budgets and targeting small agricultural areas. Crucially, no interventions are planned to support peatland rewetting and paludiculture, and the implementation of GAEC 2, the details of which have yet to be defined, is delayed.

Table 2 below presents the Strategic Plan's standards and interventions that are explicitly mentioned by Poland as contributing to specific objective 4 on climate, and more specifically to the need to improve carbon storage in agricultural lands[19]. Their main benefits and limitations are also discussed in the Table.

[16] This information was provided by national experts.

[17] This information was provided by national experts.

[18] Interventions included in the calculation of R.14 : eco-schemes I 4.2 and I 4.5, environmental and climate commitments I 8.1, I 8.2, I 8.3, I 8.8, I 8.11, and RDP 2014-2020 interventions I.8.9.1, I.8.9.2 and I.8.9.3.

[19] Contracts which were unfinished from the 2014-2020 RDP are carried over in the Plan to cover the remainder of the contracts. They include the environmental and climate commitment for the protection of habitats and endangered bird species in Natura 2000 sites (I.8.9.1, replaced by AND 8.1), the environmental and climate commitment for the protection of habitats and endangered bird species outside of Natura 2000 sites (I.8.9.2, replaced by AND 8.2) and the environmental and climate commitment for sustainable agriculture (I.9.8.3, partially replaced by the eco-scheme 4.2 on carbon farming and nutrient management). They are not described in details in the Plan and are not included in the Table.

Table 2: Potential impact of interventions on carbon storage

Carbon stock	Standard or intervention (number)	Potential benefits and limitations
Trees and shrubs (biomass)	GAEC 8 landscape features and fallow	- in theory supports carbon storage in woody landscape features and in soils (e.g. in fallow) - will not be implemented in 2023 (use of derogation) - provides exemption for small farms (<10ha) and farms with grassland, leguminous plants and fallow on more than 75% of their UAA), which significantly reduces the potential impact - the real area of non-productive features will be reduced because of using weighting factors greater than 1 for most non-productive feature types - limited list of non-productive features types (e.g excludes small wetlands, patches of biodiverse non-productive herbaceous vegetation)
	Environmental and climate commitment: Reforestation and tree premiums and agroforestry systems (I 8.8)	- compensates the cost of maintenance and care of afforested areas, in-field trees and agroforestry systems that have been created with the support of other measures - there is no evidence that caring for these trees leads to increased carbon storage - small budget (€8m, 0.1% of Pillar II budget) and small target area (maximum 8,548 ha for the year 2028, 0.1% of the UAA, less in 2023-2027)
	Investment aid: Afforestation of agricultural land (I10.11)	- supports afforestation on both agricultural and non-agricultural land - includes various safeguards linked to the species composition (e.g. only native species, preference for deciduous species, composition adapted to the habitat, creation of ecological corridors) - only on land for which an afforestation plan is drawn up by the authorities - the measure may contribute to carbon storage in wood, but long-term effect is not fully secured, due to the future harvesting of trees

		- small budget of €11m (0.15% of Pillar II budget) and small area targeted (500 ha every year), thus reducing the mitigation potential of this intervention
	Investments: Creation of in-field trees (I 10.12)	- supports establishing in-field trees to increase carbon sequestration - a detailed list of species allowed will be defined in national legislation - includes various safeguards linked to the species composition (e.g. only native species, etc.) - small budget of €6m (0.08% of Pillar II budget) and small area targeted (387 ha every year), thus reducing the mitigation potential of this intervention
	Investments: Establishment of agroforestry systems (I 10.13)	- supports the establishment of new agroforestry systems - includes various safeguards linked to the species composition (e.g. only native species, etc.) - small budget of €6m (0.08% of Pillar II budget) and small area targeted (975 ha every year), thus reducing the mitigation potential of this intervention
	Environmental and climate commitment: Preservation of orchards of traditional varieties of fruit trees (I 8.4)	- supports the maintenance of old varieties of fruit trees, thus indirectly of carbon storage in their biomass- not clear if old varieties of fruit trees store more carbon than new ones, that would be used instead - requires the proper management of these orchards, the prohibition of the use of chemical plant protection products and the use of an agri-environmental activity plan - very small budget (€0.7m, 0.001% of Pillar II budget) and very small area targeted (max 492 ha per year, less than 0.01% of the UAA), thus reducing the potential benefits for carbon storage
Arable land (soils)	GAEC 7 on crop rotation	- requirements for crop diversification and rotation - mixed evidence on benefits for soil organic carbon - use of derogation for the year 2023, exemptions for: small farms (<10ha), farms

		with grassland, leguminous plants and fallow on more than 75% of their arable land, farms with permanent grassland on more than 75% of their UAA), and organic farms, - crop rotation only mandatory on 40% of the land every year - crop diversification criteria similar to previous greening criteria, therefore not likely to bring additional benefits
	GAEC 8 on landscape features and fallow	- supports carbon storage in fallow areas - will not be implemented in 2023 (use of derogation) - provides exemption for small farms (<10ha) and farms with grassland, leguminous plants and fallow on more than 75% of their UAA
	Eco-scheme: Carbon farming and nutrient management (I 4.2)	- supports several types of agricultural practices, some of which can foster carbon storage in arable land, including the use of winter catch crops, crop diversification, the incorporation of manure in arable soils, reduced tillage and the incorporation of straw in soils - total budget for these five practices of €1.6bn (9.7% of direct payments' budget) - crop diversification criterion sets maximum for the use cereals and rapeseed, and for crops that are bad for the balance of soil organic matter and minimum for crops that are good for soil organic matter, but does not provide details about which crops were classified as such - farmers are allowed to choose between different practices and might focus on the easiest ones/ the ones with the lowest environmental and climate benefits; they might also choose practices that are not related to carbon storage - not clear if farmers are encouraged to adopt the targeted practices beyond the minimum level necessary to receive the payment
	GAEC 1 on permanent grassland	- maintenance of carbon stocks

Permanent grassland (soils)		- Poland's definition of permanent grassland allows ploughing, tilling and reseeding, thus reducing the potential benefits of maintaining permanent grassland - the ratio has to be maintained at the national level rather than at the regional or agricultural holding level so more valuable grasslands can be lost in favour of less valuable ones elsewhere - no system to discourage conversion before 5% of the national area of permanent grassland is being lost (as in France, where such a system is activated as soon as 2% of the regional area of permanent grassland is lost) - no ban on pesticides or fertiliser use on permanent grassland, thus reducing positive effect for resources and biodiversity - no ban on activities causing soil carbon degradation on remaining permanent grasslands (such as the continued drainage of peatlands still covered by grasslands)
	GAEC 9 on permanent grassland in Natura 2000 areas	- maintenance of carbon stocks, ban on ploughing (required in the EU CAP regulation) - only includes valuable grassland that have conservation plans laying down specific measures or those identified by the environmental authorities - high discrepancy between the area of environmentally-sensitive permanent grasslands which protected under GAEC 9 (269,000 ha) and the area of such type of habitats declared in the Prioritised Action Framework (hereafter PAF) for Natura 2000 (523,540 ha) (General Directorate for Environment Protection, 2021a) - no ban on activities causing soil carbon degradation on remaining permanent grasslands (such as the continued drainage of peatlands still covered by grasslands)
	Eco-scheme: Carbon farming and nutrient management (I 4.2)	- supports the extensive management of grassland

		- total budget for this practice of €275m (1.59% of direct payments' budget) and area targeted 500,400 ha every year (3.5% of the UAA and 16% of the permanent grasslands) - the support extensive use of grassland allows for relatively high stocking rate, the maximum being set at 2 LSU/ ha of permanent grassland - farmers are allowed to choose between different practices and might focus on the easiest ones/ the ones with the lowest environmental and climate benefits; they might also choose practices that are not related to carbon storage - no ban on activities causing soil carbon degradation on remaining permanent grasslands (such as the continued drainage of peatlands still covered by grasslands) - not clear if farmers are encouraged to adopt the targeted practices beyond the minimum level necessary to receive the payment
	Eco-scheme: Retention of water on permanent grassland (I 4.5)	- supports water retention on permanent grassland in areas where flooding occurs, thus reducing the decomposition of organic matter - limited to permanent grasslands where other interventions are implemented (e.g. eco-scheme on the extensive use of permanent grasslands) - details of implementation do not guarantee prevention of organic matter decomposition (the soil is required to me maintained wet only by 12 days in year, then can be drained) - relatively small budget of €97m (0.56% of Pillar I budget) and small area targeted (315,000 ha every year, 2.2% of the UAA, 9.8% of permanent grasslands), thus limiting the mitigation potential of this intervention
	Environmental and climate commitment: Conservation of valuable habitats and endangered species in Natura 2000 sites (I 8.1)	- aims to prevent the deterioration of, or restore favourable conservation status in, Natura 2000 sites, such as specific meadows, grasslands, or mires

		- requires specific requirements, including some mowing and grazing management practices, bans the use of plant protection products, requires an agri-environmental activity plan - the commitment includes an additional result-based component, but it is not described in the Plan - substantial budget of €237m, 3.1% of Pillar II budget but relatively low level of payment - reaching more than 364,000 ha in 2028, 1.8% of the Polish UAA and 11.4% of the permanent grassland area – incoherent with the needs and expectations in Prioritised Action Framework for Natura 2000 (523,540 ha) - ban on new drainage but continuation of existing drainage still allowed, thus the prevention of soil carbon degradation is not fully guaranteed - if mowing the meadow is impossible due to high water level, the beneficiary is required to return the support received in previous years of the contract for mowing this meadow, thus encouraging farmers to drain their land
	Environmental and climate commitment: Protection of valuable habitats and endangered species outside Natura 2000 sites (I 8.2)	- aims to prevent the deterioration or restore favourable conservation status outside of Natura 2000 sites, such as specific meadows, grasslands, or mires - requires specific requirements, including some mowing and grazing management practices, bans the use of plant protection products, requires an agri-environmental activity plan - the commitment includes an additional result-based component, but it is not described in the Plan - substantial budget of €301m, 4% of Pillar II budget, but relatively low level of payment - reaching more than 350,000 ha in 2028, 2.4% of the Polish UAA and 11.0% of the permanent grassland area - ban on new drainage but continuation of existing drainage still allowed, thus the

		prevention of soil carbon degradation is not fully guaranteed - if mowing the meadow is impossible due to high water level, the beneficiary is required to return the support received in previous years of the contract for mowing this meadow, thus encouraging farmers to drain their land
	Environmental and climate commitment: Extensive use of meadows and pastures in Natura 2000 sites (I 8.3)	- support extensive agricultural use of meadows and pastures on permanent grassland situated in Natura 2000 sites - includes specific requirements related to mowing and grazing management practices, a ban on the use of plant protection products, the use of an agri-environmental activity plan, limited fertilisation - small budget of €17.7m, 0.23% of Pillar II budget and small target area (31,358 ha in 2028, 0.2% of the UAA). - ban for new draining but continuation of existing drainage still allowed, thus the prevention of soil carbon degradation is not fully guaranteed - if mowing the meadow is impossible due to high water level, the beneficiary is required to return the support received in previous years of the contract for mowing this meadow, thus encouraging farmers to drain their land
Peatland and wetland (soils)	GAEC 2 on wetland and peatland restoration and protection	- not starting before 2025 - effectiveness will depend on the requirements, that are not yet defined - according to the relevant authorities, will be implemented in Poland as ban for new ploughing of permanent grasslands on peat soils, but peat degradation by continuation of ploughing or by continuation of drainage will be still allowed
All types of land	Environmental and climate commitment: Organic farming (I 8.11)	- supports organic farming, whose practices may reduce the loss of organic matter in soils (e.g. improved crop rotation) - impact on soil carbon resources is not clear

		- includes additional requirements that might favour carbon storage such as the maintenance of permanent grassland - includes an additional premium for sustainable crop and animal production if the stocking rate on the holding is between 0.5 and 1.5 LSU/ha - substantial budget of €905m (11.9% of the Pillar II budget) - will not allow Poland to reach the Farm to Fork target for organic farming (4.5% of the UAA targeted by support while currently only 3.5% of the UAA is under organic farming)
	Investments contributing to environmental and climate protection (I 10.4)	- supports investments to enhance soil sequestration through proper land use, for instance the purchase of new machinery or equipment for reduced tillage practices (e.g. belt cultivator, thicker, chisel cultivator), for soil protection (e.g. mulching), for the maintenance of in-field trees, agroforestry systems and permanent grassland. - budget of €217m, 2.9% of Pillar II funding - not clear how much of this total budget will aim to improve carbon storage, but according to result indicator R.16 only 1.12% of Polish farms will receive investment support for climate-related projects

2.3 Climate adaptation

2.3.1 State of play in Poland and resulting needs

In terms of climate adaptation, Poland faces changing weather patterns, with winters getting wetter and warmer, summers getting hotter and drier, and an increasing frequency of extreme weather events such as heavy rains and drought (Ministry of the Environment of Poland, 2020). In parallel, the risk of soil erosion is increasing[20] (European Commission, 2020). These changes affect Polish agriculture in various ways.

[20] The contribution of the Polish CSP regarding soil erosion is analysed in more detail in section 3.2

Regarding crop production, the changes in temperature extend the growing season length, thus improving conditions for thermophilic plants such as corn, sunflower, soy, vines and wheat. However, these potential advantages will often be balanced out by the risk of late frost and an increased risk of early spring and summer heat waves (Ceglar et al, 2019). Moreover, temperature changes are also likely to increase the occurrence of pests and diseases (EEA, 2019a).

In parallel, the increased frequency and intensity of droughts is affecting the production of arable crops, which can have an impact on farmers' income. In recent years, droughts have become an annual occurrence. In 2018, for instance, farmers in North-Western Poland faced crop failure, as an intense drought took place (EEA, 2019a). In addition, in upcoming decades, drought events will cause an increased demand for water for irrigation, increasing the pressure on water resources and reducing the suitability for rainfed crop production. This problem will particularly affect the Wielkopolskie province, Kujawy and Western and Central Poland (Ministry of the Environment of Poland, 2020). Excess precipitation events also pose a threat to plant production as they can lead to crop damage (either directly or indirectly because of excessively wet soils[21]) and to soil erosion in agricultural fields.

The vulnerability of agroecosystems to extreme water conditions is reinforced by past mistakes in water management in Poland: drainage of most peatlands, extensive drainage systems without water retention possibilities, excessively deepened rivers in agricultural landscapes, continuous "river maintenance" works increasing water flow, wetland degradation and general lack of nature-based solutions.

As regards animal production, climate change affects livestock systems, and therefore the productivity of the sector, directly and indirectly (EEA, 2019a). Livestock is affected directly through effects on animal health and welfare, for instance increases in the number of very hot days heightens the risk of heat stress in animals. In parallel, livestock production systems can be affected indirectly, through impacts on feed, water resources and pathogens (ibid.). Climate change may lead to an increased risk of occurrence of infectious diseases which affect the health of farm animals and so far have been of lower importance (Ministry of the Environment of Poland, 2020).

[21] Excessively wet soils can directly damage crops, due to anoxic conditions, increased risk of plant disease and insect infestation, and delayed planting or harvesting because it is not possible to operate machinery. Nevertheless, in many cases the conditions considered as "excessively wet" by farmers are the only conditions preventing degradation of organic (peat) soils.

It is therefore necessary to adapt Polish agricultural systems to new climate and geographical conditions: relocating production, adapting the types of crops cultivated (e.g. by supporting drought-resilient, less water intensive crops), supporting practices that reduce the risk of infection by pathogens (e.g. crop rotation), developing cooling systems in stables and shelters to reduce heat stress, improving the management of floodplains and adopting soil health enhancing practices, for instance by promoting nature-based solutions that improve soil moisture in dry areas and drainage in flooded areas and provide shade for livestock. As underlined in the new EU Strategy on Adaptation to Climate Change, nature-based solutions are particularly well suited for resilience to water-related stressors (European Commission, 2021).

2.3.2 Planned interventions

The Polish Plan includes three environmental and climate commitments to support orchards of traditional varieties of fruit trees (I 8.4), traditional and rare crop species (I 8.5) and traditional animal breeds (I 8.6), that might be more resilient to climate change than conventional systems and industrial varieties and species. However, the supports for traditional orchards and crop species have low budgets and are limited in terms of the total area targeted, thus the climate adaptation impact of these measures is likely to be negligible. To provide real benefits for climate adaptation, this support should be extended to encourage the transition of more farms. This support should also be targeted to the regions most sensitive to climatic hazards, in particular to drought. In these areas, additional support should also be provided for crops that are more resilient to drought and less water intensive, which are not specifically supported yet in the Plan.

The Plan also supports practices that reduce the risk of infection by pathogens and improve farms' resilience through diversification, such as crop rotation or diversification, through the GAEC standard 7 and the eco-scheme on carbon farming and nutrient management (I 4.2). However, the crop rotation requirements from GAEC 7 only requires annual crop rotation on 40% of the agricultural area and the crop diversification criteria does not substantially differ from the former diversification criteria of the green payment, which was already weak. Furthermore, Poland will not apply this standard for the year 2023 (using the derogation offered), uses weighting factors and gives exemptions to various types of farms (e.g. small farms and organic farms) thus reducing the potential benefits for climate adaptation. As a result, the potential impact of GAEC 7 on crop rotation and diversification practices at the national level remains unclear, and more information on current practices would be needed to estimate it. Regarding the eco-scheme, the support for crop diversification requires farmers

to grow at least 3 crops, which does not seem sufficiently ambitious. On the positive side, it limits the area allocated to crops that have a negative impact on soil organic matter and promotes crops that are beneficial to this objective. This way, it supports improvements in soil quality, thus increasing the climate resilience of farms. However, the Plan does not clearly explain which crops are considered good or bad for soil organic matter and whether they are also drought resilient. This intervention might therefore encourage farmers to grow water intensive crops, contrary to the need for adaptation.

The adaptation of crop and livestock systems is also supported by investments aid and sectoral interventions (for the fruit and vegetable sector), for instance through installations for improving ventilation or lowering the temperature of livestock buildings, for animals other than pigs and cattle (e.g. poultry).

Finally, as mentioned in section 2.2, various interventions aim to increase soil organic carbon and carbon storage in biomass, thus improving soil moisture in dry areas and water regulation services, in particular in areas where flooding occurs, and providing shade for livestock. The Plan states that the eco-scheme for water retention on permanent grassland (I 4.5) directly contributes to improving floodplain management, but its impact might be negligeable given that it targets a very small area of land and is limited to grasslands where other interventions are implemented (e.g. the eco-scheme on the extensive use of permanent grasslands with livestock).

Overall, most of the support aiming to improve climate adaptation focuses on using nature-based solutions to increase farm's agronomic resilience, thus bringing additional benefits for the environment and climate. However, some practices that could increase farm resilience are not supported by the Polish Strategic Plan. For instance, no intervention aims to address the need to switch to water-saving crops in in areas where drought will become more frequent. Since the expected changes in the length of the growing season could improve the temperature conditions for some water-intensive crops such as maize, such support, together with limitations on the areas dedicated to these water-intensive crops, seems even more important to implement. Furthermore, interventions supporting certain practices beneficial to farm resilience still have weak requirements (e.g. crop diversification). There is also no intervention supporting wetland or peatland rewetting and the implementation of GAEC 2 is delayed until 2025.

Table 3 below presents the standards and interventions that are explicitly mentioned by Poland's Strategic Plan as contributing to specific objective 4 on climate, and more specifically to the need of climate adaptation in agriculture. Their main benefits and limitations are also discussed in the Table.

Table 3: Potential impact of interventions for climate adaptation

Type of system	Standard or intervention (number)	Potential benefits and limitations
Adapted crop production systems	GAEC 7 on crop rotation	- requirements for crop diversification and rotation, potentially improving the climate resilience of crops and delivering a range of ecosystem services (e.g. improved soil quality) (EEA, 2019a) - nature-based solution that will increase the resilience of the whole ecosystem - use of derogation for the year 2023, exemptions for: small farms (<10ha), farms with grassland, leguminous plants and fallow on more than 75% of their arable land, farms with permanent grassland on more than 75% of their UAA), and organic farms - crop rotation only mandatory on 40% of the land every year - crop diversification criteria similar to previous greening criteria, therefore not likely to bring additional benefits - no preference for crops that are more resilient to extreme climate conditions
	Eco-scheme: Carbon farming and nutrient management (I 4.2)	- supports several types of agricultural practices, some of which can improve arable farms' resilience to climate change, including crop diversification and the introduction of winter crops - crop diversification criteria sets maximums for cereals and rapeseed, and for crops that are bad for soil quality, and minimums for crops that are good for soil quality, but does not provide details about which crops are classified as such - farmers are allowed to choose between different practices and might focus on the easiest ones/ the ones with the lowest environmental and climate benefits; they might also choose practices that are not directly related to climate adaptation - not clear if farmers are encouraged to adopt the targeted practices beyond the minimum level necessary to receive the payment

	Environmental and climate commitment: Preservation of orchards of traditional varieties of fruit trees (I 8.4)	- supports old varieties of fruit trees, that could be more resistant to climate change - requires the proper management of these orchards, the prohibition of the use of chemical plant protection products and the use of an agri-environmental activity plan - very small budget (€0.7m, 0.001% of Pillar II budget) and very small area targeted (max 492 ha per year, less than 0.01% of the UAA), thus making the potential benefits for climate adaptation negligible
	Environmental and climate commitment: Conservation of endangered plant genetic resources in agriculture (I 8.5)	- supports traditional and rare crop species of agricultural, vegetable and herbaceous plants, that could be more resistant to climate change - limited to 5 ha per holding, thus reducing the potential adaptation benefits (this support is more about preserving genetic diversity) - small budget (€6.8m, 0.09% of Pillar II budget) and small area targeted (max. 6,833 ha per year, 0.05% of the UAA), thus making the potential benefits for climate adaptation negligible
	Sectoral interventions for fruits and vegetables: Action to protect the environment and mitigate climate change (I 7.5)	- supports investments for the environment and climate in fruit and vegetable producer organisations, including to improve water use efficiency, for instance through the reuse of water from sorting and washing of fruit and vegetables or for collecting and storing water from the roofs of farm buildings. - The intervention requires producer organisations to submit an independent expert opinion confirming that the planned investment will contribute to an improvement of at least 15% compared to the initial situation (e.g. in terms of water use reduction) - no indication on the budget for this intervention in the Plan
Adapted livestock	Environmental and climate commitment: Conservation of	- supports the breeding of farm animals of traditional breeds, that could be more resistant to climate change

production systems	endangered animal genetic resources in agriculture (I 8.6)	- substantial budget (€101.8m, 1.3% of Pillar II budget) and number of animal targeted (max. 35.252 LSU per year, 23.8% of the LSU)
All systems (farm level)	Environmental and climate commitment: Conservation of endangered animal genetic resources in agriculture (I 8.6)	- supports the breeding of farm animals of traditional breeds, that could be more resistant to climate change - substantial budget (€101.8m, 1.3% of Pillar II budget) and number of animal targeted (max. 35.252 LSU per year, 23.8% of the LSU)
Soil quality enhancing practices	Interventions contributing to improving carbon storage in soils, listed in section 2.2, and to reducing the risk of soil erosion, listed in section 3.2.	
Floodplain management	GAEC 2 on wetland and peatland restoration and protection	- not starting before 2025 - effectiveness will depend on the requirements, that are not yet defined - according to the relevant authorities, will be implemented in Poland only as ban for new ploughing of permanent grasslands on peaty soils, but peat degradation by continuation of ploughing or by continuation of drainage will be still allowed
	Eco-scheme: Retention of water on permanent grassland (I 4.5)	- supports water retention on permanent grassland in areas where flooding occurs, thus theoretically contributing to floodplain management - limited to permanent grasslands where other interventions are implemented (e.g. eco-scheme on the extensive use of permanent grasslands) - relatively small budget of €97m (0.56% of Pillar I budget) and small area targeted (315,000 ha every year, 2.2% of the UAA), which might not be sufficient to properly manage floods

3. CONTRIBUTION TO THE PROTECTION OF NATURAL RESOURCES

The following section focuses on interventions contributing to the protection of water quality, water availability and soil quality in the Polish Strategic Plan.

3.1 Water quality and availability

3.1.1 State of play in Poland and resulting needs

The quality of water ecosystems is assessed by the ecological and chemical status[22] of surface water and groundwater bodies as well as the balance of nitrate and phosphorus. In 2015, around 70% of Poland's surface water bodies were in less than good ecological status and 26% were failing to achieve a good chemical status (European Commission, 2020). For groundwater, around 8% are not in good chemical status (ibid.).

Diffuse agricultural pollution linked to nutrient inputs and pesticides use is one of the main pressures on inland water quality. It also contributes to the eutrophication of the Baltic Sea, Poland being its main contributor of nutrient inputs of agricultural origin. In the country, the nitrogen surplus increased by 45% from 1995 to 2017, stabilising around 45 kg/ha/y since the mid-2010s, close to the EU average (46.5 kgN/ha/year) (European Commission, 2020). According to the Ministry of Agriculture and Rural Development of Poland (2022), only 4 to 5% of surface water and groundwater bodies are contaminated by nitrates in Poland, the lowest share of monitoring stations with poor quality waters of the EU. (Ministry of Agriculture and Rural Development of Poland, 2022) Nevertheless, the results of the monitoring of water bodies status by the General Directorate for Environment Protection (2022) show excessive level of nitrates in 22% of river water bodies in Poland in 2016-2021. As regards phosphorus, the surplus increased between 1995 and 2006, and then decreased before stabilising in recent years. In 2016-2018, the phosphorus balance was around 2.2 kgP/ha/year (vs. 5.8 kgP/ha/year in 2008-2011 and 2.0 kgP/ha/year in 2012-2015), which is above the EU average (0.5 kg P/ha/year) (European Commission, 2020; Ministry of Agriculture and Rural Development of Poland, 2022). Excessive phosphorus levels were recorded in 17% of Polish rivers in 2016-2021 (General Directorate for Environment Protection, 2022). Finally, the Water Framework

[22] Chemical status relates to the presence of regulated chemical pollutants. Ecological status is an assessment of the quality of the structure and functioning of surface water ecosystems (European Environment Agency, 2020).

Directive reporting data show that in Poland, almost no exceedances of pesticide concentration thresholds in surface and groundwater were observed in the period 2013-2020 (European Environment Agency). However, sales of pesticides increased gradually between 2011 and 2017 and the risks associated with the use of more hazardous substances increased since 2012.

Regarding water quantity, the level can be assessed by the quantitative status of groundwater and the volume of renewable freshwater resources available. In 2015, around 96% of groundwater was meeting good quantitative status in Poland (European Commission, 2020), suggesting that water remains available overall but Poland has the fourth lowest renewable freshwater resources per 1000 habitats in the EU (1.6 million m^3 annual average) indicating low water retention capacity (European Commission, 2020). While Polish agriculture is mainly rainfed and thus not directly impacted by low levels of freshwater resources, withdrawals for agricultural irrigation (including also water for aquaculture) represented 9% of overall water abstraction in 2018 and the share of irrigated land in Poland increased by 191% between 2010 and 2016. Therefore, managing water resources sustainably is of prime importance in Poland (European Commission, 2020; OECD, 2019).

Hence, Poland needs to support agricultural practices aiming at further reducing the nitrogen and phosphorous balances, the reduction of agricultural runoff to water, and maintaining low pesticide use and water abstraction for irrigation. Such practices could include: the incorporation of legumes, as they reduce the need for mineral fertilisation; crop rotation, that enables reductions in pesticide use; improved fertilisation management; soil management practices that increase water retention capacity (e.g. establishment of hedges, soil cover and reduced tillage); water saving practices (e.g. recycling water, growing less water intensive crops); and the maintenance, restoration and creation of buffer zones (especially wetland buffer zones) that reduce pollutant runoff.

3.1.2 Planned interventions

Various measures target water quality in the Polish Strategic Plan. GAEC standard 4, requiring the presence of 3-metre-wide buffer strips along watercourses, has some positive effect on nutrient leaching and runoff. The standard forbids the use of fertilisers and plant protection products. However, it does not include requirements on the type of vegetation cover that can be used or on management practices (normal cultivation may be carried out, including ploughing). Buffer strips are also not required along most drainage ditches (those less than 5 metres-wide), thus nutrients still can reach water courses through small ditches. Moreover, the Plan does not include any additional requirement going beyond those defined in the Nitrate Programmes. As a result, the impact

of this GAEC standard on nutrients runoff is likely to remain limited, as well as the potential co-benefits of this standard for carbon storage and biodiversity. The Plan also supports organic farming (I 8.11), integrated plant production methods (I 4.3) and biological crop protection (I 4.4), thus reducing the use of chemical inputs that are damaging water quality. In addition, investment aids are proposed to farmers to support the purchase of machinery and equipment to reduce pesticides and fertiliser use and promote mechanical and biological pest management.

Other interventions are also targeting specific kinds of water pollutants. For instance, the eco-scheme on carbon farming and nutrient management (I 4.2) supports, amongst other practices, the development and implementation of a fertilisation management plan based on soil analysis, with the aim to adapt nutrient inputs to plants' needs and thus to reduce them in areas where the nutrient balance is positive (i.e. where inputs exceeds outputs). Another example is the eco-scheme on biological plant protection (I 4.4) which aims to reduce the risk of pollution from chemical pesticides. However, as the compliance checks of this intervention are only based on receipts of biological products purchases and registration of practices, and the use of chemical pesticides is still allowed in some cases (as is the case in the eco-scheme for integrated plant production I 4.3), it is not certain that this intervention will lead to a significant decrease in the use of chemical pesticides.

Overall, while the Plan includes several interventions that could contribute to improving water quality, many of them have a relatively small budget (e.g. the eco-schemes on integrated plant production or on biological plant protection). As a result, they might only have a negligible impact on fertiliser use and might not stop increasing pesticides sales in Poland. in Poland. Furthermore, and most importantly, while organic farming benefits from a significant budget (€905m, 11.9% of the Pillar II budget), it targets only 4.5% of the current Polish UAA. Given that, in 2020, only 3.5% of the agricultural area was under organic farming and that there is a decline in the organic farming area since 2012, Poland will not be able to reach the Farm to Fork target for organic agriculture by 2030 (e.g. 25% of UAA) and will most likely remain behind other EU countries in this area. Finally, the Plan does not provide incentives for introducing legumes into crop rotations to reduce the need for mineral fertilisation and does not encourage crop rotation further than what is proposed in the GAEC standard 7, which imposes crop rotation on only 40% of the arable land.

The Polish Plan also includes a number of practices aiming to improve water management in the country. Many of them (the eco-schemes I 4.2 and I 4.5, the environmental and climate commitment I 8.8, and the investment aids I 10.11-

10.13) aim to improve the water retention capacity of soils though nature-based solutions, for instance by supporting practices that improving soil organic carbon and matter or the introduction of trees on farmland. While this support is essential, once again, the budget allocated to these measures remains low, the only well-supported intervention being the eco-scheme on carbon farming and nutrient management (I 4.2). Also, the implementation details of the interventions do not guarantee an effective increase in water retention in soils.

In addition, the Plan proposes investment aids for farmers (I 10.4) and for fruits and vegetables producer organisations (I 7.5) to support improvements in water management, for instance infrastructures for storing water in closed tanks or installation to recycle water. Interestingly, Poland does not support investments in irrigation systems, that can, in some cases, have undesired effects[23]. Nevertheless, as mentioned in section 2.3, the Plan does not address the need to switch to water-saving crops in drought prone regions. Moreover, there is no support planned for practices that increase water retention in the agricultural landscape through nature-based solutions, such as rewetting peatlands, blocking drainage ditches or restoring wetland buffer zones. GAEC standard 4 does not include management requirements beyond the ban on chemical products (e.g. a ban on ploughing or rules on mowing), thus reducing the potential benefits for the environment and climate.

Table 4 below presents the interventions in Poland's Strategic Plan that are linked to objective 5 on resources and more specifically to the needs to protect water quality and improve water management. Their main benefits and limitations are also discussed in the Table.

Table 4: Potential impact of intevrentio0ns on water quality and availability

Challenge	Standard or intervention (number)	Potential benefits and limitations
Water quality	GAEC 4 buffer strips along watercourses	- some positive effect on nutrient leaching and runoff, nevertheless very limited by the implementation details - requirements on buffer strips along ditches only applies to those that are more than 5 metres wide, which in practice means that farmers can still use

[23] The evaluation of the impact of the previous CAP on water shows that irrigation investments, even if they must comply with water saving requirements, can have detrimental impacts on water use, for example where they lead to expansion of the overall irrigated area (Alliance Environnement, 2020).

		pesticides and fertilisers along most ditches - no obligation to use plant cover, possibility to have productive buffer strips, thus reducing the potential benefits for carbon storage and biodiversity
	Eco-scheme: Carbon farming and nutrient management (I 4.2)	- supports several types of agricultural practices, including the development and compliance with a fertilisation plan - substantial budget allocated to this practice (€803.7m, 4.6% of direct payments' budget) and large area targeted (3.6 million ha, 25% of the UAA) - farmers are allowed to choose between different practices and might focus on the easiest ones/ the ones with the lowest environmental and climate benefits; they might also choose practices that are not related to nutrient management - not clear if farmers are encouraged to adopt the targeted practices beyond the minimum level necessary to receive the payment
	Eco-scheme: Producing plant production in the Integrated Plant Production system (I 4.3)	- supports integrated plant production methods, thus promoting various practices having a positive impact on water quality: integrated pest management, use of non-chemical plant protection, fertilisation adapted to the nutritional needs of plants, using up-to-date soil tests on nutrients and soil pH - chemical protection still allowed when it is not possible to eliminate pathogens through other methods- obligation to maintain permanent grassland, which improves water retention in soils - obligation to comply with integrated pest management principles - small budget of €40.5m (0.23% of Pillar I's budget) and small area targeted (between 24,500 and 29,800 ha annually, 0.2% of the UAA), limiting the potential benefits for water protection
	Eco-scheme: Biological crop protection (I 4.4)	- supports biological plan protection, therefore reducing the risk of pollution from chemical pesticides

		- chemical protection still allowed when it is not possible to eliminate pathogens through microbiological preparations (to be further defined in the national legislation), reducing the potential environmental benefits - compliance checks based only on receipts of purchases of biological products and recording of practices, not enough to guarantee that unauthorised chemical pesticides are not used
	Environmental and climate commitment: Conservation of valuable habitats and endangered species in Natura 2000 sites (I 8.1)	- aims to prevent the deterioration or restore favourable conservation status in Natura 2000 sites, such as specific meadows, grasslands, or mires - bans the use of plant protection products, therefore benefiting water quality - the commitment includes an additional result-based component, but it is not described in the Plan - incoherence between assumed area (364,000 ha) and needs identified in the PAF (559,593 ha) - substantial budget of €237m, 3.1% of Pillar II budget, but relatively low level of payment - reaching more than 364,000 ha in 2028, 1.8% of the Polish UAA - if mowing the meadow is impossible due to high water levels, the beneficiary is required to return the support received in previous years of the contract for mowing this meadow, thus encouraging farmers to drain their land
	Environmental and climate commitment: Protection of valuable habitats and endangered species outside Natura 2000 sites (I 8.2)	- aims to prevent the deterioration or restore favourable conservation status outside of Natura 2000 sites, such as specific meadows, grasslands, or peat bogs - bans the use of plant protection products, therefore benefiting water quality - the commitment includes an additional result-based component, but it is not described in the Plan

		- substantial budget of €301m, 4% of Pillar II budget, but relatively low level of payment - reaching more than 350,000 ha in 2028, 2.4% of the Polish UAA - if mowing the meadow is impossible due to high water level, the beneficiary is required to return the support received in previous years of the contract for mowing this meadow, thus encouraging farmers to drain their land
	Environmental and climate commitment —Extensive use of meadows and pastures in Natura 2000 sites (I 8.3)	- supports extensive agricultural use of meadows and pastures on permanent grassland situated in Natura 2000 sites - bans the use of plant protection products, therefore benefiting water quality - small budget of €17.7m, 0.23% of Pillar II budget and small target area (31,358 ha in 2028, 0.2% of the UAA). - if mowing the meadow is impossible due to high water levels, the beneficiary is required to return the support received in previous years of the contract for mowing this meadow, thus encouraging farmers to drain their land
	Environmental and climate commitment: Organic farming (I 8.11)	- supports organic farming, therefore reducing chemical pesticides and fertiliser use - includes an additional premium if the stocking rate is below 1.5 LSU/ha, therefore reducing nutrients inputs to the soil - substantial budget of €905m (11.9% of the Pillar II budget) - will not allow Poland to reach the Farm to Fork target for organic farming (only 4.5% of the UAA targeted by support while currently only 3.5% of the UAA is under organic farming)
	Investments contributing to environmental and climate protection (I 10.4)	- supports investments for the environment and climate, including the purchase of machinery and equipment to reduce pesticides use (e.g., through sensor sprayers) and fertiliser use (e.g. application of fertilisers using digital solutions) and

		promote mechanical and biological pest management (e.g. devices for mechanical pest destruction) - substantial budget of €217m, 2.9% of Pillar II funding - Not clear how much of this total budget will aim to improve water quality, but according to result indicator R.26 only 0.81% of Polish farms will receive investment support for resource-related projects
Water extraction	Eco-scheme: Carbon farming and nutrient management (I 4.2)	- likely to improve water retention capacity in soils, through the improvement of the carbon content in soils (see section 2.2) - supports for crop diversification might provide an incentive to move away from dominant crops towards less water intensive crops, if well-designed
	Eco-scheme: Retention of water on permanent grassland (I 4.5)	- supports water retention on permanent grassland in areas where flooding occurs - limited impact due to implementation details (only 12 days of flooding required) - limited only to permanent grasslands where other interventions are implemented (e.g. eco-scheme on the extensive use of permanent grasslands), thus not applicable for most areas in need- relatively small budget of €97m (0.56% of Pillar I budget) and small area targeted (315,000 ha every year, 2.2% of the UAA), thus reducing the water management potential of the measure
	Sectoral interventions for fruits and vegetables: Action to protect the environment and mitigate climate change (I 7.5)	- supports investments for the environment and climate in fruit and vegetable producer organisations, including in systems to improve water management (e.g. through infrastructure for storing water in closed tanks and managing rainwater, water re-circulation installations - does not support irrigation investments, thus limiting increases in water extraction - requires producer organisations to submit an independent expert opinion

		confirming that the planned investment will contribute to a reduction in water consumption from conventional sources by at least 5% - no further requirement in areas where water bodies are in a less than good conservation status - no indication on the budget for this intervention in the Plan
	Environmental and climate commitment: Reforestation and tree premiums and agroforestry systems (I 8.8)	- supports the presence of trees on agricultural land, thus improving water retention on agricultural land - small budget allocated to these interventions (€32m, 0.42% of Pillar II's budget) and small area targeted (10,410 ha, 0.07% of the UAA), limiting the potential benefits for water management
	Investments: Afforestation of agricultural land (I 10.11)	
	Investments: Creation of in-field trees (I 10.12)	
	Investments: Establishment of agroforestry systems (I 10.13)	
	Investments: Investments contributing to environmental and climate protection (I 10.4)	- supports investments for the environment and climate, including in systems to improve water management (e.g. through infrastructure for storing water in closed tanks and managing rainwater, water re-circulation installations) - substantial budget of €217m, 2.9% of Pillar II funding - Not clear how much of this total budget will aim to improve water management, but according to result indicator R.26 only 0.81% of Polish farms will receive investment support for resource-related projects

3.2 Soil quality

3.2.1 State of play in Poland and resulting needs

Soil quality refers to the soil's ability to provide ecosystem and social services, reflecting how well a soil performs its multiple functions (e.g. maintaining biodiversity and nutrient cycling) (Tóth, Stolbovoy and Montanarella, 2007). In

Europe, soil quality faces several threats, including loss of soil organic matter (hereafter, SOM) and soil organic carbon (hereafter, SOC), erosion and contamination (pollution) (Stolte et al, 2015). All these issues can be observed in agricultural areas.

Soil organic matter refers to 'everything that is alive or was alive in the ground. It is thus linked to soil biodiversity and SOC content. In this regard, the quality of Polish soil is rather low compared to the rest of the EU, with a mean organic carbon content of 21.9 g/kg, well below the EU-28 average of 43,1 g/kg (European Commission). Over 70% of Poland's agricultural area is made up of acidic soils with low humus content, leading to low fertility and water storage capacity and high sensitivity to drought and erosion. However, soil organic carbon and matter contents varies significantly depending on soil types, land use and land management practices. Permanent grasslands, for instance, are richer in carbon (182.6 t/ha) than cropland (31.6 t/ha) or permanent crops (50.9 t/ha), but they represent only 22% of the Polish UAA (ibid.).

Soil functions are also threatened by erosion and contamination. In Poland, erosion affected only 1.4% of the agricultural soils compared to 7% in the EU (European Commission, 2020). It also remained unchanged between 2010-2016, despite the increase in the intensity of agricultural production. However, in 2016, 95% of the Polish arable area was still under conventional tillage (Eurostat, 2020b), and 45% was left without soil cover during the winter months (Eurostat, 2020a), both practices being linked to increased soil erosion risk. There are disparities between regions, the highest level of soil loss being observed in the southern mountainous fringes of the country, and some projection models estimate that up to 10% of Polish soils are facing a moderate to strong erosion hazard. (Ministry of Agriculture and Rural Development of Poland, 2022). Regarding soil contamination, researchers analysed agricultural soils in the EU and found that around 83% of the sampled soils in Poland contain residues of at least two pesticides, and none are free from pesticide residues (Silva et al, 2019).

The standardisation of sustainable agricultural practices increasing soil organic carbon, protecting life underground and reducing the risk of soil erosion would therefore be beneficial. They include, for instance, soil cover by plants or crop residues, inter-cropping, diversification away from root crops, direct seeding and reduced tillage, and the maintenance and creation of permanent grassland.

3.2.2 Planned interventions

Some of the interventions analysed in the previous sections contribute to the improvement of soil quality. Interventions to promote carbon storage (and hence SOM and SOC) in soils are presented in section 2.2 and those to reduce chemical

use and thus contamination are presented in section 3.1 on water quality. This section therefore focuses on interventions targeting soil erosion. They are presented in Table 5 below.

Three standards and interventions in the Polish Plan could provide benefits in terms of soil erosion. First, GAEC standard 5 on tillage management defines specific requirements for arable and permanent crops land located on steep slopes of more than 14%. However, these requirements are quite minimal. Indeed, arable farmers cannot grow crops that requires ridges to be maintained along the slope or cannot have bare fallow (unseeded) during the autumn winter period. They do not ban ploughing on these steep slopes. Moreover, parcels with a lower gradient than 14% can still be at risk of soil erosion but are not affected by these requirements. GAEC standard 6 requires farmer to maintain a soil cover on their arable land (either through plant cover or the maintenance of plant residues or mulching) for three and a half months in winter. Vegetative plant cover is an effective practice. However, leaving crop residues and mulch on the soil does little to prevent erosion and water loss from the soil, regardless of whether the residues are mixed with the soil or not. In addition, farmers have to comply on 80% of their arable area, as opposed to the whole of the farm. Finally, the eco-scheme for carbon farming and nutrient management (I 4.2) supports, amongst other practices, the use of winter crops and intercrops, crop diversification away from root crops that are damaging to soil structure and reduced tillage, with a substantial budget of 870 million euros for these three practices (5% of direct payments' budget).

Overall, soil quality benefits from several interventions aiming at increasing soil organic carbon (see section 2.2), decreasing pollution (see section 3.1) and reducing the risk of soil erosion. These interventions, however, do not seem to be targeting specifically the most vulnerable regions.

Table 5: Potential impact of interventions on soil quality

Challenge	Standard or intervention (number)	Potential benefits and limitations
Erosion	GAEC 5 tillage management	- specific requirements for arable land and permanent crops located on slopes of at least 14% (for arable land: not growing crops that requires ridges to be maintained along the slope, no black fallow during the autumn-winter period, for permanent crops: keeping cover or mulch between rows)

		- potential benefits for steep slope soils that are subject to erosion - only includes slopes of at least 14%, yet parcels with a substantially lower gradient can be at risk of soil erosion - does not ban ploughing on high slopes, thus reducing the potential benefits in terms of soil erosion reduction
	GAEC 6 soil cover	- requirements to maintain soil cover (plant cover, plant residues or mulch) between the 1st of November and the 15th of February on at least 80% of the arable area - already common practice, the standard is thus unlikely to foster change - leaving crop residues and mulch on the soil does little to prevent erosion and water loss from the soil. - potential benefits for reducing soil erosion on arable land - soil cover only mandatory on 80% of the arable area
	Eco-scheme: Carbon farming and nutrient management (I 4.2)	- supports the use of winter catch crops and intercrops, crop diversification away from root crops and reduced tillage that contributes to reducing soil erosion - substantial budget for these practices of €870m (5% of direct payments' budget) and targeted area (2.2 million ha, 15% of the UAA) - farmers are allowed to choose between different practices and might focus on the easiest ones/ the ones with the lowest environmental and climate benefits; they might also choose practices that do not provide benefits for soil erosion - not clear if farmers are encouraged to adopt the targeted practices beyond the minimum level necessary to receive the payment
Contamination	See interventions contributing to water quality in section 3.1, in particular the eco-scheme for integrated plant production systems (I 4.3) and the environmental and climate commitment for organic farming (I 8.11)	
Loss of SOC / SOM	See interventions contributing to carbon storage in soils in arable land, grassland and permanent crops in section 2.2, in particular the eco-scheme	

	for carbon farming and nutrient management (I 4.2) and the eco-scheme for water retention in permanent grassland (I 4.3)

4. CONTRIBUTION TO THE PROTECTION OF BIODIVERSITY

The following section focuses on the interventions contributing to both the protection of common farmland species and to protecting valuable habitats and species.

4.1.1 State of play in Poland and resulting needs

Agriculture is one of the main pressures on biodiversity in the EU. It affects both common species and valuable habitats and endangered species covered by the Nature directives[24].

Common birds and butterflies are sensitive to environmental change and their population numbers can reflect changes in ecosystems as well as in other animal and plant populations (EEA, 2019b). Trends in common farmland bird and grassland butterfly populations can therefore be used as indicators of the health of agricultural ecosystems. In Poland, the farmland bird index decreased by 20% between 2000 and 2017, worse than the EU average trend (-17.5%) (European Commission) and continued decreasing in recent years (by 22% between 2000 and 2022 in total) (Monitoring Ptaków Polski, 2022). In particular, bird species of agricultural wetlands, including waders, are dramatically decreasing. For wet meadow breeding waders there was a decrease of 60% between 2000 and 2020 (Wardecki Ł. et al, 2021). There is no information on the grassland butterfly index at the national level, and as of yet no collection of data on this topic in Poland (Van Swaay et al, 2019). Precise information about wild pollinators is also missing, nevertheless partial data suggests strong degradation, as in other EU countries, due to habitats loss, feeding resources decreasing and pesticide use (Banaszak-Cibicka W., 2022; Zych M. et al, 2020).

As regards valuable habitats and endangered species, assessments for the reporting of EU nature directives show that, in Poland, only 20% of the habitats of Community interest and 38% of the species of Community interest were reported to be in a favourable conservation status during the 2013-2018 period (European Environment Agency, 2021a, b). The conservation status of grassland and peatland, which represent 13 and 7% of the Polish habitats of Community interest, respectively (Biodiversity Information System for Europe), is particularly

[24] Agriculture was identified as the main and first pressure and threat (47% and 49% respectively affected by agriculture) for species of Common interest and as the fifth pressure and threat in case of habitats of Common interest (29% and 24% respectively affected by agriculture) (European Environment Agency, 2019).

worrying. Based on data for 2013-2018, 85% of grassland habitats of Community interest were in unfavourable status in Poland, which is more than the EU average of 77% (European Commission). The share of grassland habitats of Community interest with a bad status also increased by around 14 percentage points between 2007-2012 and 2013-2018. For peatland, 80.2% of the habitat of Community interest in this category were in unfavourable status in 2013-2018 (close to EU average).

Several agriculture-related threats are responsible for the worsening of conservation trends: the intensification of land management, pollution (linked to the use of chemical inputs), the simplification of landscapes (including the loss of landscape features) and modifications in hydrological systems such as drainage (Estrada-Carmona et al, 2022; European Commission, 2020). In Poland, as mentioned in section 3.1, the sales of pesticides increased gradually between 2011 and 2017. Moreover, the share of the UAA under organic farming is low (3.5% in 2020) compared to the EU average (9.1%) and the organic area decreased by 4.2% since 2014 (European Commission). As regards agricultural landscapes, the average number of linear landscape elements in Poland is similar to the EU average with a higher average in the southeast than in the north and northwest. However, fallow land occupies a much smaller area of the agricultural land in Poland compared to the EU average (1.7% and 4.1% of UAA, respectively) (European Commission, 2020), despite being one of the most beneficial types of non-productive areas for biodiversity. The density of hedges in Poland also varies between areas but the average remains below 0.7 km/km^2 in most regions, below the EU average for arable land (1.05 km/km^2), permanent crops (1.13 km/km^2) and managed grassland (3.32 km/km^2) (Gallego J., 2017). Moreover, a recent analysis shows a decline by 9.3% in length of woody linear elements, 7.4% in number of woody linear elements, and 14.6% in solitary trees in the Wielkopolska region (Kujawa et al, 2021). Beyond landscape features, recent research shows that the size and shape of agricultural plots also impacts biodiversity. For example, small plots are more likely than large ones to host high levels of biodiversity and produce ecosystem services useful to farmers and society than large ones (Clough, Kirchweger and Kantelhardt, 2020; Hass et al, 2018).

Therefore, to protect biodiversity, Poland needs to limit the intensification of agricultural practices, develop its organic farming sector and diversify landscapes, including by increasing the proportion of biodiversity-rich landscape features and decreasing the size of plots. To preserve valuable habitats and endangered species, it should also promote the maintenance, creation and good management of permanent grassland, as well as the extensive restoration of drained peatland and the development of alternative production systems in these areas such as paludiculture. In total, around 1 million hectares of drained peatlands in

agriculture use must be restored i.e. rewetted, which must be followed by a transformation of production systems towards paludiculture.

On the other hand, in some regions, the opposite situation exists—agricultural areas are being abandoned. According to some estimations, over 600,000 ha of 'agricultural land have been abandoned since the 1980s in Poland (Kolecka, 2021). Areas with the least fertile soils, those with highly fragmented ownership of agricultural land (small farms), and those facing significant natural constraints (e.g. high altitudes mountain meadows) are particularly at risk. They are very often agricultural lands of high conservation value. The abandonment of all agricultural activity on these lands leads to the loss of the biodiversity associated with agricultural landscapes.

4.1.2 Planned interventions

Poland includes several interventions aiming to support low input use and extensive farming systems in its Strategic Plan. First, an environmental and climate commitment aims to support organic farming (I 8.11), thus contributing to reducing chemical inputs use which is beneficial for biodiversity. However, as already mentioned in section 3.1, it only targets 4.5% of the total Polish UAA. As a result, Poland will most likely remain behind other EU countries in this area. Several eco-schemes are also proposed to support reductions in chemical input use (e.g. I 4.3 on integrated plant production, I 4.4 on biological pest control or I 4.2 on carbon farming and nutrient management), but their budgets and areas targeted remain low in most cases. The only one with a significant budget and target area is the one targeting carbon farming and nutrient management. However, this eco-scheme does not really focus on the reduction of input use, as only one of the eight proposed practices actually directly contributes to this objective (the use of a fertilisation management plan). In addition, eco-schemes for integrated plant production (I 4.3) and for biological pest control (I 4.4) still allow the use of chemical methods, which significantly reduces their effectiveness.

As regards extensive systems, a few interventions also support the extensive use of grassland. However, not much is proposed on the management of permanent grassland beyond environmentally sensitive ones, for which several payments support extensive mowing and grazing management practices addressing the needs of specific habitats and rare species (I 8.1-8.3). Moreover, as far as endangered species are concerned, only the protection of selected bird species is supported (i.e. not other animals such as insects). In common permanent grassland (those that are not environmentally sensitive), ploughing, tilling and reseeding is allowed, and, most often, the use of fertilisers is not banned, therefore reducing the potential benefits for biodiversity (and carbon storage). GAEC 1, which aims to maintain the ratio of permanent grassland at the national

level, also allows the destruction of grassland in some regions, as long as it is compensated somewhere else, thus not preventing the loss of grassland with higher value for biodiversity, especially outside Natura 2000 sites. Eco-scheme 'I 4.2', which supports, amongst other practices, the extensive use of grassland, also authorises a quite high stocking rate of up to 2 LSU/ha of permanent grassland.

Regarding landscape diversity, and in particular the presence of landscape features and fallow land, the Polish Plan relies primarily on the GAEC standard 8. However, Poland has not chosen the stricter implementation option. Indeed, it gives farmers the possibility to choose between two options (to have 4% of non-productive areas and features in their arable land, including land lying fallow or to have 7% of non-productive areas and features in their arable land but this time including catch crops or nitrogen-fixing crops), the second one being clearly less ambitious for biodiversity than the first one. In addition, the Polish list of landscape features protected under GAEC 8 remains limited and many farms are exempted from compliance with this standard, reducing further its potential biodiversity benefits.

In addition to GAEC 8, Poland supports the introduction and maintenance of in-field trees and flower strips/biodiverse gardens through various interventions (environmental and climate commitments I 8.7 and I 8.8 and investments aids I 10.12, I 10.13 and I 10.4) but most of these interventions have small budgets and target areas. Moreover, and contrary to a number of other Member States[25], Poland does not further support the maintenance or creation of other types of landscape features and fallow land, despite the latter's high biodiversity benefits and low I on Polish agricultural land. As a result, the target set by Poland for result indicator R.34 on landscape features is very low (0.23% of the UAA under supported commitments for managing landscape features, including hedgerows and trees). A recent report estimated that, through GAEC 8 and several interventions, Polish farmers will maintain or restore non-productive landscape features on 2.50-3.26% of the agricultural land (BirdLife, EEB and NABU, 2022) which is significantly far from the 10% recommended by science and targeted by the EU Biodiversity Strategy (Pe'er et al, 2021a). Furthermore, even this 2.50-3.26% target will not be reached quickly, as Poland decided to use a derogation for GAEC 8 in 2023.

With regard to the conservation of wild pollinators, the Plan therefore contains several interventions that can contribute to their protection by reducing the use of pesticides and improving their food resources through the maintenance and

[25] Several Member States propose an eco-scheme supporting an area of landscape features and fallow greater than 5% (e.g. France).

introduction of landscape features. However, as mentioned above, their expected impact is reduced due to implementation details that do not guarantee the full effectiveness of the measures. As a result, the Plan does not contain enough measures to significantly prevent the loss of habitat for wild pollinators.

Concerning biodiversity in arable land, the Plan only includes an intervention on perennial flower strips (I 8.7)—an effective practice, but with a very limited area targeted. Given the decline in the Farmland Bird Index, experts from the Polish Polish Society for the Protection of Birds recommend introducing interventions for 'skylark plots', aiming to create foraging sites for different species of farmland birds (e.g. Skylark *Alauda arvensis*, Ortolan *Emberiza hortulana*, Corn bunting *Emberiza calandra*, birds of prey) in areas dominated by dense, large-scale field crops, would be relevant, along the lines of solutions used in Germany, the UK or Sweden (Wärnbäck, Josefsson and Eggers, 2018). Poland also does not plan any specific measures to reconfigure plot sizes and shapes in a way that would have positive impacts on biodiversity. Several interventions focus on crop diversification, yet evidence for the acclaimed biodiversity benefits of landscape-level crop diversity is ambiguous. In fact, several researchers showed that landscape heterogeneity rather than crop diversity, maintain pollination, plant reproduction and bird diversity (Hass et al, 2018; Redlich et al, 2018).

The Polish Plan also dedicates two interventions to the protection and restoration of valuable habitats and endangered species inside and outside of Natura 2000 sites (I 8.1 and 8.2). The targeted habitats are valuable meadows and mires and breeding habitats of eight endangered bird species. In addition, an environmental and climate commitment aims to support the extensive management of meadows and pastures in Natura 2000 areas (I 8.3), but it has a quite small budget. These measures require farmer to adopt specific grazing and mowing management practices, defined for each type of habitats. Interestingly, the scope of measures targeting the protection of endangered birds' breeding habitats, limited to Natura 2000 sites in the 2014-2022 period, has been extended to the whole country for this period, thus providing additional biodiversity benefits (BirdLife, EEB and NABU, 2022). However, taken together, interventions I 8.1 (protection of valuable habitats and endangered species in Natural 2000 areas) and I 8.3 (extensive use of meadows and pasture in Natura 2000 areas) aims to target an area of 295,790 ha in 2028, therefore only covering slightly more than half of the area of habitats identified in the Prioritised Action Framework will be supported (559,593 ha) (BirdLife, EEB and NABU, 2022). Moreover, the level of payment of these interventions (I 8.1, 8.2 and 8.3) is low (at the limit of profitability for farmers) making them unattractive, particularly for small farms.

As regards wetlands, the Polish Plan lacks effective measures to support the maintenance and restoration of wetlands in agricultural use, therefore not effectively protecting waterbirds' and waders' habitats. Overall, environmental and climate commitments forbid building new drainage systems on targeted area but allow the continuation of drainage by existing systems. The eco-scheme for water retention on permanent grasslands (I 4.5), although intended to support high water levels, risks not being effective due to poorly designed implementation details (i.e. only applying to permanent grassland under other commitments, only providing compensatory payments for twelve days of flooding, and very low payment rates) and its small budget. The Plan does not include any measures promoting active rewetting of degraded peatlands nor measures promoting transformation towards paludiculture.

Finally, it is important to note that, contrary to other Member States, such as France or Germany, Poland does not propose any result-based payments for biodiversity (see section 5.2).

Table 6 below presents the interventions that are mentioned in the Plan as contributing to specific objective 6 on biodiversity and are likely to contribute to the protection of common farmland species, valuable habitats and endangered species, as well as their main benefits and limitations.

Table 6: Potential impact of interventions on biodiversity

Need/beneficial practice	Standard or intervention (number)	Potential benefits and limitations
Landscape diversity (including landscape features)	GAEC 8 landscape features and fallow	- provides habitats for farmland species - will not be implemented in 2023 (use of derogation) - provides exemption for small farms (<10ha) and farms with grassland, leguminous plants and fallow on more than 75% of their UAA) - the real area of non-productive features will be reduced as a result of using weighting factors greater than 1 for most non-productive feature types - Poland did not chose the most ambitious implementation option (farmers can use a proportion of catch crops and nitrogen-fixing crops to comply) - limited list of non-productive features types (e.g. does not include small

		wetlands, patches of biodiverse non-productive herbaceous vegetation)
	Environmental and climate commitment: Biodiversity on arable land (I 8.7)	- supports the creation and maintenance of in-field perennial flower belts and biodiversity gardens, which provides habitats for farmland species and feeding places for wild pollinators - beneficial especially in areas with more intensive agriculture - includes several management requirements, such as the prohibition of the use of herbicides - small budget allocated to these interventions (€2.8m, 0.04% of Pillar II's budget) and small area targeted (1,416 ha, 0.01% of the UAA), limiting the potential benefits for biodiversity - does not require management that leaves soil and vegetation intact, which are necessary for many species
	Environmental and climate commitment: Reforestation and tree premiums and agroforestry systems (I 8.8)	- supports the presence of trees on agricultural land, thus providing habitats for farmland species - small budget allocated to these interventions (€32m, 0.42% of Pillar II budget) and small area targeted (10,410 ha, 0.07% of the UAA), limiting the potential benefits for water management - the establishment of agroforestry systems (I. 10.13) through tree plantation takes time before providing substantial biodiversity benefits (around 50-60 years) and it is unlikely that such systems will be maintained for such a long period of time. **-** the environmental and climate commitment (I 8.8) is likely to have positive effects, by encouraging farmers to maintain their afforested areas and not to destroy afforestation from natural succession. However, the payment requires farmers to carry out silvicultural treatments, which are unnecessary and rather detrimental to biodiversity. The overall effect is impossible to predict, as it will depend on the implementation details
	Investments: Afforestation of agricultural land (I 10.11)	
	Investments: Creation of in-field trees (I 10.12)	
	Investments: Establishment of agroforestry systems (I10.13)	

	Investments contributing to environmental and climate protection (I 10.4)	- supports the purchase of new machinery or equipment for the maintenance of in-field trees and agroforestry systems - the impact on the biodiversity of agroecosystems remains uncertain (as the intervention might tidy up the agricultural landscape, eliminating certain 'messy' elements which may be important for biodiversity) - substantial budget of €217m, 2.9% of Pillar II funding - not clear how much of this total budget will aim to manage landscape features, but according to result indicator R.32 only 0.38% of Polish farms will receive investment support for biodiversity-related projects
Extensive use of permanent grassland	GAEC 1 on permanent grassland	- supports the maintenance of permanent grassland - Poland's definition of permanent grassland allows ploughing, tilling and reseeding, thus reducing the potential benefits for biodiversity - the ratio has to be maintained at the national level rather than at the regional or agricultural holding level so more valuable grasslands can be lost in favour of less valuable ones elsewhere - no system to prevent conversion before 5% of the national area of permanent grassland is being lost (as in France, where such a system is activated as soon as 2% of the regional area of permanent grassland is lost) - no ban on pesticide or fertiliser use on permanent grassland, thus reducing positive effect for resources and biodiversity
	Eco-scheme: Carbon farming and nutrient management (I 4.2)	- this eco-scheme supports, among other practices, the extensive use of grassland - the support extensive use of grassland allows for relatively high stocking rate, the maximum being set at 2 LSU/ ha of permanent grassland

		- tilling and reseeding of permanent grassland is allowed, thus reducing the potential benefits for biodiversity - farmers are allowed to choose between different practices and might focus on the easiest ones/ the ones with the lowest environmental and climate benefits; they might also choose practices that don't have biodiversity benefits (e.g. the incorporation of manure in soils) - not clear if farmers are encouraged to adopt the targeted practices beyond the minimum level necessary to receive the payment
Low input use systems	Eco-scheme: Areas with melliferous plants (I 4.1)	- supports areas with melliferous plants that provide long-term, diverse and safe feeding grounds for honeybees and wild pollinators - includes requirements with benefits for biodiversity (prohibits agricultural production on these area before the 31st of August and the use of plant protection products) - small budget (€39.5m, 0.25% of Pillar II's budget) and small are targeted (30,000 ha annually, 0.2% of the UAA) - impact strongly depends on details which are not known yet - there is a risk that the scheme will be honeybee-oriented, and not effective for protecting wild pollinators
	Eco-scheme: Carbon farming and nutrient management (I 4.2)	- supports, amongst other practices, the development and compliance with a fertilisation plan, which might reduce nutrients inputs, and crop diversification, which might contribute to pesticide use reductions - substantial budget allocated to these practices (€1.2bn, 6.7% of direct payments' budget) and large area targeted (4.7 million ha, 32.4% of the UAA) - does not support zero tillage as it is often linked to increased herbicide use,, therefore limiting potential negative impacts on biodiversity

		- farmers are allowed to choose between different practices and might focus on the easiest ones/ the ones with the lowest environmental and climate benefits; they might also choose practices that are not likely to impact input use - does not seem to be encouraging farmers to adopt the targeted practices beyond a minimum level, thus reducing potential benefits
	Eco-scheme: Integrated Plant Production system (I 4.3)	- supports integrated plant production methods, thus promoting various practices that might have a positive impact on biodiversity: integrated pest management, use of non-chemical plant protection and optimised fertilisation - biodiversity is not the main objective of integrated plant production, that remains targeted at production; obligation to maintain permanent grassland, but biodiversity benefits likely to be limited because ploughing is allowed - small budget of €40.5m (0.23% of Pillar I) and small area targeted (between 24,500 and 29,800 ha annually, 0.2% of the UAA), limiting the potential benefits for biodiversity
	Eco-scheme: Biological crop protection (I 4.4)	- supports biological plant protection that is more favourable to biodiversity than chemical - chemical protection still allowed when it is not possible to eliminate pathogens through microbiological preparations, thus reducing the potential benefits - compliance checks might not guarantee that unauthorised chemical pesticides are not used
	Sectoral interventions for fruits and vegetables: Action to protect the environment and mitigate climate change (I 7.5)	- supports investments for the environment and climate in fruit and vegetable producer organisations, including in systems to improve water management (e.g. through infrastructure for storing water in closed tanks and managing rainwater, water re-circulation installations)

		- does not support irrigation investments, thus limiting increases in water extraction - requires producer organisations to submit an independent expert opinion confirming that the planned investment will contribute to a reduction in water consumption from conventional sources by at least 5% - no further requirement in areas where water bodies are in a less than good conservation status - no indication on the budget for this intervention in the Plan
	Environmental and climate commitment: Organic farming (I 8.11)	- supports organic farming, therefore reducing chemical pesticides and fertiliser use - substantial budget of €905m (11.9% of the Pillar II budget) - will not allow Poland to reach the Farm to Fork target for organic farming (only 4.5% of the UAA targeted by support while currently only 3.5% of the UAA is under organic farming)
	Investments contributing to environmental and climate protection (I 10.4)	- supports investments for the environment and climate, including the purchase of machinery and equipment to reduce pesticides use (e.g. through sensor sprayers) and fertiliser use (e.g. application of fertilisers using digital solutions) and promote mechanical and biological pest management (e.g. devices for mechanical pest destruction) - substantial budget of €217m, 2.9% of Pillar II funding - Not clear how much of this total budget will aim to reduce input use, but according to result indicator R.32 only 0.38% of Polish farms will receive investment support for biodiversity-related projects
Valuable habitats (grassland and wetland) and	GAEC 9 on permanent grassland in Natura 2000 areas	- ban on conversion and on ploughing of sensitive grassland (as per the EU regulation) - only includes valuable grasslands that have conservation plans laying down

endangered species		specific measures or those identified by the environmental authorities - high discrepancy between the area of environmentally sensitive permanent grasslands which should be protected under GAEC 9 (269,000 ha) and the area of such type of habitats declared in Prioritised Action Framework for Natura 2000 (523,540 ha)
	Environmental and climate commitment: Conservation of valuable habitats and endangered species in Natura 2000 sites (I 8.1)	- aims to prevent the deterioration or restore favourable conservation status in Natura 2000 sites, such as specific meadows, grasslands, or peat bogs - requirements includes criteria on mowing and grazing management practices (according to the type of habitats), a ban on the use of plant protection products, the establishment of an agri-environmental activity plan - the commitment includes an additional result-based component, but it is not described in the Plan - substantial budget of €237m, 3.1% of Pillar II budget - reaching more than 364,000 ha in 2028, 1.8% of the Polish UAA - incoherence between assumed area (364,000 ha) and needs identified in PAF (559,593 ha) - if mowing the meadow is impossible due to high water levels, the beneficiary is required to return the support received in previous years of the contract for mowing, thus encouraging farmers to drain their land
	Environmental and climate commitment: Protection of valuable habitats and endangered species outside Natura 2000 sites (I 8.2)	- aims to prevent the deterioration or restore favourable conservation status outside of Natura 2000 sites, such as specific meadows, grasslands, or peat bogs - requirements includes criteria on mowing and grazing management practices (according to the type of habitats), a ban on the use of plant protection products, the establishment of an agri-environmental activity plan

		- the commitment includes an additional result-based component, but it is not described in the Plan - substantial budget of €301m, 4% of Pillar II budget - reaching more than 350,000 ha in 2028, 2.4% of the Polish UAA - if mowing the meadow is impossible due to high water levels, the beneficiary is required to return the support received in previous years of the contract for mowing, thus encouraging farmers to drain their land
	Environmental and climate commitment: Extensive use of meadows and pastures in Natura 2000 sites (I 8.3)	- supports extensive agricultural management of meadows and pastures on permanent grassland situated in Natura 2000 sites - requirements include criteria on mowing and grazing management practices (according to the type of habitats), a ban on the use of plant protection products, the establishment of agri-environmental activity plan and limited fertilisation - small budget of €17.7m, 0.23% of Pillar II budget and small target area (31,358 ha in 2028, 0.2% of the UAA) - if mowing the meadow is impossible due to high water level, the farmer is asked to return the support achieved for mowing this meadow in the former years of the 5-year contract, thus encouraging farmers to drain their land

5. CROSS-CUTTING INTERVENTIONS AND INNOVATIONS

This section reviews the cross-cutting interventions in the Polish Plan that can contribute to environmental and climate action, and hence are additional to those reviewed in sections 1 to 4. It also takes a look at innovative approaches in the Plan, both in terms of innovative types of schemes and in terms of technological innovation, in order to assess the extent to which Poland is supporting or testing new and appropriate solutions to the challenges faced.

5.1 Cross-cutting interventions

The cross-cutting interventions in the CAP, such as support for knowledge exchange and dissemination, advisory services and cooperation can contribute to environmental and climate action. Knowledge exchange and dissemination, as well as advisory services, can improve farmers' knowledge on the linkages between climate change, resources and ecosystem protection and agriculture. They can also allow them to learn the necessary skills to change their farming systems, adopt more sustainable practices and improve their farm's resilience to climate stressors. However, they can also provide harmful advice (e.g. recommending irrigation, the maintenance of existing drainage ditches or plant protection by pesticides). The impact will depend on the detailed content disseminated, which is unpredictable at this stage.

Cooperation measures, particularly the ones supporting the European Partnership for Innovation (EIP), can drive research and innovation on environmental and climate questions which in turn can improve the knowledge base and capacity to deliver (Alliance Environnement and Ricardo-AEA, 2018). In the Polish Plan, the total budget for EIP interventions is 109 million euros (1.44% of Pillar II funding). This support can fund projects relating to sustainability, in particular those linked to objective 4 (climate action) and objective 5 (protection of natural resources). However, the Plan does not specify the share of the total intervention's budget that will go to these objectives. Although overall there were few EIP projects funded in the last CAP period in Poland that supported environmental or climate objectives, some examples are presented in box 2 below.

Box 2: Examples of Polish EIP projects funded under the previous CAP

Diversification of protein sources for animal feed by insect rearing

This EIP project aimed to develop new container-based insect production technologies suitable for feed, to allow farmers to diversify the sources of protein in their farms (EIP-Agri, 2019). Such solutions can be beneficial for climate and food security by providing alternative protein sources for feed production that do not require significant land area.

Innovative technology for vegetable growing in a closed water cycle

This project aimed to achieve the optimum water and energy balance while maintaining high quality yields for vegetable crops, both those cultivated off-ground and according to traditional methods (EIP-Agri, 2021). In practice, it helped farmers estimate the dates and amounts of irrigation doses needed depending on the actual water needs of plants.

As regards knowledge-sharing interventions, the CAP Regulation specifies that knowledge sharing should, to some extent, target nature, environment and climate protection. However, it does not impose clear rules on how Member States should implement this in their Strategic Plans. For instance, there is no minimum share of these interventions' budgets that should go to climate and environmental action.

Poland has four knowledge exchange interventions that could contribute to environmental and climate action: support for the professional development of farmers (I 14.1), for advisory services (I 14.2), for the development of advisory staff (I 14.3) and for the development of demonstration farms (I 14.4). However, the Plan does not provide a clear indication of the proportion of these that are environment or climate related. These measures also have small budget allocations, from 0.12% of the Pillar II budget for the development of advisory staff to 1.80% of the Pillar II budget for improving advisory services.

Overall, cross-cutting interventions targeting environmental and climate objectives will most likely benefit a small number of beneficiaries, as illustrated by the low target set by Poland for the number of recipients benefitting from cross-cutting interventions related to environmental or climate-related performance (result indicator R.28, around 20,000 beneficiaries annually by 2028, representing around 1.2% of the annual working units in Polish agriculture in 2016).

5.2 Innovative approaches in the Polish Strategic Plan

Beyond the EIP interventions, the Strategic Plan supports other innovative forms of environmental and climate action. These are innovative either by design (for instance result-based payments or collective approaches), because they support the use of new technologies on-farm or for monitoring, or because they include new requirements that are relevant for environmental and climate action. This section presents some of the innovative interventions identified in the Polish Strategic Plan.

5.2.1 Innovative interventions design

Among the interventions introduced in this CAP, Poland has brought in an eco-scheme on carbon farming and nutrient management (I. 4.2), based on a point system in which farmers can choose amongst different practices, each of them bringing a certain number of points (see box 1). Amongst the practices supported, the development and compliance with a fertilisation plan based on a soil analysis on arable and permanent grassland and with the help of fertilisation decision support systems seems promising. The results of the soil analysis will be used to develop the fertilisation plan, indicating the quantities of N, P, K, Mg and Ca to be used in fertilisers on a given agricultural parcel. The acidity of the soil will also be analysed, and a liming treatment will be supported by an additional payment where the pH is below or equal to 5,5, once every four years. Although the impact of such intervention may be small in Poland, as many farms already have fertilisation plans or use soil testing, few Member States currently support these practices. Another interesting practice supported is diversification away from crops that are damaging to soils (e.g. root crops), which would be particularly beneficial in areas that are prone to erosion. However, the Plan does not clearly explain how crops are categorised. Moreover, as the scheme relies on a "point system", it allows farmers to choose amongst a set of practices. They might therefore not choose the ones that are the most beneficial for the environment and climate. Only the implementation phase will show how this works in practice and what environmental impact will be achieved.

Result-based payments in their purest form, make funding conditional on the achievement of pre-defined results. Instead of paying farmers for implementing practices on a certain area of land, they have to demonstrate that they have improved or achieved better environmental or climate results. The Polish Strategic Plan mentions that two interventions aiming to protect and restore habitats inside and outside Natura 2000 areas include a result-based element, for non-agricultural land where flooding occurs (confirmed using satellite monitoring). However, the scheme seems rather intended to compensate the impact of natural

floodings, not to support intentional flooding by farmer (as the level of payment is too small to promote any result-oriented activities and only provides an additional payment to other environmental and climate commitments). There are no other result-based interventions proposed in the Plan.

Collective approaches can be understood as actions taken by a group of farmers (and stakeholders) who jointly apply to participate in an environmental and climate commitment or an eco-scheme, therefore providing higher levels of environmental public goods and ecosystem services through landscape-level implementation. They are used, for instance, in the Netherlands and Ireland. However, no such intervention is funded in the Polish Plan. The lack of a collective approach will reduce the effectiveness of interventions, at least in some areas of Poland, where the agricultural mosaic is predominantly made up of very small and narrow plots.

5.2.2 New technologies

Some technical innovations, such precision farming technologies involving tools such as sensors or drones, can help farmers improve the sustainability of their farming systems, for instance through reductions in chemical inputs. In the Polish Plan, an investment measure (I 10.4) and a sectoral intervention (I 7.5) in the fruit and vegetables sector provide funding opportunities for the acquisition of equipment to reduce GHG emissions, limit pollution and improve resource use efficiency, including precision farming tools (e.g. via the application of fertilisers using digital solutions). Interestingly, to receive the sectoral support, producer organisations must show that their planned investment will contribute to an improvement in the environment of at least 15% compared to the initial situation, in terms of reductions in the current use of inputs, pollutant emissions or waste. This is not the case for the investment aid (I 10.4), that does not require farmers to reach a specific GHG emissions or input reduction target or to report their reductions. Moreover, whilst being positive for efficiency, the overall impact of such technologies, for example on biodiversity and soil, does depend on how they are deployed and combined with other practices on the ground (such as crop rotation, biodiversity friendly management and features).

6. CONCLUSIONS

Overall, the Polish Strategic Plan appears insufficient to respond to the country's needs in relation to environment and climate challenges. The largest share of Poland's CAP support continues to go to basic income support payments and there is still significant funding going to coupled support, both of which are not sufficiently conditioned on sustainable practices. We estimate that the total budget dedicated to environmental and climate objectives represents 20.5% of the CAP budget, while 64% supports economic objectives. The transfer of more than 1.5 billion euros from Pillar II to Pillar I, cutting Pillar II's budget by almost 30%, as well as the large number of interventions that could benefit the environment and climate but which impacts are limited due to small budgets, further illustrate the lack of priority given to environment, climate and rural development in the Plan. Poland also tends to set GAEC standards with low ambition, therefore diminishing their potential benefits for the environment and climate. Therefore, Poland has on the whole not used the flexibility available to significantly improve requirements and funding for the environment and climate.

Nevertheless, the Plan contains some interesting new interventions and improvements. The new environmental and climate commitment promoting perennial flower strips (I 8.7), for instance, can be of a great value, especially in agricultural landscape dominated by industrial agriculture. Other measures also have the potential to improve the environment and climate, but their effectiveness is likely to be limited by small budgets and ill-defined implementation parameters. For instance, the eco-scheme on water retention on permanent grasslands, which should promote the maintenance of moisture on wetlands (including wet grasslands), is limited by weak requirements and a low target area.

Member States' CAP Strategic Plans can be amended once per year, and a mid-term review is scheduled for 2026. The next CAP will come into force after 2027, with discussions already beginning. We therefore propose two sets of recommendations: 1) amendments to the Polish Plan in the current period, and 2) wider recommendations for the CAP and EU agri-food policy as a whole:

Recommendations for amending the Polish Plan:

- Address gaps in the in the intervention logic (between needs identified and the proposed interventions), in particular concerning peatland restoration, climate adaptation (e.g. on the increased frequency of droughts) and biodiversity (e.g. regarding landscape features and fallow land).

- Strengthen GAEC requirements, in particular for GAEC 1 (e.g. by maintaining the ratio of permanent grassland at a regional level and by forbidding ploughing), GAEC 2 (e.q. by prohibiting the further degradation of peat soils through the continuation of draining and ploughing), GAEC 4 (by requiring the creation of strips along all watercourses, including all ditches, and prohibiting ploughing of buffer strips), GAEC 5 (e.g. by defining requirements for slopes lower than 14%), GAEC 7 (e.g. by requiring crop rotation on the total land area) and GAEC 8 (e.g. by requiring 10% of landscape features and fallow instead of 4% following (Pe'er et al, 2021b), the removal of weighting factors and by adjusting the list of protected landscape features). GAEC 2 should also be implemented as soon as possible, without waiting until 2025, despite the possibility of derogation.

- Evaluate the impact of the derogations granted to farmers in 2023 for GAEC standards 7 and 8, with a view to avoiding further derogations that would damage biodiversity and the environment.

- Review the eco-scheme on carbon farming and nutrient management (I 4.2) after one year (as planned) to make sure that the most beneficial options from an environmental and climate point of view are the most attractive to farmers and to support the adoption of practices beyond the minimal level required.

- Correct the implementation details of the eco-scheme on water retention on permanent grasslands (I 4.5) to improve its effectiveness. The ecoscheme should be applicable everywhere and the payment should be proportional to the flooding time (without the twelve-day limit). Additionally, unable to implement the requirements due to high water levels should not face penalties.

- Include measures supporting grassland restoration (including the conversion of arable land into grasslands on flooded areas), wetland buffer zones restoration and creation, the rewetting of peatlands in agricultural use and the transition from current farming systems towards paludiculture.

- Adjust the area targeted by environmental and climate commitments in Natura 2000 to reflect the needs identified in Prioritised Action Framework.

- Strengthen interventions supporting biodiversity on arable lands, for instance by increasing the targeted area of intervention 'I 8.7' and by further supporting landscape features.

- Step up the support for organic farming. This could be accompanied by promotion campaigns to explain the environmental benefits of such systems to consumers.

- Improve the targeting of some intervention to address specific regional issues (e.g. soil erosion or droughts).

- Include innovative interventions such as result-based payments or bonuses and collective approaches that could be beneficial for the preservation of natural resources and biodiversity, as well as accompanying training and advice.

- Increase the budgets for eco-schemes, environmental and climate commitments, environmental and climate investments and cross-cutting measures, with a corresponding decrease in basic income support and coupled support. This recommendation could also be implemented at the EU-level.

- Fund additional studies and research to evaluate the potential impacts of the Strategic Plan and its interventions on environmental and climate action (in particular regarding their climate mitigation potential). This recommendation could also be implemented at the EU-level.

Wider recommendations

- Introduce environmental and climate ring-fencing for cross-cutting measures, all sectoral interventions and investments in the next EU regulation, to ensure a minimal share of the budget will be spend on projects contributing to these objectives.

- Biodiversity- and climate-proof the CAP Strategic Plans and their interventions to include additional safeguards where needed, as Poland seems to have done for many interventions (e.g. on afforestation).

- Improve transparency, including by publishing a complete version of all CAP Plans, providing the output targets and budgets for all interventions.

- Accompany changes in the production systems by changes in other parts of the food systems, for instance by developing a food systems strategy that includes targets for meat and dairy consumption, or by applying sustainability standards to imported goods. This would limit the risk of carbon leakage to non-EU countries.

To summarise, while the new CAP structure provides more flexibility to Member States with the aim to increase EU's ambitions in terms of sustainability, our analysis of the Polish Strategic Plan suggests that Poland did not take the opportunity offered to significantly increase its support for environmental and climate action. The new delivery model which introduced the CAP strategic planning process, has been positive in terms of encouraging Member States to adopt an "intervention logic approach", but does not appear to have resulted in significant changes to interventions and budgets. In some cases, the evolution has even been in the wrong direction in Poland, as for example for the budgets allocated to basic income support and coupled aids that are planned to increase in this new period, despite the fact that these aids support the status quo, or can indirectly support harmful forms of farming. The revision of the interventions and budgets proposed in the EU Regulation therefore appears necessary for the next CAP

REFERENCES

Alliance Environnement (2020) *Evaluation of the Impact of the CAP on Water*. Alliance Environnement study for European Commission, DG AGRI, Publications Office of the European Union, Luxembourg.

Alliance Environnement and Ricardo-AEA (2018) *Evaluation study of the impact of the CAP on climate change and greenhouse gas emissions*. ISBN 978-92-79-85797-3, Alliance Environnement study for European Commission DG AGRI, Brussels.

Banaszak-Cibicka W. (2022) *Wskazanie gatunków owadów zapylających oraz możliwości realizacji działań ochronnych - wstępne badania studyjne dotyczące realizacji celów unijnej strategii różnorodności biologicznej*. . Expertise for Ministry of Climate nad Environment.

Biodiversity Information System for Europe *Poland*. https://biodiversity.europa.eu/countries/poland Accessed

BirdLife, EEB and NABU (2022) *New CAP unpacked.. and unfit*. BirdLife International, European Environment Bureau, NABU, Brussels.

Ceglar, A, Zampieri, M, Toreti, A and Dentener, F (2019) Observed northward migration of agro-climate zones in Europe will further accelerate under climate change. *Earth's Future* No 7 (9), 1088-1101.

Clough, Y, Kirchweger, S and Kantelhardt, J (2020) Field sizes and the future of farmland biodiversity in European landscapes. *Conservation Letters* No 13 (6), e12752.

Crippa, M, Solazzo, E, Guizzardi, D, Monforti-Ferrario, F, Tubiello, F and Leip, A (2021) Food systems are responsible for a third of global anthropogenic GHG emissions. *Nature Food* No 2 (3), 198-209.

EEA (2019a) *Climate change adaptation in the agriculture sector in Europe*. 4/2019.

EEA (2019b) *The European environment — state and outlook 2020: knowledge for transition to a sustainable Europe*. European Environment Agency, Copenhagen.

EIP-Agri (2019) *Dywersyfikacja źródeł białka na cele paszowe w oparciu o hodowlę owadów w gospodarstwach rolnych nastawionych na produkcję ekologiczną*. https://ec.europa.eu/eip/agriculture/en/find-connect/projects/dywersyfikacja-

%C5%BAr%C3%B3de%C5%82-bia%C5%82ka-na-cele-paszowe-w Accessed 15/02/2023

EIP-Agri (2021) *Innowacyjna technologia uprawy warzyw w zamkniętym cyklu wody*. https://ec.europa.eu/eip/agriculture/en/find-connect/projects/innowacyjna-technologia-uprawy-warzyw-w-zamkni%C4%99tym Accessed 15/02/2023

Estrada-Carmona, N, Sánchez, A C, Remans, R and Jones, S K (2022) Complex agricultural landscapes host more biodiversity than simple ones: A global meta-analysis. *Proceedings of the National Academy of Sciences* No 119 (38), e2203385119.

European Commission *Agri-food data portal*. https://agridata.ec.europa.eu/extensions/DataPortal/home.html Accessed

European Commission (2019) *Factsheet on 2014-2020 Rural Development Programme for Poland*. European Commission.

European Commission (2020) *Commission recommendation for Poland's CAP strategic plan*. European Commission, Bruxelles.

European Commission (2021) *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions – Forging a climate-resilient Europe - the new EU Strategy on Adaptation to Climate Change*. COM(2021) 82 final, European Commission, Strasbourg.

European Commission (2022) *At a glance: Poland CAP Strategic Plan*. European Commission, Brussels.

European Environment Agency *Pesticides in rivers, lakes and groundwater in Europe*. https://www.eea.europa.eu/ims/pesticides-in-rivers-lakes-and Accessed

European Environment Agency (2019) *Main pressures and threats to habitats and species*. https://www.eea.europa.eu/themes/biodiversity/state-of-nature-in-the-eu/article-17-national-summary-dashboards/main-pressures-and-threats Accessed 18/01/2023

European Environment Agency (2020) *EEA 2018 water assessment*. https://www.eea.europa.eu/themes/water/european-waters/water-quality-and-water-assessment/water-assessments Accessed

European Environment Agency (2021a) *Conservation status of habitats under the EU Habitats Directive*. https://www.eea.europa.eu/ims/conservation-status-of-habitats-under Accessed

European Environment Agency (2021b) *Conservation status of species under the EU Habitats Directive*. https://www.eea.europa.eu/ims/conservation-status-of-species-under Accessed

Eurostat (2020a) *Agri-environmental indicator - soil cover*. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Agri-environmental_indicator_-_soil_cover Accessed

Eurostat (2020b) *Agri-environmental indicator - tillage practices*. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Agri-environmental_indicator_-_tillage_practices Accessed

Gallego J. (2017) *Copernicus Land Services to improve EU statistics*. EUR 29027 EN, Joint Research Center, Publications Office of the European Union, Luxembourg.

General Directorate for Environment Protection (2021a) *Priorytetowe ramy działan (PAF) dla sieci Natura 2000 w Polsce na lata 2021–2027*

General Directorate for Environment Protection (2021b) *Projet strategii ochrony obszarów wodno-blotnych w Polsce na lata 2022-2032*.

General Directorate for Environment Protection (2022) *Monitoring i ocena jednolitych części wód powierzchniowych rzecznych*.

Greifswald Mire Centre (2020) *Peatlands in the EU. Common agricultural policy (CAP) after 2020*. Greifswald Mire Centre, Wetlands International, National University of Ireland (NUI) Galway (2020), Greifswald Mire Centre, Germany.

Hass, A L, Kormann, U G, Tscharntke, T, Clough, Y, Baillod Aliette, B, Sirami, C, Fahrig, L, Martin, J-L, Baudry, J, Bertrand, C, Bosch, J, Brotons, L, Burel, F, Georges, R, Giralt, D, Marcos-García María, Á, Ricarte, A, Siriwardena, G and Batáry, P (2018) Landscape configurational heterogeneity by small-scale agriculture, not crop diversity, maintains pollinators and plant reproduction in western Europe. *Proceedings of the Royal Society B: Biological Sciences* No 285 (1872), 20172242.

Kolecka, N (2021) Greening trends and their relationship with agricultural land abandonment across Poland. *Remote Sensing of Environment* No 257, 112340.

Kotowski, W (2021) *Oszacowanie emisji gazów cieplarnianych z użytkowania gleb organicznych w Polsce oraz potencjału ich redukcji*. Fundacja WWF Polska Warsaw.

Kujawa, K, Janku, K, Mana, M and Choryński, A (2021) The loss of woody linear landscape elements in agriculture landscape in Wielkopolska region (Poland) in 21th century. *Baltic Forestry* No 27 (1), 459.

Ministry of Agriculture and Rural Development of Poland (2022) *CAP Strategic Plan Report*. Ministry of Agriculture and Rural Development of Poland,, Warsaw.

Ministry of Climate and Environment of Poland (2021) *Poland's National Inventory Report 2021: Greenhouse gas inventory for 1988-2019*. Ministry of Climate and Environment of Poland,, Warsaw.

Ministry of the Environment of Poland (2020) *Polish National Strategy for Adaptation to Climate Change (NAS 2020)*. Ministry of the Environment of Poland, Warsaw.

Monitoring Ptaków Polski (2022) *Wskaźnik liczebności pospolitych ptaków krajobrazu rolniczeg, rok 2022*. https://monitoringptakow.gios.gov.pl/ptaki-krajobrazu-rolniczego.html Accessed

OECD (2019) *Agriculture and water policies: main characteristics and evolution from 2009 to 2019 - Poland*.

Pe'er, G, Birkenstock, M, Lakner, S and Röder, N (2021a) *The Common Agricultural Policy post-2020: Views and recommendations from scientists to improve performance for biodiversity. Volume 2 – Annexes*. Thünen Working Paper 175 – Volume 2, Johann Heinrich von Thünen Institute, Braunschweig/Germany.

Pe'er, G, Birkenstock, M, Lakner, S and Röder, N (2021b) *The Common Agricultural Policy post-2020: Views and recommendations from scientists to improve performance for biodiversity. Volume 3 – Policy Brief*. Thünen Working Paper 175 – Volume 3, Johann Heinrich von Thünen Institute, Braunschweig/Germany.

Redlich, S, Martin, E A, Wende, B and Steffan-Dewenter, I (2018) Landscape heterogeneity rather than crop diversity mediates bird diversity in agricultural landscapes. *PLoS ONE* No 13 (8), e0200438.

Silva, V, Mol, H G J, Zomer, P, Tienstra, M, Ritsema, C J and Geissen, V (2019) Pesticide residues in European agricultural soils – A hidden reality unfolded. *Science of the Total Environment* No 653, 1532-1545.

Stolte, J, Tesfai, M, Øygarden, L, Kværnø, S, Keizer, J, Verheijen, F, Panagos, P, Ballabio, C and Hessel, R (2015) *Soil threats in Europe: status, methods, drivers and effects on ecosystem services*. JRC Technical Reports, 978-92-79-54019, Joint Research Centre, European Commission.

Tóth, G, Stolbovoy, V and Montanarella, L (2007) Soil quality and sustainability evaluation. *An integrated approach to support soil-related policies of the European Union. Office for Official Publications of the European Communities, EUR* No 22721.

Van Swaay, C A M, Dennis, E B, Schmucki, R, Sevilleja, C, Balalaikins, M, Botham, M, Bourn, N, Brereton, T, Cancela, J P, Carlisle, B, Chambers, P, Collins, S, Dopagne, C, Escobés, R, Feldmann, R, Fernández-García, J M, Fontaine, B, Gracianteparaluceta, A, Harrower, C, Harpke, A, Heliölä, J, Komac, B, Kühn, E, Lang, A, Maes, D, Mestdagh, X, Middlebrook, I, Monasterio, Y, Munguira, M L, Murray, T E, Musche, M, Õunap, E, Paramo, F, Pettersson, L B, Piqueray, J, Settele, J, Stefanescu, C, Švitra, G, Tiitsaar, A, Verovnik, R, Warren, M S, Wynhoff, I and Roy, D B (2019) *The EU Butterfly Indicator for Grassland species: 1990-2017: Technical Report*. Butterfly Conservation Europe & ABLE/eBMS (www.butterfly-monitoring.net).

Wardecki Ł., Chodkiewicz T., Beuch S., Smyk B., Sikora A., Neubauer G., Meissner W., Marchowski D., Wylegała P. and Chylarecki P. (2021) Monitoring Ptaków Polski w latach 2018–2021. . *Biuletyn Monitoringu Przyrody* No 22, 1-80.

Wärnbäck, J, Josefsson, J and Eggers, S (2018) *Farmers for Skylarks*. pp.

Zych M., Denisow B., Gajda A., Kiljanek T., Kramarz P. and Szentgyörgyi H. (2020) *Narodowa Strategia ochrony Owadów Zapylających*. . Greenpeace Polska

ANNEX

Budget of the interventions related to environmental and climate objectives

N°	Title	Pillar	Planned budget (in million euros, whole period)	Planned budget (% of direct payments or Pillar II budget, whole period, total public expenditure)
I 4.1	Eco-scheme - Areas with melliferous plants	P1	39.5	0.2
I 4.2	Eco-scheme - Carbon farming and nutrient management	P1	2,777.2	16.0
I 4.3	Eco-scheme - Integrated plant production	P1	40.5	0.2
I 4.4	Eco-scheme - Biological plant protection	P1	2.2	<0.1
I 4.5	Eco-scheme - Water retention on permanent grassland	P1	97.3	0.6
I 8.1	Environmental and climate commitment - Protection of valuable habitats and endangered species in Natura 2000 sites	P2	237.5	3.1
I 8.2	Environmental and climate commitment - Protection of valuable habitats and endangered species outside Natura 2000 sites	P2	301.4	4.0
I 8.3	Environmental and climate commitment - Extensive use of meadows and pastures in Natura 2000 sites	P2	17.7	0.2

I 8.4	Environmental and climate commitment - Preservation of orchards of traditional varieties of fruit trees	P2	0.7	<0.1
I 8.5	Environmental and climate commitment - Conservation of endangered plant genetic resources in agriculture	P2	6.8	0.1
I 8.6	Environmental and climate commitment - Conservation of endangered animal genetic resources in agriculture	P2	101.8	1.3
I 8.7	Environmental and climate commitment – Biodiversity in arable land	P2	2.8	<0.1
I 8.8	Environmental and climate commitment - Afforestation and tree premiums and agroforestry systems	P2	8.0	0.1
I 8.11	Environmental and climate commitment - Organic farming	P2	904.9	11.9
I 10.2	Investments - Investments in agricultural holdings in the field of renewable energy supply and energy efficiency improvement	P2	267.7	3.5
I 10.4	Investments - Investments contributing to environmental and climate protection	P2	217.5	2.9
I 10.11	Investments - Afforestation of agricultural land	P2	11.6	0.2
I 10.12	Investments - Creation of in-field trees	P2	6.0	0.1
I 10.13	Investments - Establishment of agroforestry systems	P2	6.0	0.1
I 13.5	Cooperation - Cooperation of the EIP Operational Groups	P2	109.0	1.4

I 14.1	Knowledge exchange - Professional development of farmers	P2	33.7	0.4
I 14.2	Knowledge exchange - Comprehensive Agricultural Consultancy	P2	136.5	1.8
I 14.3	Knowledge exchange - Professional development of advisory staff	P2	8.8	0.1
I 14.4	Knowledge exchange - Support for demonstration farms	P2	22.0	0.3

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