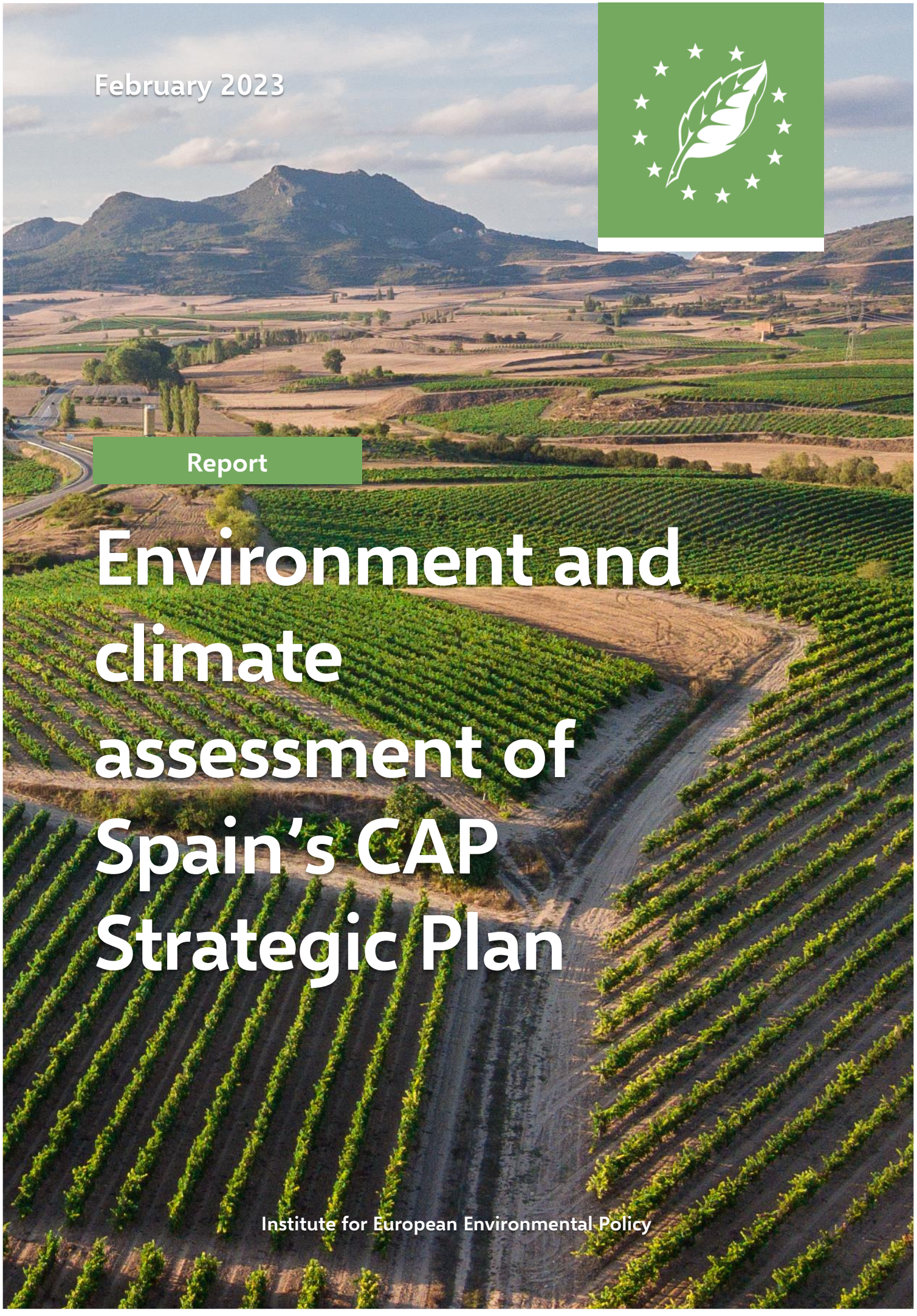

February 2023

Report

Environment and climate assessment of Spain's CAP Strategic Plan

Institute for European Environmental Policy

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Nadeu, E., Midler, E. and Pagnon, J. (2023) 'Assessment of the Spanish CAP Strategic Plan: environmental and climate contributions', Policy report, Institute for European Environmental Policy

CORRESPONDING AUTHORS

Elisabet Nadeu (enadeu@ieep.eu)

ACKNOWLEDGEMENTS

We gratefully acknowledge helpful reviews from Harriet Bradley (IEEP) and comments from Inma Batalla (BC3).

This work has been produced with the financial support of the LIFE Programme of the European Union. The paper reflects only the views of its authors and not the donors.

IEEP office
Rue Joseph II 36-38,
1000 Brussels, Belgium
Tel: +32 (0) 2738 7482
Fax: +32 (0) 2732 4004

CONTENTS

GLOSSARY

AC: Autonomous Community

ANC: Areas of Natural Constraints

CAP: Common Agricultural Policy

CSP: CAP Strategic Plan

CH_4: Methane

CO_2: Carbon dioxide

EAFRD: European Agricultural Fund for Rural Development

EAGF: European Agricultural Guarantee Fund

EIP: European Innovation Partnership

EU: European Union

GAEC: Good Agricultural and Environmental Conditions

GHG: Greenhouse Gas

LSU: Livestock Unit

LULUCF: Land Use and Land-Use Change and Forestry

$MtCO_2e$: Million tons of CO2 equivalent

N_2O: Nitrous Oxide

NVZ: Nitrate Vulnerable Zones

PNACC: Spanish National Climate Change and Adaptation Plan

SO: Specific Objective

SOC: Soil Organic Carbon

SOM: Soil Organic Matter

UAA: Utilised Agricultural Area

EXECUTIVE SUMMARY

The European Union's food system has considerable impacts on the climate and environment. European food systems are responsible for an estimated 30% of the continent's GHG emissions. Agriculture is also the main pressure on biodiversity (through pesticides use, landscape simplification and the destruction 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 were asked to submit a National Strategic Plan presenting, among other things: the country's needs for each specific objective, the interventions they planned 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 Spain.

The findings suggest that, overall, Spain has not significantly increased its environmental and climate ambition for the new CAP. The Plan contains some improvements such as increased support for organic farming and a new requirement to register fertiliser and organic inputs to soils (GAEC 10). However, the budget allocation to environmental and socio-economic objectives does not present significant differences to the previous CAP period and falls short of meeting the identified environment, biodiversity and climate needs. Novel interventions like eco-schemes, if properly re-designed and rewarded, as well as revised conditions for coupled income support and investments for irrigation

systems, could provide an opportunity to improve the environmental and climate performance of the Spanish agricultural sector, contributing to the objectives set by the European Green Deal.

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

- Address the gaps between the identified challenges and needs and the planned interventions (e.g. climate adaptation and water use, GHG emissions reduction from livestock). In the case where a lack of certain specific interventions is complemented by national legislation, explain these in the Plan.

- Strengthen baseline (GAEC) requirements. In particular for the area devoted to landscape features (GAEC 8, e.g. 10% of landscape features and fallow instead of 4%) and for fertiliser use (GAEC 10, e.g. consider introducing a commitment or targets to effectively reduce fertiliser use) in line with the objectives in the Farm to Fork Strategy.

- Review the eco-schemes to strengthen requirements and introduce payments rewarding increased levels of ambition to reward farmers more fairly for their efforts. Spain currently provides flat-rate eco-schemes, with just an additional 25 euros/ha amount for two practices if the commitment is maintained in subsequent years. This bonus could be extended to all practices, in particular those that lead to an increase in soil organic carbon (to avoid its release in the short-term).

- Improve coherence between the identified needs and the interventions in relation to water quantity and use. Examples include introducing more stringent requirements for interventions supporting investments in irrigation systems to further reduce, or at least avoid the increase of, water consumption; reducing the allocated payments on irrigated land and increasing those for rainfed areas and the promotion of shifts to low water-intensive crops (in eco-schemes and Pillar II measures).

- Include safeguards to take into account the potential trade-offs between environmental objectives (e.g. limiting or banning herbicide use in eco-scheme practices promoting conservation agriculture and direct seeding (P4)) and strengthen the requirements and safeguards on potentially harmful measures such as coupled support for livestock (e.g. place a cap on the number of cattle eligible for support in line with climate objectives).

- Introduce results-based payments for specific interventions targeting particular problems. Include collective approaches that could be beneficial for the preservation of natural resources and biodiversity and increase the budget for innovative approaches (e.g. result-based payments) and accompanying training and advice.

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

- Biodiversity- and climate-proof the CAP Strategic Plans and their interventions. This means considering trade-offs between environmental and climate objectives, including additional safeguards (e.g. for biodiversity when supporting no-till, or climate in coupled income support), and identifying and promoting win-win strategies.

- Increase action to reduce the agriculture sector's GHG emissions and carbon removals in the 2023 revision of Member States' National Energy and Climate plans (NECPs, due by 30 June 2023), and amend the CAP Strategic Plan accordingly.

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

- 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.

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 Union's GHG emissions (Crippa et al, 2021). They are also the main pressure on biodiversity (through pesticides use, landscape simplification and the destruction of habitats), and responsible, to a large extent, for the physical, chemical, and biological degradation of soils and deterioration of water quality and availability. To 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 reduction 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 opportunity for the achievement of 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, accounting for 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 (hereafter SO): one cross-cutting on knowledge and innovation, three economic, three social, and three that are environment and climate related: climate action (SO4), the protection of natural resources (SO5) and the conservation of biodiversity (SO6). 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, CSP, 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, Member States are required to set targets for a set of 'result indicators' (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 Plans' likely contribution to climate mitigation and adaptation, natural resources, and biodiversity protection, in this case for Spain. Spain is one of the EU's major agricultural producers: dedicating one third of its land to agricultural production and representing 15% of the total EU agricultural area (European Commission, 2022a). In terms of land distribution, arable crops are the most extensive (17% of Spain's total area), followed by woody crops (10%) and fallow land (6%) (MAPA, 2022a). There are more than 900,000 farms in Spain, representing 9.2% of the EU's farms, half of which are very small (<5 ha or less) (European Commission, 2022b). In 2017 Spain produced 13% of the total value of EU crop production and almost 11% of the value of EU animal production (European Commission, 2019). The most important sectors in terms of production value are olive oil, fruits, vegetables and wine. There are large differences in climate, topography, soil conditions and water availability within the country. The Spanish agricultural sector has undergone significant intensification. Between 2005 and 2017, the percentage of Utilised Agricultural Area (hereafter, UAA) managed intensively[1] increased from 27% to 42%[2].

Spain's CAP Strategic Plan was approved by the European Commission in August 2022. This assessment focuses on agriculture (excluding forestry) and is structured in five sections. First, it presents the general priorities set up by Spain in its Strategic Plan and the planned allocation of funding, together with an estimate of the amount of funding targeting environmental and climate objectives. The three following sections explore the planned interventions for climate mitigation and adaptation (section 2, SO4), natural resources protection, in particular water and soil (section 3, SO5) and the conservation and restoration of biodiversity (section 4, SO6). Then, the report presents the transversal interventions that could contribute jointly to these three objectives, i.e. those supporting cooperation, innovation, knowledge exchange and dissemination and advisory services, as well as innovative approaches. Finally, the concluding section summarises the results and proposes key recommendations to improve the environmental and climate contribution of the Strategic Plan.

[1] Intensity is defined as the level of inputs used by the farm per unit of factor of production

[2] See results for the farming intensity context indicator (C33) on the CAP Indicators portal

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

The Spanish CAP Strategic Plan defines three main lines of action to respond to a set of needs identified by the European Commission:

1. Greater equity in income support, through an improvement in the distribution system of direct aid.
2. Ensure compliance with environmental commitments and targets, combining regulatory measures with payments that reward farmers' efforts beyond the baseline.
3. Implementation of a wide range of measures aimed at contributing to the environmental, economic and social sustainability of the sector.

Regarding environmental and climate targets and commitments, the Spanish Plan prioritises the following issues under each specific objective:

- Climate (SO4): minimising greenhouse gas (GHG) emissions, increasing carbon sequestration, reducing the impact of climate change

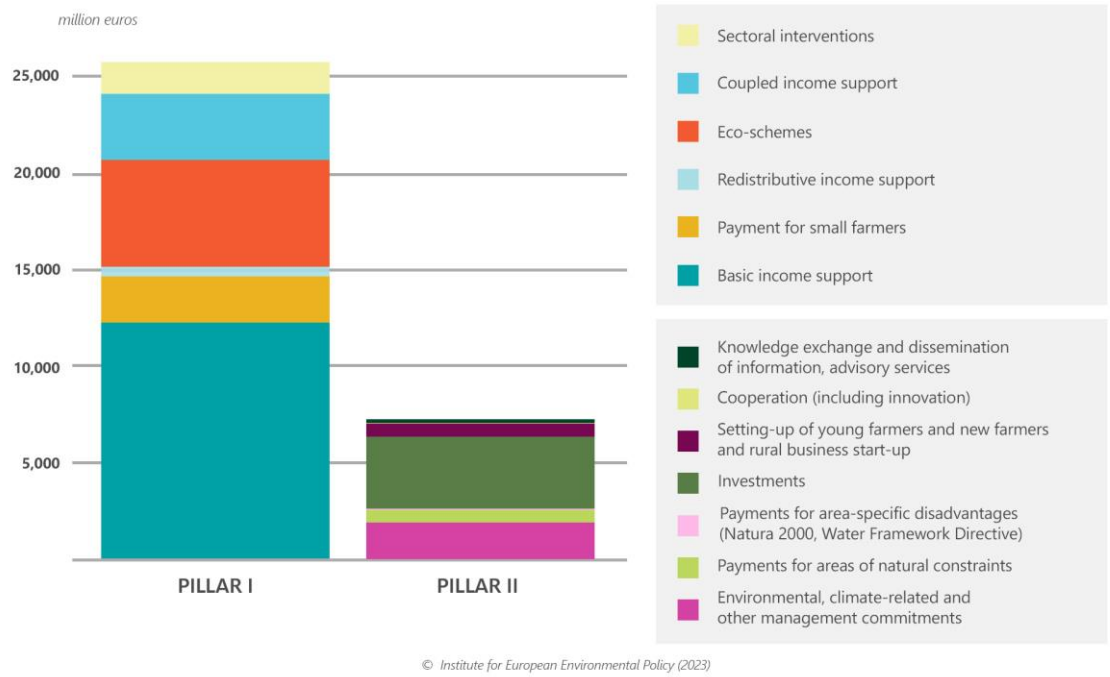
- Resource use (SO5): reaching good status for water quality, reducing water pollution by agriculture, reducing ammonia (NH_3) emissions

- Biodiversity (SO6): reversing the negative trend in common farmland birds, maintenance and recovery of habitats, Natura 2000, and promoting sustainable production systems

An analysis of CAP budget allocation sheds light on the priority given to the different objectives in the Plan. In total, the CAP budget in Spain will be of approximately 34 billion euros, out of which around 31 billion euros come from the EU and the remaining three billion euros from national co-funding. 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')[5]. 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-schemes.

Chart 1 below shows the allocation of Spain's CAP budget to different Pillar I and Pillar II interventions[3]. Overall, for the upcoming period (from 2023 on) around 76% of the total CAP budget will go to Pillar I. This proportion is similar to the EU average, with 75% of the total EU funding going to Pillar I. Within Pillar I, Basic Income Support payments constitute 51% of direct payments. This represents a small reduction from the previous period (51% now vs 55% in the previous period). Spain has decided not to use the possibility to transfer funds between Pillars. Also, Spain has not programmed interventions under "risk management tools", understanding that risk is already supported via national instruments such as the Spanish Agricultural Insurance System (ENESA). Since the Plan does not provide information on this separate system or how it links with the identified needs, the impact of risk management has not been considered in this report.

Chart 1: Budget allocation to interventions in Pillar I and Pillar II (in million euros)



Source: Spanish CSP, available here

[3] These estimations are based on the version of the Spanish CSP available from the website of the Spanish Ministry for Agriculture, Fisheries and Food: https://www.mapa.gob.es/es/pac/post-2020/plan-estrategico-pac.aspx There may be some differences between this version and the oen from the European Commission.

To guarantee a minimum budget ('ringfencing') for interventions benefiting public goods in all countries, the EU CAP Regulation[4] 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[6]. 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). Spain has allocated 23%[5] of its direct payments budget to eco-schemes (around 5.5 billion euros), whereas for Pillar II they exceeded the minimum, allocating 48% of Pillar II to environmental, climate and animal welfare objectives[6] (around 3.9 billion euros). Most of the spending under Pillar II is directed to investments.

Looking at the detailed allocation of the CAP budget[7] to the different types of interventions (see Chart 2 below), basic income support, which, as its name indicates aims to support farmers' income, remains the most funded instrument, with a budget of 12 billion euros (36% of the total CAP budget). This is more than twice the eco-scheme budget and four times the budget for Pillar II environment and climate commitments. The budget for interventions contributing to green objectives (environment, climate, and marginally in the case of Spain, animal welfare) is 9.3 billion euros, 27% of the total CAP budget. This includes Pillar I eco-schemes, 15%[7] of the sectoral interventions targeting the fruit and vegetable sector, Pillar II environmental, climate and other commitments, investments contributing to environmental objectives[8] as well as payments for area-specific disadvantages. Almost half of the Pillar II spending is allocated to investments (45%). While aid for productive investments might contribute to the objectives (i.e. by supporting the modernisation of buildings to improve their energy performance) it is not clear to what extent it will be used for these purposes, as it

[4] EU Regulation 2021/2115 establishing rules on support for national CAP strategic plans, and repealing EU Regulations 1305/2013 and 1307/2013

[5] The EC allows Member States to allocate less than 25% of P1 budget to eco-schemes if they are spending particularly high proportions of their rural development funding on the environment and climate, which is the case of Spain.

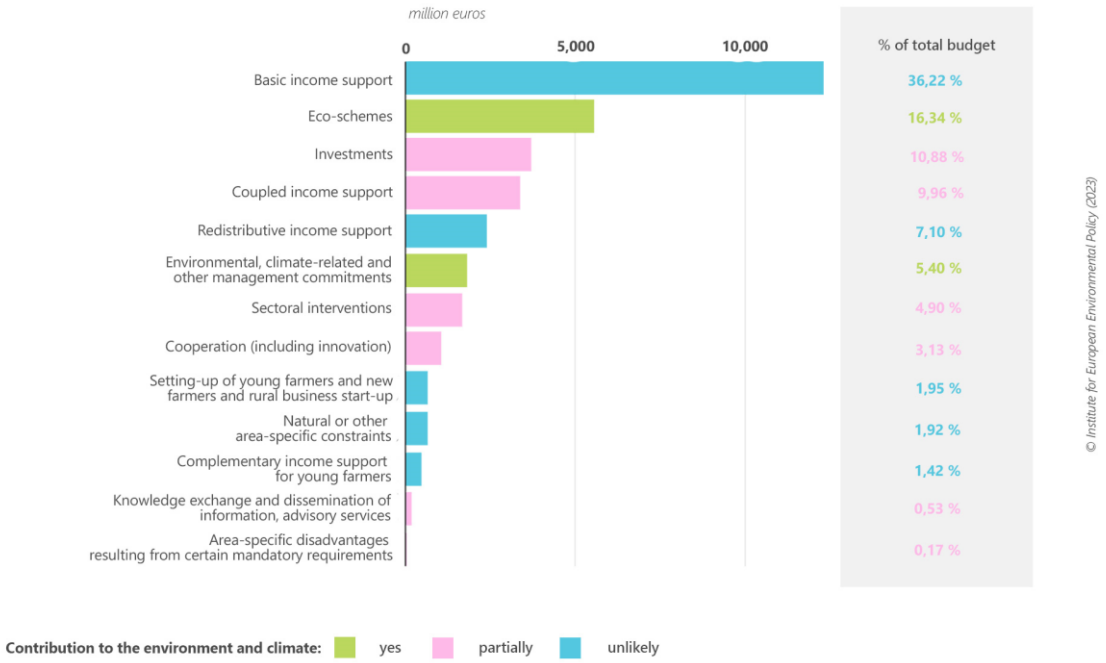
[6] Several interventions in the Plan address animal welfare, but they only cover 3.6% of LSU. A dedicated animal welfare intervention (6504) receives 80 million euros (represents 4% of environmental and climate commitments).

[7] In agreement with Article 93 in the CAP regulation, but we have not been able to verify this.

[8] Includes productive and non-productive investments listed in the plan as contributing to Specific Objectives 4, 5 and 6.

also funds investments focusing on other objectives such as productivity improvements, on-farm transformation and diversification of economic activities. For comparison, we estimate that around 23 billion euros[9] of Spain's CAP budget is allocated to socio-economic objectives, corresponding to around 70% of the total spending.

Chart 2: Budget allocation to interventions (in million euros)



Source: Spanish CSP, available here. Interventions targeting specifically environmental and climate action are shown in green. Interventions coloured in pink might partially contribute to the environment and climate. Interventions coloured in blue target other objectives.

Assessing the share of funding allocated to the three specific environmental and climate objectives is not straightforward. The Plan defines detailed needs for each of the specific objectives, and associates each intervention[11] with one or more of these needs (e.g. there are ten identified needs for SO4 on climate). Given that most of the interventions address several of the objectives and needs at the same time, a precise estimate of the budget allocated to each is complex and would involve making many assumptions, which is not attempted here. It is also difficult

[9] We estimate that the following interventions contribute to economic objectives: All Pillar I interventions except the eco-schemes. From Pillar II: payments for area of natural constraints, area-specific disadvantages resulting from certain mandatory requirements and productive investments not targeting environmental and climate objectives and payments for setting up young farmers and new farmers. Some of these interventions also contribute to social and rural development objectives but are included in the calculation since they support the income of specific farmers' populations.

to estimate the effectiveness of each of the interventions to reaching the overall goals. While the Plan gives an estimate of the targeted output area for each intervention, which provides an indication of its priorities, there is no information on its expected impact. To make it even more challenging, the same interventions are not implemented in all regions and their implementation requirements differ between Spain's Autonomous Communities (hereafter ACs), who decide on the final allocation of funds and level of ambition.

Notwithstanding these challenges, given that the largest share of spending on environment and climate goes to the eco-schemes, their potential effectiveness is particularly important as an indicator of the contribution of the CSP to the environment and climate. Box 1 below presents an overview of the eco-schemes designed by Spain, which, as mentioned, receive 23% of the Pillar I budget. There are nine of them, which cover seven types of practices related to carbon farming and agroecology.

Box 1: The Spanish eco-schemes

One of the novelties in the CAP structure is the introduction of eco-schemes. Voluntary for farmers, they can support the implementation of sustainable agricultural practices. Their content and design vary between countries.

The Spanish Plan proposes nine eco-schemes linked to carbon farming and agroecology which can be grouped in four main categories: extensive grazing and mowing in pastures, rotations and no-tillage in cropland, soil cover in woody crops, and landscape and biodiversity features in croplands (see Figure 1 below). Combined, these categories include seven different practices (P) which farmers can choose from, depending on their interest or current practices and their geo-biophysical characteristics. Spain has opted for eco-schemes that can be applied virtually on all agricultural land, rather than targeting specific regions or types of agriculture with the most pressing environmental, climate and biodiversity impacts.

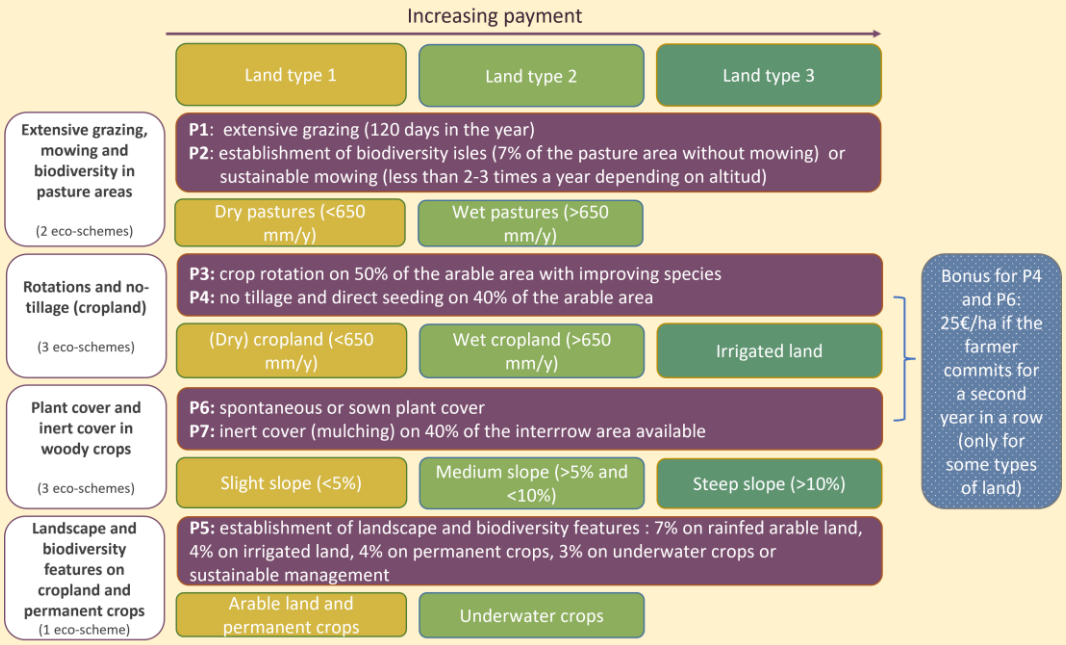


Figure 1: Authors' elaboration, based on Spain's Plan description.

The eco-schemes support the implementation of sustainable grazing and mowing practices in pastures (P1-P2), enhanced crop rotations and conservation agriculture in arable land in drylands, wet drylands and irrigated land (P3 and P4), the establishment of vegetation and mulching in woody crops under various slopes (P6-P7), and increased biodiversity in cultivated land as well as permanent crops (P5)[10]. All these measures are expected to contribute to specific objectives 4, 5 and 6, although practices P1, P2 and P5 are more oriented towards biodiversity while practices P3, P4, P5 and P6 focus on improving soil quality. The Plan says that all practices contribute to climate objectives.

The payments are area-based payments to compensate for the income forgone and the additional costs arising from the application of the practices. Each hectare of land can only opt for one type of practice (P). The amounts range between 40-165 euros/ha. Spain has not used the possibility of incorporating different payments for increasing levels of environmental and climate ambition, nor opted for result-based payments. It also doesn't oblige farmers to commit for more than one year. However, a bonus of 25 euros/ha is foreseen for those farmers who

[10] Specific information on eco-schemes can also be found here (in Spanish only):

commit for a second year for two of the practices (P4 and P6), which increases their positive benefits for the environment and climate. Not all hectares of land are supported equally, the amounts paid per area are higher for irrigated land (P3, P4) as well as those under steeper slopes (P6, P7). Payments are also higher for farmers in the Islands (Canary and Balearic Islands) than for the Peninsula.

Most of the practices supported under these eco-schemes build on the mandatory requirements from conditionality (i.e. GAEC 6 on soil cover, GAEC 7 on crop rotations in arable land and GAEC 8 on non-productive areas or landscape features). For instance, in GAEC 7 rotations are required after three years only, while the eco-schemes ask for annual rotations (on 50% of the land). In the case of landscape features the percentage of land covered must be 7% instead of the 4% required under GAEC 8. It can also be expected that farmers will choose the eco-schemes that support some of the practices that they are already implementing, thus reducing the potential additional benefits of these interventions. Spain has therefore not used the full potential of eco-schemes to implement innovative or additional practices and boost the environmental and climate performance of the CAP.

2. CONTRIBUTION TO CLIMATE CHANGE MITIGATION AND ADAPTATION

This section focuses on the standards of Good Agricultural and Environmental Conditions (hereafter GAEC), and the interventions in Spain's Strategic Plan that contribute to: (i) reducing GHG emissions, (ii) carbon storage and (iii) climate adaptation. We review the three of them in detail.

2.1 GHG emissions' reduction

2.1.1 State of play in Spain and resulting needs

Spain's agricultural GHG emissions[11] represent 11.3% of its total national emissions. The country is the third largest agricultural GHG emitter in the EU (after France and Germany), accounting for 10% of total EU agricultural emissions (European Commission, 2020). Around 44.6% of the total net agricultural GHG emissions in Spain are directly related to livestock farming (i.e. enteric fermentation from cattle production) and 31.1% stems from agricultural soils (European Commission, 2020). Emissions from the agricultural sector fell by 7% from 1990 to 2013 but increased afterwards by 9.3% to the current levels (European Commission, 2020). The increase in GHG emissions from the agricultural sector in Spain has been higher than the EU average.

As in other sectors, Spain will be increasingly pressured to reduce its agricultural GHG emissions in the coming years. Measures with the largest potential to achieve would consist in reducing livestock numbers, improving manure and slurry management (which accounts for 22% of agricultural emissions) and adopting fertilisation strategies that contribute to an overall reduction in fertiliser use.

2.1.2 Planned interventions

To understand how the Plan has addressed these needs, Table 1 presents the interventions and standards that are explicitly mentioned by Spain as targeting GHG emission reductions. Their main benefits and limitations are included in the Table and their assigned budget is provided in the Annex.

In addition to the listed measures, two conditionality standards will contribute to reducing GHG emissions: GAEC 3, which places a ban on the burning of stubble (avoiding CO_2 emissions), and the novel GAEC 10, contributing to achieving

[11] Including LULUCF (Land Use, Land Use Change and Forestry)

sustainable fertilisation[12] (thus reducing N_2O emissions). GAEC 10 requires farmers to plan and record nutrient and organic carbon inputs to soil, in line with the recently approved Royal Decree 1051/2022, but there are no quantitative targets set for reduction or for the optimisation of their use, which would have been welcome. Next to these, there are four main types of interventions targeting reductions in GHG emissions: eco-schemes, environmental and climate commitments, productive investments and sectoral interventions. The eco-schemes relevant for this objective support increased crop rotations (P3), implementation of no-tillage (P4) and the application of soil cover on woody crops (P6, P7). These measures contribute to maintaining soil organic matter in soils and reducing carbon emissions that result from soil degradation. A requirement to introduce leguminous crops in P3 is likely to reduce fertiliser inputs, overall decreasing GHG emissions. However, the requirements are very minimal (e.g. 10% of the surface sown with species to improve soil fertility, of which at least half must be leguminous crops). Additional payments are provided for those farmers maintaining the measure in subsequent years. Two eco-schemes supporting practices P1 and P2 have not been listed in the Plan as contributing to GHG emission reductions, although they also limit stocking rates in wet pastures (0.4-2 LSU/ha) and Mediterranean grasslands (0.2-1.2 LSU/ha).

One of the environmental and climate commitments (6501.3) focuses on sustainable pasture management to reduce GHG emissions. This area-based payment can include the implementation of no-tillage, limits to fertiliser and pesticide use, extensive grazing, controlled grazing, limits on livestock stocking rates (in general between 0.1-2 LSU/ha) as well as temporary sequestration of livestock. The only common requirement for ACs is to limit fertiliser (and pesticide) use, additional ambition is left to ACs. This commitment is one of the few interventions where number of ACs programming it has reduced in relation to the previous CAP period (8 ACs now vs 14 ACs in the past) due to interactions with practice P1 supported by two of the eco-schemes.

The Plan also offers co-financing for productive investments linked to efficient use of resources (6841.1), including investments to reduce GHG emissions through the efficient management of manure and slurry, machinery for precision agriculture and investments in new machinery that can reduce or substitute

[12] Note that while the CSP promotes sustainable use of fertilisers, Spain provides at the same time "state aid for fertilisers", paying farmers between 22-55 euros/ha to compensate for high fertiliser costs and in detriment to small farmers (farmers entitled to less than 200 euros won't receive the payment).

current fuel use as well as investments to reduce energy consumption and transition towards renewables. This measure represents 2% of Pillar II spending.

While the above interventions can contribute to decreasing GHG emissions from fertiliser use, soil degradation, machinery and even manure and slurry, the Strategic Plan lacks measures to reduce emissions from its single largest contributor, enteric fermentation. In fact, Spain mentions that it only expects 0.12% of its share of livestock units to be under commitments to reduce GHG emissions (including manure management) (target for R.13). Rather than supporting reductions, the Plan provides aid for cattle farmers by offering Coupled Income Support (CIS) for cow milk production (up to 726 cows eligible per farm), suckler cows and calf fattening from extensive operations (without caps on numbers), and calf fattening in other operations (up to 1417 calves eligible). CIS for the livestock sector represents 11% of total direct payments. For comparison this spending corresponds to half of the spending on eco-schemes and is 50% higher than the budget for environmental and climate commitments. The share of direct payments going to CIS (all sectors) has also increased in the new CAP (14% in the current CSP versus 11% in the previous). The justification given for the CIS allocation for livestock is that the sector is highly reliant on public aid and that its disappearance would have negative social and environmental consequences (i.e. on biodiversity of the grazed pastures). However, coupled support may also be maintaining livestock numbers at higher levels than they might be without support, meaning further GHG reductions could be achieved without the aid. 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). However, if the aim is to support the low economic profitability of a sector that generates positive externalities for nature, stricter conditions should be set (e.g. a lower cap on animal numbers, a maximum stocking rate), to prevent the most intensive and damaging farms from receiving this support.

In summary, the Plan focuses on reducing emissions from crop production, by supporting practices that address soil fertility, reduce soil degradation and reduce the need for fertilisation. More interventions targeting reductions in emissions from livestock are needed to significantly reduce overall agricultural GHG emissions within the country.

Table 1: Potential impact of interventions on GHG emissions

Source of emissions	Interventions	Potential benefits and limitations
GHG emissions from crops	Eco-schemes on carbon farming and agroecology: rotations and no-tillage (1PD31001803V1, 1PD31001804V1, 1PD31001805V1)	+: introduction of leguminous crops can reduce fertiliser use, fertiliser plans and no-till required, higher payment for pluriannual application -: allows limiting rotations to 25% of the area of the agricultural holding (GAEC requirement), no limits to herbicide use (to be revised by 2025)
	Eco-schemes on carbon farming: cover crops and inert covers (mulching) on woody crops (1PD31001806V1, 1PD31001807V1, 1PD31001808V1)	+: increased carbon sequestration, reduced fertiliser use, encourages reduction in conventional tillage (reduced emissions) and removal of woody residues, builds up on obligations under GAEC 6, supplement of 25 euros/ha received if the farmer commits for more than one year -: easily reversible, no obligation to commit for more than one year
GHG emissions from livestock	Environmental and climate commitments for the promotion and sustainable management of pastures (6501.3)	+: supports no-till, limits on fertiliser use, extensive grazing, limitations to livestock stocking rates -: the only common obligation in relation to GHG emissions reduction are limits to fertiliser use, the rest varies widely between ACs, applied by 8 ACs only
	Aid for productive investments (6841.1)	+: manure management, feeding strategies -: broad range of measures; the impact will depend on the measures chosen by ACs and farmers
GHG emissions from energy consumption	Aid for productive investments (6841.1, 6842.1)	+: broad range of measures with high emission reduction potential -: impact will depend on the measures chosen
	Sectoral intervention for Fruit and Vegetables: investments in tangible and intangible assets, research and experimental and innovative production methods (1IS501801V1)	+: Investments in renewable energy production and increased energy efficiency -: this intervention covers a wide range of actions, the Plan doesn't specify the budget share to this particular objective

2.2 Carbon storage

2.2.1 State of play in Spain and resulting needs

The LULUCF (Land Use, Land Use Change and Forestry) sector in Spain is a net remover of GHG (-38k Mt CO2-equivalent), mostly due to the contribution of its forests (European Commission, 2020). Croplands are also a carbon sink (-3k Mt CO2-equivalent) but grasslands and wetlands are currently emitters. Spain needs to further develop its forest and agricultural carbon sinks to improve carbon removals, as proposed in its 2021-2030 National Energy and Climate Plan (NECP). Substantial changes in management practices will be required to achieve this. Specifically, the NECP mentions crop rotations on non-irrigated land as a measure that could increase carbon storage. In addition to this, the conservation of valuable traditional grasslands, orchards and agroforestry systems provide climate adaptative agroecosystems with "self-sustaining" nutrient cycles, limiting soil erosion and increasing carbon sequestration and capture capacity. A recent study suggests that the introduction of no-till and cover crops in cropland, next to an improvement in grassland management could increase the annual mitigation potential in Spain's agricultural land by almost 5.3 and 2.6 Mt CO2-equivalent in croplands and grasslands, respectively (Andrés et al, 2022).

2.2.2 Planned interventions

The Spanish Strategic Plan includes a number of interventions aiming to increase the carbon sink capacity of soil, woody crops and forestry systems (Table 2). In total, Spain expects to have approximately 32% of its UAA under commitments to enhance carbon storage (target for R.14[13]), but there is no estimation of how this will translate into quantitative removals. The relevant interventions are found as eco-schemes and Pillar II measures (environmental and climate commitments, productive and non-productive investments and cooperation measures). Some of the productive and non-productive investments directly address the forestry sector, but we have only assessed these if they also mention agroforestry. In addition to these interventions, the reinforced CAP conditionality will also contribute to increasing carbon sequestration in soils (via GAECs 1, 2 and 9).

All but one of the eco-schemes include measures to increase carbon storage in permanent grasslands, arable land and permanent woody crops. Two of the eco-schemes are on permanent grasslands (one on wet pastures and the other on Mediterranean grassland areas) and support extensive livestock pasture (P1) (with

[13] Share of Utilised Agricultural Area (UAA) under supported commitments to reduce emissions or to maintain or enhance carbon storage

maximum ceilings that range from 0.2 to 2 LSU/ha) and sustainable mowing (P2). The remaining six eco-schemes focus on arable land, both rainfed and irrigated land, and woody crops, all under the label of "carbon farming". They include measures that aim to increase soil organic carbon, and overall soil quality, by keeping soils covered under woody crops (P6 and P7), enhancing crop rotations (P3), and promoting conservation agriculture and direct seeding (P4). While the latter measure can have positive impacts on carbon storage, it should be regarded with caution since it does not include safeguards to limit herbicide use.

Measures aiming at storing carbon in soils and biomass have also been programmed under the Rural Development Fund (EAFRD) as part of the environmental and climate commitments. These are area-based payments covering a broad range of systems and support, for instance, the sustainable management of pastures (controlled grazing, limitations to fertilisation, limitation of stocking rates, no tillage), organic farming (5% of total UAA and 10.5% of the total EAFRD budget, increasing its budget relative to the previous period) and the implementation and maintenance of agroforestry (and forestry) systems. There is a requirement attached to these measures to maintain at least 80% of the area subject to the original commitment until the end of the programming period which could substantially increase its benefits. However, it is interesting to note that fewer Autonomous Communities (ACs) have opted for some of these interventions, often because some of them (partly) overlap with the new eco-schemes. This could reduce the level of environmental and climate ambition of the Plan, given that measures under environmental and climate commitments have more stringent requirements.

The Plan also mentions that certain productive and non-productive investments will increase the carbon sink capacity of soils, permanent crops and forestry systems by changing the type of crops grown on farms towards those with greater carbon sequestration capacity (e.g. 6841.1).

In summary, the mandatory standards and planned interventions will lead to higher organic carbon stocks over time by targeting improvements in soil quality, increased carbon inputs and a reduction in soil erosion rates. However, the magnitude of the sequestered carbon in soils through these measures remains limited and the problem of permanence (i.e. sequestered carbon can be easily released back to the atmosphere if the soil is ploughed, or if soil cover is lost and the soil is eroded) implies that safeguards would be needed to ensure their medium/long-term impact. The requirement attached to interventions under environmental and climate commitments to maintain at least 80% of the area subject to the original commitment in subsequent years are a positive step in this direction, but the level of ambition in the Plan could be increased. It is observed

that the introduction of eco-schemes has reduced the continuation of certain rural development interventions (e.g. 6501.8) in some ACs due to overlaps, it will need to be seen if this limits the environmental and climate benefits given the lower requirements in the eco-schemes.

Table 2: Potential impact of interventions on carbon storage

Carbon stocks	Interventions	Potential benefits and limitations
Woody landscape features	Environmental and climate commitments to maintain forestry and agroforestry systems (6502.2)	+: maintenance of agroforestry systems -: very small percentage of UAA covered (0.05%) and small budget (27 million euros)
	Sectoral intervention for Fruit and Vegetables: actions to mitigate and adapt to climate change (1IS501809V1)	+/-: broad range of measures, difficult to assess its impact. In relation to biomass it mentions afforestation
Arable land (soils)	Eco-schemes on carbon farming and agroecology: rotations and no-tillage (1PD31001803V1, 1PD31001804V1, 1PD31001805V1)	+: increased soil organic matter, reduced soil organic carbon oxidation, reduced soil erosion, leguminous crops must be included in the rotation (at least 5% of the eligible area) -: annual crop rotation only required on 50% of the eligible land, herbicides allowed on direct seeding (this will be revised in 2025)
	Eco-schemes on carbon farming: cover crops and inert covers (mulching) on woody crops (1PD31001806V1, 1PD31001807V1, 1PD31001808V1)	+: increase in carbon inputs and reduction of losses through erosion by protecting soil between woody crop rows, planned for approx. 10% of UAA, payments higher for steeper slopes more prone to run-off -: additional SOC can be lost if the commitment is only entered for one year (and ploughs the soil after that)
	Environmental and climate commitments for soil improvement and erosion control practices (6501.8)	+: includes support for improved crop rotations, precision farming, carbon farming and improved manure management -: implementation in ACs is weak in relation to its potential (e.g. in Navarra, manure management just ensures compliance with legislation)

	Environmental and climate commitments in organic farming (6503)	+: increased soil organic stocks (organic fertilisation), increased budget relative to previous period -: no safeguards to avoid tillage practices increase soil erosion rates
	Aid for productive investments (6841.1)	+: broad range of investments including those for conservation agriculture (increased SOC), and switch to crops with higher carbon storage potential -: broad range of measures, not targeting only carbon storage
Permanent grassland (soils)	Eco-schemes on extensive grazing, mowing and biodiversity in wet pastures (1PD31001801V1) and Mediterranean grassland areas pastures (1PD31001802V1)	+: supports extensive grazing with limited stocking rates, reduced soil degradation, also good for animal welfare +/-: stocking rates up to 2 LSU/ha for wet pastures, public authorities can modify stocking rates and minimum grazing conditions in some cases, doesn't mention if ploughing is allowed
	Environmental and climate commitments for the promotion and sustainable management of pastures. (6501.3)	+: restoration of pastures for improved ecosystem resilience, limits to stocking rates, limitations to fertilisation -: not all ACs establish limits to stocking rates
	Aid for non-productive investments (6844)	+: increase on carbon storage through pasture management -: the aid is not specific to climate or soil related objectives
Permanent crops (soils)	Aid for productive investments (6841.1)	+: broad range of measures with high emission reduction potential -: impact will depend on the measures chosen
	Non-productive forestry investments in afforestation and agroforestry systems (6881.1)	+: the combination of trees and herbaceous crops increases soil organic carbon storage and water retention -: broad range of measures supported, difficult to assess impact

2.3 Climate adaptation

2.3.1 State of play in Spain and resulting needs

Spain is one of the most vulnerable regions in the EU to the effects of climate change. The rise of temperatures (+1.7°C since pre-industrial times) and changes in precipitation patterns, leading to hydric stress, have been identified as the most important challenges for the country (European Commission, 2020). The effects are already being felt. For instance, changes in seasonality have led to the progress of a semi-arid climate, which has increased by 6% of the national territory coverage over the last 40 years. Diseases and pests may also increase or spread to higher latitudes, which will lead to negative productivity trends (European Commission, 2020). According to the Spanish National Climate Change and Adaptation Plan 2021-2030 (PNACC), the natural control by frost and low winter temperatures may be reduced, affecting the quality of products such as wine (EEA, 2019a). Land abandonment tendencies increase the likeliness of forest fires and sea-level rises can lead to more flooding and seawater inland intrusion, affecting irrigation and causing soil salinisation. Overall, heat waves, water stress and extreme weather events will impact crop and livestock productivity. The sector needs to improve its resilience to adapt to climate change.

Measures that can be put in place to increase agricultural adaptation include relocating production, switching to crop species and breeds better adapted to the new climatic conditions, restoring soil fertility to enhance water and nutrient storage and pressure from pests and diseases, increasing efficiency in water use to reduce overall water consumption and loss, ensuring strong animal welfare by providing livestock with shade when grazing and investing in infrastructures to cope with increased weather events. 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 Spanish Plan includes interventions that address climate adaptation from two different angles. A first set of interventions aims to reduce the impact of climate change on agricultural production through nature-based solutions, while a second set seeks to promote adaptation of crops and livestock by switching to varieties and breeds that can tolerate the new conditions (e.g. heat and drought). The interventions planned that directly respond to these adaptation needs are summarised in Table 3. The Plan also includes five Pillar II interventions focusing on forestry systems which cover specific objectives on climate adaptation and increased resilience in forests, but these are outside the scope of the current analysis.

The first set of interventions, nature-based solutions, focus mostly on arable land, but there are also interventions targeting pastures, agroforestry and particularly vulnerable sectors such as the fruit and vegetable and the wine sector. The interventions aim to build resilience by increasing soil quality and reducing the impact of extreme weather events. This is the case of eco-schemes and environmental and climate commitments which aim to contribute to climate adaptation by reducing soil erosion and maintaining soil moisture, and improving soil organic carbon stocks as well as the water storage capacity of soils and their biodiversity. The same principles apply to intervention 6501.8 in Pillar II (environmental and climate commitments), which aims to reduce soil erosion, but also to increase crop diversification. Crop diversification can contribute to increased resistance not only to changes in climate but also in reducing risks associated with pests.

The second set of interventions supports a switch to breeds and varieties that can tolerate new conditions (e.g. extreme heat and droughts). These are addressed under sectoral interventions (fruit and vegetable and wine), and also included in aid to productive investments (6841.1). This latter intervention, for instance, co-finances productive investments which support climate change adaptation, but the scope is very broad. Examples mentioned include the diversification of production and the inclusion of crops and breeds with higher potential for adaptation to climate change (i.e. for instance a switch to drought-resistant crop varieties). Although this intervention represents 2% of the Pillar II budget, it also includes support for other types of investments (e.g. improving existing irrigation systems, precision farming machinery), which means that its effective contribution to adaptation could be much lower. The sectoral intervention in the vegetable sector is very broad and does mention reduction in water use for instance (although without targets) and increased resilience against risks caused by climate change, but also supports a switch to renewables and reductions in GHG emissions which could use much of the spending. In the wine sector, the relevant intervention provides support for the restructuring of vineyards but with a much wider scope than climate adaptation, thus not allowing an assessment of its contribution to this objective.

In terms of livestock, the main interventions focus on extensive grazing (cattle in particular), by addressing sustainable grazing practices both in eco-schemes and environmental and climate measures, which could lead to lower livestock numbers in some areas (but higher in others). The Plan also mentions changes in breeds. Interestingly, the intervention on animal welfare (6504) does not mention adaptation to climate change.

In addition to the listed interventions in Table 3, the Plan also counts payments to areas under disadvantages as contributing to climate adaptation. The enhanced conditionality for several GAECS and the new GAEC 10 are also expected to contribute to reducing the vulnerability of the agriculture, livestock and forestry sectors helping them adapt preserve resources, reduce inputs to climate change.

Finally, Spain acknowledges in the Strategic Plan that there is a lack of awareness, knowledge and training among the crop, livestock and forestry sectors when it comes to climate change adaptation measures. It aims to address these gaps through interventions such as knowledge transfer (7201), advisory services (7202) and cooperation through operational (7161) or cooperation (7162) groups. However, there is little detail on how they will be implemented in practice or the type of information that will be shared. These cross-cutting measures are discussed in Section 5.

Overall, the percentage of the UAA under commitments to improve climate adaptation is expected to be 0.4% (R.12), which seeing the challenges that lie ahead for the Spanish agricultural sector seems insufficient. Many of the measures focus on the application of sustainable soil management practices to preserve resources and reduce the need for inputs, as well as to increase resilience to changes in climate and extreme events. These are overall positive and even some interventions with similar goals have not been counted towards indicator R.12 (such as organic farming). However, the CSP could do better in helping farmers switch to more suitable crops depending on the changing conditions per region, as well as towards reducing the dependency on water for irrigation. These are practically non-existent.

Table 3: Potential impact of interventions on climate adaptation

Type of systems	Interventions	Potential benefits and limitations
Crops systems	Eco-schemes on carbon farming: cover crops and inert covers (mulching) on woody crops on different slopes (1PD31001806V1, 1PD31001807V1, 1PD31001808V1)	+: reduction in soil erosion contributing to higher soil fertility (carbon stocks and better soil water retention capacity, less fertiliser use), overall increased resilience -: no obligation to commit for more than one year
	Sectoral intervention in the fruit and vegetable sector. Actions to mitigate and adapt to climate change (1IS501809V1)	+/-: Broad range of measures, difficult to assess impact. Mentions reduction in water use and increased resilience against

		soil erosion, but also switch to renewables and reductions in GHG
	Sectoral intervention in the wine sector. Vineyard restructuring and conversion (01IS581801V1)	+: promotes diversification and switching to varieties with a higher adaptation potential to climate change -: primarily addresses competitiveness, focuses on reducing inputs
	Environmental and climate commitments on soil improvement and erosion control practices (6501.8)	+: reduced soil degradation, supports crop rotations with legumes -: only programmed by four ACs, implementation by ACs focus on manure application and management of crop residues
	Environmental and climate commitments on agricultural land under organic agriculture (6503)	+: by reducing chemical inputs increases soil biodiversity, soil organic carbon -: tillage practices can reduce soil quality
	Aid for productive investments in agricultural holdings linked to contributing to climate change mitigation-adaptation, efficient use of natural resources and animal welfare (6841.1)	+: support to diversify production, switch to breeds and crops with higher adaptation potential -: includes aid for irrigation systems (in principle with safeguards)
Livestock systems	Eco-schemes on extensive grazing, mowing and biodiversity in wet pastures ((1PD31001801V1) and Mediterranean grassland areas (1PD31001802V1)	+: increased SOC, avoids abandonment, fire prevention -: minimum number of grazing days and stocking rates can be adapted by the public authority (under certain circumstances)
	Environmental and climate commitments for the promotion and sustainable management of pastures (6501.3)	+: restoration of pastures for improved ecosystem resilience, limits to stocking rates, limitations to fertilisation -: not all ACs establish limits to stocking rates
	Aid for non-productive investments in agricultural holdings linked to climate change mitigation-adaptation, efficient use of natural resources and biodiversity (6844)	+: aims to reduce impacts of climate change, controlled livestock grazing -: only programmed by seven ACs, mostly focused on biodiversity

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.

3.1 Water quality and availability

3.1.1 State of play in Spain and resulting needs

Agriculture has a significant impact on the quality and quantity of Spanish surface and groundwaters. The quality of water ecosystems is assessed by the ecological and chemical status[20] of surface water bodies and the chemical status of groundwater bodies. In 2015, 87% of surface water and 69% of groundwater were in good chemical condition, making Spain the Member State with the lowest share of groundwater resources with good quality (European Commission, 2020). Water quality is affected by diffuse pollution due to nitrate from mineral fertilisers and pesticides, which is the most significant pressure on groundwater and the second most significant pressure on surface water. Pollution caused by nitrates is still widespread and nitrate vulnerable zones (NVZ)[14] represent 35% of the agricultural area. Agriculture also pressures water availability, since irrigation alone is responsible for 80% of freshwater consumption in the country, and 50% of the final crop output is produced in irrigated land (European Commission, 2020). Although 81% of groundwater bodies in Spain are in "good quantitative status", in some regions, like Murcia, an important agricultural exporter, 60% of groundwater bodies have a "poor quantitative status" due to lowering water table and saline intrusion (European Environment Agency, 2018). In the context of climate change and increased droughts, 70% of Spanish river districts monitored are already facing risks of water scarcity. Freshwaters are also affected by salinisation, which concerns more than a quarter of Spanish streams and rivers, particularly in the most arid central and southern regions, as a direct consequence of urbanisation and agricultural activity (Daliakopoulos et al, 2016).

Concerning water quality, Spain needs to address the lack of knowledge on the appropriate use and management of fertiliser and pesticides in order to reduce their use. On the quantitative side, the country needs to closely monitor water use, improve the irrigation systems and reduce overall water extraction. By 2040, river basins in Spain will see their water resources reduced by 3-7% on average (CEDEX, 2017). The fact that no payment is required for water consumption up to

[14] Areas designated as being at risk from agricultural nitrate pollution

a certain volume for agricultural use (7000 m^3/y in Andalusia), or that there are no limits to abstraction when farmers do it for their own use, contributes to an inefficient use of irrigation systems. On top of this, the OECD has estimated that there are around half a million illegal wells in Spain (OECD, 2015), which is particularly problematic in drier areas where agricultural and environmental interests conflict (e.g. Castilla-la-Mancha and Andalusia).

Spain has a long history of irrigation use and extensive knowledge on water saving techniques in agriculture. The Spanish Plan mentions that modern irrigation systems have allowed to reduce water needs in agriculture while maintaining their economic viability due to increased irrigation efficiency, but large areas of the irrigation systems are still not modernised. Also, increases in efficiency can lead to an increase in the irrigated surface therefore resulting in no real water consumption reduction. To avoid this in the future, it is important that measures aiming to increase water use efficiency provide safeguards to avoid increasing the irrigated surface.

3.1.2 Planned interventions

Achieving good water quality status (quantitative and qualitative) and reducing water pollution from agriculture rank among the top priorities in the Plan. As such, we expect the related interventions to have a high level of ambition. Some of the outlined needs are to improve water quality status, water use efficiency, modernise old irrigation infrastructures and overall adapt irrigation plans to climate change. Spain intends to achieve this with a number of interventions (see Table 4) programmed under the eco-schemes, sectoral investments (fruits and vegetables, wine), environment and climate commitments, productive and non-productive investments as well as cooperation and knowledge (which are addressed in Section 5). Three GAECs—GAEC 2 on the protection of wetlands and peatlands, GAEC 4 on buffer strips along watercourses (for which Spain applies a 5-metre buffer strip, higher than the minimum 3-metre requirement) and GAEC 10 on sustainable fertilisation, a novelty in the Spanish Plan—are expected to also contribute to reducing pollution to surface and groundwaters.

In terms of water quality, the interventions seek to address reductions in nutrient and pesticide run-off and leaching by supporting the implementation of management practices such as soil cover, tailored fertilisation, bans on pesticide use and the cultivation of leguminous crops. Although these measures can contribute to improved water quality, not many ACs program them and the specific regional commitments vary widely in scope. For instance, under Pillar II, intervention 6501.8 targeting soil improvement and erosion control practices can greatly reduce run-off, however, it is only implemented by five ACs and only one of them bans the use of chemical products (e.g. pesticides). For the same

intervention, Navarra asks farmers to develop a fertilisation plan but the high limits placed to nitrogen application (250 kg/ha) as well as nitrate concentrations in soils (established by the competent authority but according to legislation) show that many regions require a minimum effort from farmers to access these additional funds. Support to organic agriculture (6503) is not mentioned in the Plan as contributing to this objective, but since it prohibits pesticide and synthetic fertiliser use it can contribute to reducing water pollution. Finally, the fruit and vegetable sector as well as the wine sector receive support under sectoral interventions for investments that contribute to increased water quality (among other objectives) as well as training and advice.

In terms of water quantity, there seem to be two main lines of action in the Plan. The first is represented by measures aiming to increase soil water retention from rainfall and reduce its loss. The second provides economic support for the modernisation of irrigation systems to promote water saving. Measures in the first group are found under environment and climate commitments and support sustainable management of soils and pastures (6501.1, 6501.2, 6501.3, 6501.6). Their aim is to improve soil structure, quality and protection in order increase the water retention capacity of soils, reduce evapotranspiration and run-off. These measures can contribute to reducing the water requirements of crops as well as increasing natural water retention capacity of agricultural land from rainfall, but the expected uptake in terms of agricultural area is relatively small (less than 5% UAA annually).

The second line of action is constituted of productive investments, that include the possibility of funding measures that improve the management of water resources in agricultural holdings (i.e. irrigation). Two of the four investments that explicitly include irrigation systems have clear environmental and climate objectives (6841.1, 6843.1). Intervention 6841.1 co-funds productive investments linked to a long range of measures aimed at mitigating and adapting to climate change, including, but not limited to, irrigation. For irrigation it mentions support for the modernisation of irrigation systems to make them more efficient. The measure requires irrigation systems to install, as part of the investment, a measuring system. Eligibility criteria include demonstrating a minimum potential water saving rate of 5-25%, depending on whether irrigation is done with sprinklers, localised, or localised with sprinklers. If the investment affects water bodies that are in a "less than good" status in the hydrological plan, the reduction in water consumption must be at least 50% of the potential saving[15]. However, the "less than good" is defined at the Member State level and the definition is not always clear (European Court of Auditors, 2022). A second intervention, 6843.1

[15] It's important to differentiate between 'potential' saving and 'effective' saving. The latter

directly targets investments in irrigation systems with environmental objectives. It aims to also modernise irrigation systems, improving regulation, storage and control of irrigation water and the use of non-conventional water. Besides establishing minimum water saving requirements (which require a minimum potential saving of 7%), it also includes an obligation for eligible projects to incorporate at least two measures (of a list of 5) to contribute to environmental objectives (e.g. sensors to monitor soil water content or nutrients, wildlife protection in ponds, dissemination and training in good agricultural practices, implementation of vegetable structures to reduce erosion and run-off). While on paper the intervention could contribute to reduced water use, there are not enough safeguards to ensure that this will effectively happen. The fruit and vegetable sector, an important user and consumer of water resources, can also receive additional support for its irrigation systems through a specific measure which the Plan includes as addressing both economic and environmental objectives. Note that irrigation systems also receive support outside of the CAP, but the potential impact of those funding schemes are not addressed here.

There are some interventions in the Plan not addressing environmental objectives which could negatively impact water quantity, such aids in investments for the modernisation or improvement of agricultural exploitations (6841.2) or to increase competitiveness (6843.2). The budget allocated to these two interventions (28% of the total investment budget) is double that allocated to the two investments described above (6841.1, 6843.1), the latter representing only 13% of the investment budget. Under intervention 6841.2 the ACs decide on the minimum required water saving amount (between 3-25%), allowing also for increases in the irrigated surface if the total water abstraction decreases. The second also allows for a net increase in the irrigation area provided a several conditions are met (e.g. environmental assessment, water body status qualifies as "good" or above that). In addition, the intervention allows for the 'creation or enlargement of reservoirs (including ponds or similar) for irrigation purposes provided that there is no significant negative environmental impact' but does not specify what "significant negative environmental impact' means in practice. However, not all ACs have decided to include financial support for irrigation under this measure. Similar measures apply to the sectoral intervention on investments in tangible and intangible assets for the fruit and vegetable sector. In previous years, Andalusia had programmed the highest support for irrigation measures under these sectoral interventions (European Court of Auditors, 2022).

In summary, interventions targeting water quality and quantity fall short of contributing to the resilience of the agricultural sector vis-à-vis water quality and supply. In terms of quantity, it provides safeguards for productive investments that have environmental objectives (as required by EU law), but for those that do

not have environmental objectives it is questionable whether new irrigation systems will be beneficial to water bodies or even do no harm to water resources, when they tend to encourage intensification and cultivation of water–intensive crops. In this regard, environmental safeguards for the cultivation of water–intensive crops in water–stressed regions would be helpful, as would measures to transition from these crops to less water–intensive crops. However, all these seem to be lacking in the approved CSP. Although not included here because they do not target water quantity or quality, the fact that eco-schemes reward farmers on irrigated land better than those on rainfed areas does not contribute to promote good agricultural water use.

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

Issue	Interventions	Potential benefits and limitations
Water quality (nutrients and pesticides)	Environmental and climate commitments targeting integrated production (6501.1)	+: very broad in scope, includes assessment of fertilisation requirements for crops to tailor fertilising plans -: expected UAA covered is less than 0.3% (4 ACs)
	Environmental and climate commitments targeting sustainable cultivation commitments (6501.2)	+: broad range of measures that contribute to reducing water pollution (i.e., bans in pesticide and mineral fertiliser use, leguminous crops, no-till) -: level of ambition highly variable between ACs
	Environmental and climate commitments targeting maintenance of habitats and preservation of biodiversity (6501.6)	+: reduction in run-off, pesticides not allowed in floodplain pastures (in Catalonia)
	Environmental and climate commitments targeting soil improvement and erosion control practices (6501.8)	+: reduction in run-off and in mineral fertiliser use -: can increase herbicide use, requirement for no chemical products only in the Canary Islands
	Aid for investments with environmental objectives (6842.1)	The Plan mentions this objective as contributing to "achieving a good water status", but does not specify how this will be achieved
	Area-specific disadvantages resulting from certain mandatory requirements (6712)	+: includes management of flood zones, limits on pesticide use, introduction of legumes

		-: only implemented by 5 ACs
	Sectoral intervention in the fruit and vegetable sector: investments in tangible and intangible assets, research and experimental and innovative production methods (1IS501801v1)	+: irrigation measures are only eligible for support if they have or plan to install a water measuring systems to monitor the water use linked to the funded investment -: broad range of measures in the intervention, not possible to know the water-related budget
	Wine sector: Vineyard restructuring and conversion (01IS581801V1)	+: priority given to organic producers, promotion of practices that reduce water use -: addresses primarily competitiveness in the sector
Water quantity	Environmental and climate commitments targeting integrated production (6501.1)	+: cultivation according to the "integrated production" regulation (Royal Decree 1201/2002), encourages biological control -: bans in line with CAP conditionality (so little additionality), no effective ban on pesticide use, expected UAA covered is less than 0.3% (4 ACs)
	Environmental and climate commitment targeting maintenance of habitats and preservation of biodiversity (6501.6)	+: maintenance of traditional water harvesting structures -: implementation by ACs not relevant to water quantity objectives
	Aid for productive investments linked to climate change mitigation-adaptation, efficient use of water resources and animal welfare (6841.1)	+: support to modernise and develop water supply infrastructures to contribute to efficient resource use; water savings have to be higher than 5%, and higher than 50% when the water bodies are in a less than good conservation status -: broad range of measures included, their impact will depend on the measures chosen
	Aid for investments in irrigation infrastructure with environmental objectives (6843.1)	+: modernisation of irrigation systems, improving regulation, storage and control of irrigation water and the use of non-conventional water; potential water savings higher than 7%, and higher than 50% when the water bodies are in a less than good conservation status, eligible projects must include additional measures to comply with environmental objectives (list provided in the CSP) -: low budget compared to that of irrigation measures without environmental objectives

3.2 Soil quality

3.2.1 State of play in Spain 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, contamination (pollution) and compaction (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. Soil organic carbon and matter contents vary significantly depending on soil type, climate, land use and land management practices. Spanish soils store 2.1 billion tonnes of carbon, with the richest soils found in the AC of Galicia and the ones with the lowest SOC content located in Andalusia and Murcia (both with important agricultural sectors) (Stolte et al, 2015). Average SOC contents in Spanish soils are not high; 88% of the provinces have SOC contents lower than 2% (more than half of which below 1%) and agricultural soils are the ones that have lost the most SOC from a historical perspective (González Sánchez et al, 2018).

Soil functions in agricultural land are threatened mainly by erosion, contamination, salinisation and acidification, which are all linked to some extent to agricultural practices. Soil erosion is a particularly important threat for Spanish soils. The CSP highlights that soil losses due to erosion processes average 3.73 t/ha/y, much higher than the average losses in the EU which are estimated at 2.4 t/ha/y. Of special concern are soil losses on woody crops, where soil is kept uncovered and soil losses can amount to 47 t/ha/y. It is estimated that erosion risk affects up to half of the exploitations eligible for CAP funding, with soil loss rates higher than 25 t/ha/y. These degradation processes increase desertification risk and threaten the productive capacity of soils. It is well known that desertification is driven and amplified by agricultural soil management through processes such as the physical disturbance of soils (conventional tillage applied to 75% of tillable area in 2016), over-abstraction of water, and the absence of soil cover during the winter months (23% of arable land) (European Commission, 2020). Salinisation and acidification are two other important issues linked to the intensive use of fertilisers and unsustainable irrigation practices. A 2020 European assessment shows significant agricultural areas affected by very severe constraints due to acidity caused by salinisation, which affects ground and freshwater and then passes on to soil via agricultural irrigation (EIP-AGRI, 2020b).

In terms of contamination, 66% of Spanish soils assessed in a recent study had traces of at least two pesticides (Silva et al, 2019).

In 2022 Spain published its National Strategy to Combat Desertification (MITECO, 2022). The document performs a diagnosis of the drivers and processes of desertification in Spain and presents proposals for action, including sustainable soil management practices, to contribute to meeting land degradation neutrality objectives. Part of the funding required to meet the established targets is expected to come from the current CAP. A list of the most relevant interventions which could contribute to combatting desertification is provided in the Strategy.

Overall, Spain needs to halt soil degradation and increase the carbon sequestration capacity of its soils. The Plan could encourage mainstream implementation of soil conservation measures such as minimum tillage, mulching, cultivation of catch crops and cover crops, wider crop rotations, intercropping, promotion and maintenance of grassland and promotion of landscape features and buffer strips.

3.2.2 Planned interventions

In response to the identified needs, the Spanish Plan programmes a large number of interventions focusing on halting soil degradation and improving overall soil quality. These measures are expected to cover 43% of the UAA (R.19) proving that the country is well aware of the need to preserve its fragile soil resources. Several of the interventions have already been analysed in the previous sections in relation to improved SOC storage (reduced SOC, increased inputs) and water quality (reduced contamination) and are therefore not repeated here.

This section focuses on the interventions tackling soil erosion and reducing desertification risk, key challenges for Spain. But first we discuss three interventions that address overall soil quality by promoting a change to more sustainable farming practices or systems. These are funded under environmental and climate measures and support organic agriculture (6503), integrated production (6501.1) and sustainable management (6501.2). Organic agriculture, which currently covers 10.7% of UAA in Spain (MAPA, 2022b), focuses primarily on removing or reducing chemical inputs (fertilisers and pesticides), but since it allows tillage (and in some cases is the only method used by farmers to eradicate weeds), it can increase soil erosion unless other measures are put in place. The expected supported area for organic agriculture in the Plan is 5% of UAA, including land under adoption or maintenance, which is not ambitious enough to contribute to reaching the target set by the European Commission in the Farm to Fork Strategy (25% of agricultural land under organic farming by 2030). Integrated production also focuses on reducing inputs but includes measures

such as maintenance of vegetation cover and establishes many GAECs as baselines, including minimum soil cover and minimal soil disturbance. However, this intervention is only programmed by four ACs. The intervention on sustainable management commitments offers a broad range of measures, many of which focus on maintaining soil structure (conservation agriculture, soil cover) but also include crop rotation, introduction of leguminous crops or even of landscape elements. Despite the broad range of practices supported, this measure is only expected to cover 0.35% of the UAA.

In relation to soil erosion, several interventions and conditionality standards in the Spanish Plan can provide important benefits. GAEC 4 on buffer strips, GAEC 5 on tillage management (i.e. the soil must not be tilled in the direction of the steepest slope) and GAEC 6 on minimum soil cover (during sensitive periods only), are of particular relevance to reducing soil erosion and degradation. They represent the baselines for many of the optional interventions in the Plan, which build up on them. All eco-schemes except the one focused on biodiversity are highly relevant vis-à-vis addressing soil erosion. For example, practices P6 and P7 on vegetation cover can significantly reduce soil erosion from permanent woody crops. Although many farmers already apply them and GAEC 6 only requires those working on land with a slope equal or higher than 10% to keep a soil cover of one metre wide, the eco-scheme, with the additional funding it provides, should further encourage maintenance of the cover between the rows. It only requires farmers to implement this for one year but gives a bonus if they maintain the commitment for an additional year. The higher payments for steeper slopes represent a positive incentive to increase the effectiveness of the eco-schemes.

The Plan includes an environmental and climate commitments specifically addressing soil erosion control (6501.8). It allows ACs to support measures such as the maintenance of soil cover and soil residues, minimum or no-till, crop diversification by introducing leguminous crops, use of organic fertilisers and maintenance of landscape elements. Despite the importance of this intervention, its large overlaps with eco-schemes and other interventions such as organic agriculture (6503) or sustainable management (6501.2) have led only four ACs to program it. The ACs programming it have decided to support practices related to manure application and management of crop residues, and in some cases the required minimum area to be eligible for support is small (e.g. application of organic fertilisation on 20% of the land in Castilla y León) and there is no requirement to target the most degraded soils. The low level of planned uptake and ambition of the final measures seems like a missed opportunity.

Another measure that is mentioned as contributing to reducing soil erosion from highly degraded areas is the coupled income support for olive groves with high

environmental value. Although this intervention is programmed to support productivity for a sector with low margins, the Plan mentions that it also aims to reduce soil erosion. However, the Plan does not properly explain which supported practices will reduce soil erosion and how, thus making it impossible to assess the related beneficial impacts.

In summary, there are many measures addressing soil quality, and in particular soil erosion control, in the Spanish Plan. The high coverage of these measures (43% of UAA under beneficial soil management commitments for the improvement of soil quality and biota, R.19) is in accordance with the challenge that the country faces regarding soil loss and desertification. However, despite the extensive coverage, which is in part explained by the fact that most eco-schemes contribute towards indicator R.19, the implementation by ACs lacks ambition and the baselines set by the GAECs also fall short to ensure that erosion trends are effectively reversed.

Table 5: Potential impact of interventions on soil erosion control and sustainable soil management

Soil threat	Interventions	Potential benefits and limitations
Erosion and soil loss	Environmental and climate commitment targeting integrated production (6501.1)	+: cultivation according to the "integrated production" regulation (Royal Decree 1201/2002), encourages biological control -: bans in line with CAP conditionality (so little additionality), no effective ban to pesticide use, expected UAA covered is less than 0.3% (4 ACs)
	Environmental and climate commitment targeting sustainable cultivation (6501.2)	+: broad range of measures that contribute to reducing water pollution (i.e. bans in pesticide and mineral fertiliser use, leguminous crops, no-till) -: level of ambition highly variable between ACs
	Environmental and climate commitments on soil improvement and erosion control practices (6501.8)	+: reduced soil degradation, supports crop rotations with legumes -: only programmed by four ACs, not targeting the most erosive areas, small budget
	Environmental and climate commitment targeting organic farming (6503)	+: increased soil quality (more SOC, biodiversity), increased budget relative to previous period -: tillage practices can increase soil erosion

	Coupled aid for olive groves with specific constraints and high environmental value (1PD32001814V1)	+: the Plan mentions that it supports a reduction in soil loss from highly erosion–prone areas -: main support for productivity, no requirements on measures to reduce soil erosion are detailed in the Plan
	Non-productive forestry investments in afforestation and agroforestry systems (6881.1)	+: the combination of trees and herbaceous crops increases soil organic carbon storage and water retention, reducing soil loss -: other measures supported (including afforestation)
	Aid for non-productive investments in agricultural holdings linked to contributing to environment, climate and animal welfare (6844)	+: controlled livestock grazing can reduce soil degradation -: intervention focusing on multiple objectives, which can reduce its impact
Contamination (pesticides)	See interventions contributing to water quality in Table 7	
Loss of SOC/SOM	See interventions contributing to carbon storage in soils in arable land, grassland and permanent crops in Table 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 sensitive habitats and species.

4.1 Common species related to agricultural landscapes

4.1.1 State of play in Spain and resulting needs

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 farmland bird and grassland butterfly populations can, therefore, be used as barometers of the health of agricultural ecosystems. In Spain the farmland bird index declined by 33% between 2000 and 2017, with declines varying amongst species (e.g. the Iberian grey shrike and the red-legged partridge declining by 63% and 38% respectively since 1984 (SACRE, 2020). The European Grassland Butterfly Index also shows a declining trend. These general declines in farmland birds and grassland butterflies have been associated with agricultural activity, with the increased use of pesticides and the reduction of their habitats as important drivers (Traba and Morales, 2019).

To reverse these trends, and restore common species and habitats, Spain could make use of several interventions that can be funded through Pillars I and II. These should, as a priority, support the reduction in chemical inputs (fertilisers and pesticides) as well as increasing habitat spaces and feed sources by promoting fallow land in crop rotations, maintaining or introducing high biodiversity landscape features such as flower strips and hedges, and sustainable grazing. According to the Plan, 10% of agricultural surface in Spain is devoted to non-productive elements[16].

4.1.2 Planned interventions

The Spanish Plan includes a large number of interventions aiming to support several of the best practices identified above. These are found under the eco-schemes, ANC payments, environmental and climate commitments as well as investment aid (Table 6).

[16] One of the targets set in the EU Biodiversity Strategy is to devote 10% of agricultural land to high-diversity landscape features.

A first set of interventions aims to increase the surface of landscape features, which are key providers of many ecosystem services and benefit biodiversity. Spain has opted to give farmers maximum flexibility by providing all available options to comply with the EC recommendations. These are: (i) a minimum 4% non-productive features under GAEC 8, (ii) participation in an eco-scheme (practice P5) topping this up to 7% (with lower values for irrigated and underwater cultivation) that reduces GAEC requirements to 3% of the area, or (ii) including catch crops/nitrogen fixing crops cultivated without pesticides on at least 4% of the area, that also reduces the requirement for non-productive area to 3% (in total 7% of area covered by catch/nitrogen fixing crops and non-productive area/elements). A few exceptions apply. Farmers that cultivate less than 10 ha of land are exempted, as well as those where 75% of the UAA is under permanent pasture or used to produce fodder, leguminous crops or fallow. Spain uses weighing factors for the different landscape elements in order to calculate the achieved percentage of non-productive features. These factors range between 1-2, which implies that some landscape features (e.g. biodiversity margins and hedges) are attributed up to double the amount of land than that which they actually occupy, to the detriment of biodiversity.

A second set of interventions focuses on helping farmers shift, or maintain, low input intensity systems (that reduce chemical inputs). These interventions are all found under environmental and climate commitments and are: integrated production (6501.1), sustainable cultivation commitments (6501.2) and organic agriculture (6503). Integrated production[17] encourages biological control (although it does not prohibit pesticide use) and establishes certain bans which are actually conditionality requirements under the CAP (i.e. burning residues) therefore not providing additional benefits. Given the lack of targets and the low planned output (0.3% of UAA) it is expected to have little benefits for birds and biodiversity. It has also only been programmed by a small number of ACs, as others have opted to have larger budgets for organic agriculture. Next are the sustainable cultivation commitments (6501.2), which aim to implement "sustainable agriculture". The type of measures supported vary widely among ACs. The most relevant ones for biodiversity are those that ban pesticide use, reduce intensification, manage soil cover, preserve landscape elements or require the use of organic fertilisers. As in the case of integrated production, the planned output is very small (0.35% of the UAA), which, together with the flexibility given to ACs on the measures supported, suggests that its benefits for biodiversity will also be very limited. Support to organic agriculture (6503) can contribute to biodiversity objectives by promoting organic fertilisation and banning pesticide

[17] Legally defined by Real Decreto 1201/2022

use. It is therefore more stringent in requirements than the previous two measures. Since it is planned to cover 5% of the UAA it is expected to have a positive impact on overall biodiversity. In addition to these three interventions, environmental and climate commitment 6501.5 targeting the protection of birdlife also supports measures in various ACs such as bans on the use of pesticides and fertilisers, specifications on the type of seeds to be used or commitments to leave 10% of the area unharvested.

A third set of interventions that could increase the presence of common species in permanent grassland is linked to extensive livestock. This is the case of two eco-schemes which provide support to extensive grazing (in wet and Mediterranean pastures) and place limits on stocking densities. These eco-schemes also support mowed pastures through two practices: sustainable mowing (with a maximum frequency and ban on mowing in summer) as well as the establishment of biodiversity islands occupying 7% of the unmown area (landscape features count towards that). An environmental and climate commitment also supports restricted or controlled grazing and limits the use of fertilisers and pesticides (6501.3). These measures can have positive effects on biodiversity by maintaining habitats linked to extensive grazing while reducing the pressure from livestock on land. In addition to the previous, a Coupled Income Support intervention targeting extensive cattle farmers is mentioned in the Plan as supporting biodiversity objectives. Although it's identified as having a positive impact on biodiversity, the lack of a cap on the number of potentially funded LSU as well as stocking densities could reduce its positive impact on biodiversity. However, eligible exploitations must be registered in the REGA (General Registry for Livestock Exploitations) as "pasture type" or "production-reproduction", and classified as "extensive", which should ensure some safeguards vis-à-vis preventing intensification.

Another intervention that the Plan counts towards increasing biodiversity is the environment and climate commitment on beekeeping for biodiversity (6501.4), which the Plan says will contribute to preserve habitats and halt or reverse the negative tendency in common farmland birds. While these measures may maintain and support current number of beehives linked to honey production, it does not increase natural habitats for wild bees or other pollinators and the impact is not clear.

Overall, the Plan includes a large number of interventions contributing to biodiversity objectives, many of which support general sustainable agricultural management practices but lack effective targets, such as for the reduction of pesticides which is key to reverse pollinator declines. Except in the case of organic agriculture, bans or strong limitations on pesticide use in these interventions are

limited to specific areas (such as permanent pastures) and taken up only by a few ACs, which reduces their impact further. In terms of result indicators, the share of UAA under commitments to support biodiversity conservation or restoration, and including high-nature-value-farming practices is 16% (R.31). The share of farms benefiting from CAP investment support contributing to biodiversity is 0.2%. Overall, the interventions need to better target species and strengthen requirements on pesticide use. As mentioned in the previous sections, the higher payments allocated to intensive irrigated areas versus extensive rainfed crops including agroforestry systems such as dehesas, runs counter to environmental and biodiversity objectives.

Table 6: Overview of the interventions for common species related to agricultural landscapes

Practices and systems supported	Interventions	Potential benefits and limitations
Extensive livestock / High Nature Value farming	Eco-schemes on extensive grazing, mowing and biodiversity in wet pastures (1PD31001801V1) and Mediterranean grassland pastures (1PD31001802V1)	+: biodiversity islands to cover 7% of the total surface; biological cycle of lepidoptera to be considered -: location of the biodiversity islands can rotate annually, thus reducing many of the benefits; farmers can opt for sustainable mowing instead of biodiversity islands (between 2-3 mowing periods per year allowed), stocking reate of up to 2LSU/ha allowed in wet pastures
	Environmental and climate commitment for the promotion and sustainable management of pastures (6501.3)	+: restricted and/or controlled grazing, surface regeneration, limits on use of fertilisers and pesticides -: applied by 8 ACs only
	Environmental and climate commitment for the promotion of beekeeping for biodiversity (6501.4)	-: does not increase habitats for wild bees or their presence
Low input intensity systems	Environmental and climate commitment for integrated production (6501.1)	+: cultivation according to the "integrated production" regulation (Royal Decree 1201/2002), encourages biological control -: bans in line with CAP conditionality (so little additionality), no effective ban on pesticide use, only 0.3% of UAA
	Environmental and climate commitment for sustainable cultivation (6501.2)	+: Aims to implement "sustainable agricultural production". Farmers subscribe for 5 years, broad range of measures that

		contribute to reducing water pollution (i.e. bans in pesticide and mineral fertiliser use, leguminous crops, no-till) -: level of ambition highly variable between ACs, only 0.3% of UAA
	Environmental and climate commitment for the protection of birdlife (6501.5)	+: commitments within ACs include a ban on pesticides and fertilisers, established dates for planting and harvest, maintenance of fallow and vegetative cover; -: number of participating ACs reduced from 14 to 8 relative to the previous period, Murcia applies an additional payment for the cultivation of legumes on fallow land
	Environmental and climate commitment for alternatives to chemical control (6501.7)	+: promotes the use of alternative systems to chemical pest, disease and weed control -: application of pesticides still allowed in some ACs if pests are not under control, some ACs target only a limited range of crops; small percentage of UAA covered (0.4%)
	Environmental and climate commitment in organic farming (6503)	+: chemical fertiliser and pesticides use reduction and increased diversity -: some management practices that are beneficial for biodiversity are not required by organic certification (e.g. the presence of landscape features, restrictions on ploughing)
Landscape features	Environmental and climate commitment on the maintenance or enhancement of traditional habitats and farming activities that preserve biodiversity (6501.6)	+: conservation of traditional cultivation elements (hedges, fences, stone walls) -: Fewer ACs programming this intervention than in the previous period (only 7 vs 12 before)
	Eco-scheme: biodiversity hotspots in croplands and permanent crops (1PD31001809V1)	+: increases requirements in relation to conditionality (GAEC 8), fertiliser and pesticide use not allowed on landscape elements (with exceptions) -: mentions migratory birds and birds in general but not species by name
	Aid for non-productive investments in agricultural holdings linked to climate change mitigation-adaptation, efficient use of natural resources and biodiversity (6844)	+: supports maintenance of landscape elements, wildlife crossings, drinking ponds, promotes natural pest control and ensures compatibility with large carnivores -: small budget and small area covered (0.25 % UAA)
Diversified systems / landscapes	Commitments to maintain forestry and agroforestry systems (6502.2)	+: support for the maintenance of agroforestry systems -: very small percentage of UAA covered (0.05 %)

	Non-productive investments in basic services in the natural environment (6871)	Wide range of measures, final impact will depend on the measures chosen
	Non-productive forestry investments in afforestation and agroforestry systems (6881.1)	+: supports agroforestry systems, which have high biodiversity value -: It's not clear which of the presented measures will contribute to biodiversity

4.2 Specific habitats and species

4.2.1 State of play in Spain and resulting needs

Spain is a country rich in biodiversity, with 26% of the species protected under the EU's Birds and Habitats Directives, and 55% of the habitats protected under the Habitats Directive (MITECO, 2018). Agricultural land hosts a large share of this biodiversity; 40% of the species and 48% of the habitats protected under EU law in Spain are associated with agricultural landscapes (Díaz et al, 2021), making Spain the EU country with the highest levels of agricultural biodiversity. Spain also has the largest share of total EU Natura 2000 area in the EU (18%), and a large percentage of it (17%) is found in agricultural areas, including natural grassland. However, most of the total protected species and habitats are not in a good conservation status and data show a negative trend. The latest figures (2013–2018) show that only 19% species and less than 9% of the habitats protected under the Habitats Directive are in good conservation status (the status of 15% of species is unknown). Compared to the previous reporting period 2007-2012, this represents a large decrease from 27% and 11,5%, respectively (European Environment Agency, 2019). The main threats to protected habitats in Spain are considered to relate to agricultural intensification with practices such as: use of pesticides, homogenisation of the landscape, habitat fragmentation and the increase of infrastructure for the tertiary sector. Agriculture threatens almost two thirds of the habitats[18] (European Environment Agency, 2019).

The recommendations issued by the European Commission consider that Spain's Plan should focus on halting and reversing the loss of biodiversity, including protected species and habitats. Emphasis is placed on the promotion of landscape connectivity and diversity of landscape elements. In addition to this, protecting permanent grassland and steppes, improved management of dry cereal habitats and reinforcing traditional grazing could contribute to reversing current trends.

[18] Habitats in the Habitats Directive 92/42/EEC

Particular attention should be placed on afforestation practices to ensure that these are not detrimental to biodiversity.

4.2.2 Planned interventions

The Spanish Plan has programmed an intervention to directly address the EC's recommendations on halting biodiversity loss and improving landscape connectivity and diversity of landscape elements. This intervention (6871 on non-productive investments in basic services in the natural environment), supports investments in Natura 2000 site as well as other rural areas with specific conservation needs and allows ACs to fund, among others, connectivity routes in the natural environment, infrastructures that promoting the compatibility of extensive livestock farming with the presence of large carnivores/predators, and habitats and species conservation measures. It has a total allocation of 190 million euros (2.3% of Pillar II budget) and has been programmed by 12 ACs (the Plan mentions that the remaining ACs will fund these investments through other interventions or with own funds, but doesn't specify precisely how).

The majority of the interventions discussed in Section 4.1 also contribute to the protection of specific habitats and species (and thus no table is presented in this section). In some cases, they include specific provisions when the area targeted is located within Natura 2000 sites or in specific sensitive geographic areas. For instance, for the environmental and climate commitment on the protection of birdlife (6501.5), the selection criteria benefits those farmers operating in Natura 2000 sites or certain geographical areas. In the case of the aid for productive investments, many ACs specify in their eligibility conditions that funded projects must not adversely and significantly affect the established conservation objectives of the Natura 2000 site (see for instance 6841.1, 6843.2), however, no details are provided on how this is exactly implemented. The first two eco-schemes also draw specific rules for Nature 2000 sites. When farmers apply for support to implement sustainable mowing practices within these sites, they must use haymaking or any other alternative practice to silage.

The co-existence between livestock and large carnivores is also something addressed in the Plan, although it's not ranked as a high priority due to other national instruments already funding this such as the Strategy for the Conservation and Management of the Wolf and its Coexistence with Rural Activities[19] approved in 2022 and which will provide 15 million euros to the ACs to compensate farmers for their losses and to apply preventative measures. While the CAP is not the main source of funding for this issue, a few of the interventions

[19] The full text of the Strategy can be read here (in Spanish).

provide support to livestock farmers in order to defend their herds, therefore fostering the co-existence between pastoral activities and wolfs/bears. This is the case of the intervention 6871 mentioned above, as well as the intervention on animal health and welfare (6504), and the intervention on non-productive investments for environment, climate and biodiversity (6844).

Finally, the Plan also includes compensatory payments for areas with specific disadvantages linked to the Natura 2000 network and the Water Framework Directive. These are area-based payments (ranging between 150-475 euros/ha) and are programmed by five ACs only. However, other ACs may be using different (own) sources of funding. The total funding for areas with specific disadvantages in the Plan amounts to 60 million euros (0.7 % of Pillar II budget).

Overall, the share of Natura 2000 area under supported commitments is 13 % (R.33) which includes the areas with measures programmed within the eco-schemes and the environmental and climate commitments within the different ACs. Many of the interventions in the Plan take into consideration the different needs of sensitive habitats and species, but it is difficult to estimate the impact that they will have on their maintenance and restoration due to overlapping objectives. This will become clearer once the schemes are in place and their impacts assessed.

5. CROSS-CUTTING INTERVENTIONS AND INNOVATIONS

This section reviews the cross-cutting interventions that can contribute to environmental and climate action, and hence are additional to those reviewed in sections 1 to 4. It also looks 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 Spain 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. The Spanish Plan specifies that knowledge sharing must focus on the protection of nature, the environment and the climate, including environmental awareness and education actions and the development of rural enterprises and communities. The Plan foresees that over the whole period, an estimated 225,645 people will be trained to achieve environmental and climate results. Part of this is expected to be training directed to the implementation of eco-schemes.

Cooperation measures, particularly the ones supporting the European Partnership for Innovation (EIP), can drive research on environmental and climate questions which in turn can improve the knowledge base and capacity to deliver (Alliance Environment and Ricardo-AEA, 2018). In the Spanish Plan, the total budget for EIP interventions is 162 million euros (2% of PII funding). This support can fund projects relating to sustainability, but no specific contribution to objectives 4, 5 and 6 is mentioned in the Plan. A look at EIP projects funded in the last CAP shows that few of them have supported improvements in these areas (see examples in box 2 below).

Box 2: Examples of EIP projects under the previous CAP

Control of emissions in manure management and treatment

This EIP project aimed to develop an on-farm manure management and treatment system to reduce emissions from both storage and agricultural application by measuring manure storage emissions in farms, installing biogas collection systems from slurry storage, introducing catch crops in rotations and assessing the reduction of ammonia emissions using a disc injection system (EIP-AGRI, 2021b).

Tomato industry footprint

This project aimed to reduce the water and carbon footprint of tomato plants through four main activities: 1) Implementation plan and risk management of operational groups, 2) Establishment of the current footprint of the tomato industry, 3) Development of a tool to collect data on water and carbon footprint and provide a plan to reduce this footprint in industries, and 4) Validation of the tool (EIP-AGRI, 2017).

Innovative cropping systems based on grain legumes

This project aimed to establish criteria that integrate grain legumes for human consumption and innovative management practices in cropping systems to improve farm economic resilience. The project focused on three main activities: 1) Diagnosis of production, value chain and consumption of pulses for human consumption, 2) Implementation of demonstrations of production systems and innovative agricultural techniques for the cultivation of grain legumes in selected case studies, and 3) Public communication of the objectives, activities and results of the operational groups and the importance of human consumption of pulses (EIP-AGRI, 2021a).

New alternative sources of animal feed

This project looked at the feasibility of obtaining feed and feed products for poultry from insects. It included the selection of by-products to use as substrates, the production of the meal and its characterisation, the formulation of the organic feed for organic chickens and the validation of the industrial viability of the feed production process (EIP-AGRI, 2020a).

The Plan also considers that advisory services can play a central role in achieving higher environmental and climate performance in agriculture. One specific intervention supports these services (7202) and it has an allocated a budget of 103 million euros (1.3% of Pillar II funding). Interestingly, the Plan has linked this intervention with objectives 4 (climate change) and 6 (biodiversity), but not 5 (resources). Three ACs do not subscribe to this intervention but support this activity with their own funds (Canary Islands, Basque Country and Comunitat Valenciana). Knowledge exchange and training activities is also a separate intervention of its own (7201). This receives 1% of the Pillar II budget and covers a wide range of eligible activities: training and skills' acquisition, demonstration and information activities, short exchanges and training of advisors. Overall, measures 7161, 7165, 7201 and 7202 are framed as part of Agricultural Knowledge and Innovation Systems (AKIS) and represent 4.4% of the total spending in Pillar II.

5.2 Innovative approaches

The Strategic Plans support environmental and climate action through innovative instruments, beyond EIP interventions. These interventions are innovative either by design (for instance result-based payment or collective approaches, or those with new requirements that are relevant for environmental and climate action), or because they support the use of new technologies on-farm or for monitoring.

5.2.1 Interventions with innovative design

In result-based payment schemes farmers receive a payment for delivering a specific objective (e.g. increased soil organic carbon, improved water quality), rather than being paid to manage their land in a certain way. Overall, Spain has not introduced result-based payments in the CSP as a requirement for implementation by Autonomous Communities, and the large majority of payments remain management and area-based. Interestingly, Navarra has opted to include a result-based payment for intervention 6501.3 in High Nature Value pastures. Farmers commit to maintaining or improving the high floristic diversity for five years, and the payment applies if the floristic diversity is maintained or increased compared to the initial state. In this case, beneficiaries commit to receiving advice and training to elaborate their own activity plan to achieve the result. Further, although not result-based, some interventions include bonuses for expected increased environmental benefits. This is the case of practices P4 and P6 in the eco-schemes, where farmers are rewarded with a bonus if they maintain the commitments beyond the initial year. Other environmental and climate measures require farmers to maintain the commitment on at least 80% of the land in subsequent years, but no payment is attached to that.

In addition to result-based payments, some countries have implemented collective approaches to allow group of farmers (and stakeholders) to jointly apply to participate in an environmental and climate commitment or an eco-scheme. This is expected to provide higher levels of environmental public goods and ecosystem services through landscape-level implementation, which could result particularly beneficial for biodiversity. They are used, for instance, in the Netherlands and Ireland. However, no such intervention is funded in the Spanish Plan.

5.2.2 New technologies

Some technical innovations, such as 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. Spain has included funding opportunities for the acquisition of equipment to reduce GHG emissions, limit pollution, and improve resource use. This is done through various investment interventions (6841.1, 6841.2, 6843.1). These include the modernisation of livestock buildings to reduce GHG emissions and in general to increase energy efficiency, the use of information technology to improve water management, as well as fertiliser and pesticide application. 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 (such as crop rotation, biodiversity friendly management and features). In addition, the interventions do not always require farmers to prove that they have reached a particular improvement in relation to a baseline. Finally, digitalisation is a word that appears often in the Spanish Plan and has been assessed as one of the needs. It is applied at various levels but since it is not directly linked to environmental and climate objectives in the Plan it is not discussed in further detail.

6. CONCLUSIONS

The budget allocation and interventions programmed in the Spanish CAP Strategic Plan fall short of the needs identified in the Plan itself. Overall, the budget allocated to interventions potentially contributing to environment and climate objectives represents 27% of the total CAP budget. The bulk of Spain´s CAP support continues to be directed to basic income support payments (70% of the spending), often without sufficient safeguards to ensure the implementation of sustainable farming practices. Spain has exceeded the minimum required spending for environment and climate in Pillar II (47%, vs. 35%), but an important part of it is directed to investments (including irrigation).

There are some mismatches between the priorities set in the Plan and their allocated budget or share of UAA benefited for support. Improving soil quality and reducing erosion and desertification risk do not appear as a top priority in the Plan, but most of the environmental interventions address this, in many cases by promoting sustainable soil management practices including enhanced crop rotations and soil cover, reduced or no-till and organic fertilisation. On the contrary, GHG emissions mitigation and climate adaptation, which come as a high priority in the Plan, are not effectively addressed. The main source of GHG emissions, enteric fermentation, is barely targeted, while the Plan also falls short of helping farmers adapt to crucial challenges such as changes in water availability by continuing to reward irrigated crops better than rainfed ones and including weak safeguards for investments in irrigation systems.

As a novelty, Spain has introduced a new GAEC (10) requiring farmers to plan and record nutrient and organic carbon inputs on their land. But overall, the funding opportunities to support farmers towards the much-needed environmental transition is highly dependent on their geographical location. Many of the environment and climate commitments in Pillar II have been taken up by a small number of Autonomous Communities and have small budgets. Half of the spending in this group of interventions is directed to organic farming, which has seen its budget increase relative to the previous period. Overall, there has been a tendency for Autonomous Communities to shift support from environmental and climate commitments in Pillar II towards eco-schemes due to overlaps. This has resulted in reduced environmental ambition due to the less stringent requirements of eco-schemes. Spain has also not used the opportunity to introduce innovative schemes such as results-based payments or collective approaches.

Member States' CAP Strategic Plans can be amended once per year, and a midterm 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 Spanish Plan in the current period, and 2) wider recommendations for the CAP and EU agrifood policy as a whole:

Recommendations to amend the Spanish Plan

- Address the gaps between the identified challenges and needs and the planned interventions (e.g. climate adaptation and water use, GHG emissions reduction from livestock). In the case where a lack of certain specific interventions is complemented by national legislation, explain these in the Plan.

- Strengthen GAEC requirements. GAEC 8 (e.g. 10% of landscape features and fallow instead of 4%, following Pe'er et al (2021), GAEC 10 (consider introducing a commitment or targets to effectively reduce fertiliser use in line with the objectives in the Farm to Fork Strategy).

- Review the eco-schemes to strengthen requirements and introduce payments rewarding increased levels of ambition. Spain currently provides flat-rate eco-schemes, with just an additional 25 euros/ha amount for two practices if the commitment is maintained in subsequent years. This bonus could be extended to all practices, in particular those that lead to an increase in soil organic carbon (to avoid its release).

- Improve coherence between the identified needs and the interventions in relation to water quantity and use. Examples include introducing more stringent requirements for interventions support investments in irrigation systems to further reduce, or at least avoid the increase of, water consumption; reducing the allocated payments on irrigated land and increasing those for rainfed areas and the promotion of shifts to low water-intensive crops (in eco-schemes and Pillar II measures).

- Include safeguards to take into account the potential trade-offs between environmental objectives (e.g. limiting or banning herbicide use in eco-scheme practices promoting conservation agriculture and direct seeding (P4)) and strengthen the requirements and safeguards on potentially harmful measures such as coupled support for livestock (e.g. place a cap on the number of cattle eligible for support in line with climate objectives).

- Introduce results-based payments for specific interventions targeting particular problems. Include collective approaches that could be beneficial for the preservation of natural resources and biodiversity and increase the budget

for innovative approaches (e.g. result-based payments) and accompanying training and advice.

Wider recommendations

- Biodiversity- and climate-proof the CAP Strategic Plans and their interventions. This means considering trade-offs between environmental and climate objectives, including additional safeguards (e.g. for biodiversity when supporting no-till, or climate in coupled income support), and identifying and promoting win-win strategies.

- Increase action to reduce the agriculture sector's GHG emissions and carbon removals in the 2023 revision of Member States' National Energy and Climate plans (NECPs, due by 30 June 2023), and amend the CAP Strategic Plan accordingly.

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

- 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, Spain has not used the flexibility provided within the new CAP structure to significantly increase its environmental and climate ambition. Rather, the current Plan does not present significant differences, in terms of budget allocation to environmental and socio-economic objectives, than the previous CAP period. Novel interventions like eco-schemes, if properly re-designed and rewarded, as well as revised conditions for coupled income support and investments for irrigation systems could provide an opportunity to improve the environmental and climate ambition of the CAP in Spain and support farmers to better contribute to the objectives set by the Green Deal. The revision of the interventions and budgets proposed in the EU Regulation therefore appears necessary for the next CAP.

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ANNEX

Table: Budgets of the interventions related to environmental and climate objectives

N°	Title	Pilar	Planned budget (in million euros, whole period)	Planned budget (% of the Pilar[20], whole period, total public expenditure)
1PD31001801V1	Eco-schemes on extensive grazing, mowing and biodiversity in wet pastures	P1	517.2	2.1%
1PD31001802V1	Eco-schemes on extensive grazing, mowing and biodiversity in Mediterranean Grassland areas	P1	578.1	2.4%
1PD31001803V1	Eco-schemes on rotations and no-tillage in rainfed croplands	P1	1,177.4	4.9%
1PD31001804V1	Eco-schemes on rotations and no-tillage in wet rainfed croplands	P1	187.8	0.8%
1PD31001805V1	Eco-schemes on rotations and no-tillage in irrigated croplands	P1	859.7	3.6%

[20] For Pillar I, the percentages are relative to the total direct payments (sectoral measures not included), for Pillar II they relate to the total public spending (FEADER + national contribution).

1PD31001806V1	Eco-schemes on cover crops and inert covers (mulching) in woody crops on flat land	P1	367.0	1.5%
1PD31001807V1	Eco-schemes on cover crops and inert covers (mulching) in woody crops on medium slopes	P1	398.0	1.6%
1PD31001808V1	Eco-schemes on cover crops and inert covers (mulching) in woody crops on steep slopes	P1	776.9	3.2%
1PD31001809V1	Eco-scheme on biodiversity hotspots in croplands and permanent crops	P1	690.3	2.9%
CIS	Coupled income support for livestock	P1	2,716.1	11.2%
1PD32001814V1	Coupled aid for olive groves with specific handicaps and high environmental value	P1	138.0	0.5%
ANC	Natural or other area-specific constraints	P2	654.1	8.0%
ASD	Area-specific disadvantages resulting from certain mandatory requirements	P2	59.6	0.7%
6501.1	Environmental and climate commitments	P2	87.1	1.1%

	targeting integrated production			
6501.2	Environmental and climate commitments targeting sustainable cultivation commitments	P2	201	2.5%
6501.3	Environmental and climate commitments for the promotion and sustainable management of pastures	P2	130.7	1.6%
6501.4	Environmental and climate commitment for the promotion of beekeeping for biodiversity	P2	124.4	1.5%
6501.5	Environmental and climate commitment on the protection of birdlife	P2	62.8	0.8%
6501.6	Environmental and climate commitments targeting maintenance of habitats and preservation of biodiversity	P2	88.7	1.1%
6501.7	Environmental and climate commitment on alternatives to chemical control	P2	33.8	0.4%
6501.8	Environmental and climate commitments for soil improvement and erosion control practices	P2	34.5	0.4%

6502.2	Environmental and climate commitments to maintain forestry and agroforestry systems	P2	27.1	0.3%
6503	Environmental and climate commitments in organic farming	P2	819.4	10.0%
6841.1	Aid for productive investments in agricultural holdings linked to contributing to climate change mitigation-adaptation, efficient use of natural resources and animal welfare	P2	175.4	2.2%
6842.1	Aid for investments with environmental objectives	P2	104.0	1.3%
6843.1	Aid for investment in irrigation infrastructure with environmental objectives	P2	316.6	3.9%
6844	Aid for non-productive investments in agricultural holdings linked to climate change mitigation-adaptation, efficient use of natural resources and biodiversity	P2	20.2	0.2%
6871	Non-productive investments in basic services in the natural environment	P2	190.0	2.3%

6881.1	Non-productive forestry in-vestments in afforestation and agroforestry systems	P2	68.8	0.8%
7161	EIP-Agri	P2	162.4	2.0%
7162	Cooperation groups for Innovation not linked to EIP-Agri	P2	28.0	0.3%
7201	Knowledge transfer, training, and information activities	P2	78.5	1.0%
7202	Advisory Services	P2	103.5	1.3%

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

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