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Analysis of Sustainable Energy and Environmental Policies in Agriculture in the EU Regarding the European Green Deal

Ioan Prigoreanu , Bianca Antonela Ungureanu ^{*}, George Ungureanu ^{*} and Gabriela Ignat

Department of Agroeconomy, Faculty of Agriculture, University of Life Sciences "Ion Ionescu de la Brad", Mihail Sadoveanu Alley, 700489 Iasi, Romania; ioan.prigoreanu@iuls.ro (I.P.); gabriela.ignat@iuls.ro (G.I.)

^{*} Correspondence: bianca.ungureanu@iuls.ro (B.A.U.); george.ungureanu@iuls.ro (G.U.)

Abstract: The paper analyzes energy and environmental policies in agriculture in the context of the European Green Deal, emphasizing the contribution of the Common Agricultural Policy in supporting sustainability objectives. The study explores how Member States implement specific measures to reduce greenhouse gas emissions, conserve natural resources, and protect biodiversity by 2030. The analysis focuses on three main objectives: reducing emissions and adapting to climate and energy changes, managing natural resources sustainably and ensuring energy efficiency, and promoting organic farming and conserving biodiversity. Using a methodology that aligns Green Deal goals with CAP measures, this research involves a comparative analysis between Member States, highlighting disparities in policy implementation, particularly between Eastern and Western Europe, suggesting that a coordinated EU approach is needed to support equitable progress. The paper provides a detailed perspective on the progress made and offers recommendations for harmonizing agricultural policies in the EU, supporting farmers in adopting ecological and energy efficient practices, and ensuring a consistent approach in achieving Green Deal objectives by 2030.

Keywords: European Green Pact; sustainable agriculture; energy policies; environmental policies; ecological transition; climate targets



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1. Introduction

European agriculture plays a central role in addressing energy, climate, and environmental issues. Over the years, sustainable development strategies and programs have been implemented to tackle these challenges. However, despite the correct orientation of these initiatives, they remain insufficient to meet the current needs of the agricultural sector. The 2003 reform of the EU Common Agricultural Policy [1] marked a significant change by providing direct and decoupled financial support to farmers, thus reducing their motivation to intensify production. Instead, the new support framework required farmers to adopt ecological cultivation methods [2], aimed at conserving environmental energy. Nevertheless, the energy and climate challenges associated with agricultural activities necessitate the implementation of sustainable and efficient practices. The European Environment Agency [3] highlights several essential areas for transitioning to a sustainable agricultural and economic system, including: (a) strengthening policy implementation and cohesion methods; (b) creating a long-term policy framework oriented towards sustainability; (c) promoting international cooperation for sustainable development; (d) supporting innovation through social actions; (e) increasing investments and reorienting finances; (f) managing risks and ensuring a fair transition; and (g) integrating knowledge into concrete actions.

In response to the deteriorating state of the natural environment in Europe, including the effects of climate change, the European Commission launched the European Green Deal in 2019 [4], with the aim of stimulating international actions to achieve economic objectives in balance with environmental protection, reaffirming the EU's commitment to addressing the energy, climate, and environmental crisis, considered the most pressing issues of society [5].

The European Green Deal is the growth strategy proposed by the European Union to transform the economy into a modern, resource-efficient, and competitive one [6], with the objective of zero net greenhouse gas emissions by 2050 [7]. Thus, through this strategy, the EU seeks to decouple economic growth from excessive use of natural resources, putting the economy and society on a sustainable trajectory that covers all sectors, including agriculture [8].

Countries with more developed economies, such as Germany and France, have access to more funds and advanced technologies, allowing them to implement carbon sequestration or pesticide use reduction measures more quickly, while Eastern European countries face challenges in accessing funds and adopting modern practices due to economic and infrastructural constraints [9]. Thus, the Green Pact promotes eco-schemes, which include voluntary measures to encourage farmers to adopt sustainable practices (e.g., growing legumes, maintaining fallow areas for biodiversity, using renewable energy) [10]. However, differences in participation rates between countries reflect varying levels of awareness and financial support [11]. According to the Green Pact, by 2030, 25% of the EU's agricultural land should be organic. Some countries, such as Austria, have already exceeded this target, while others, such as Romania, have more modest targets due to lack of demand and limited subsidies.

EU countries are implementing the Common Agricultural Policy 2023–2027 through customized national CAP strategic plans targeting local needs while supporting EU objectives and the European Ecological Pact. Thus, the European Green Pact policies and related strategies such as Farm to Fork and Biodiversity mark a significant transition towards more sustainable agriculture in the European Union [12]. These policies aim to address climate challenges, reduce negative environmental impacts, and improve the use of natural resources in the agricultural sector. The main action lines and impacts include [9] reducing environmental impacts; thus, pesticide sales have fallen by 7% between 2011 and 2019, representing progress in reducing risks to biodiversity and human health, and greenhouse gas emissions from agriculture have been reduced by 25% since 1990, in line with climate change mitigation targets.

In terms of the area of land used for organic farming, it increased annually by 5.5% between 2012–2019, reaching 13.8 million ha in 2019, and the 2030 target is to reach 25% of the agricultural area used. In addition, increasing the diversity of agricultural landscapes by keeping 10% of agricultural land for areas of high biodiversity contributes to the restoration of natural ecosystems and habitats [13], and Member States such as Denmark, Germany, and the Netherlands are leaders in the uptake of renewable energy sources, including biogas and solar energy. However, challenges of high upfront costs and limited infrastructure prevent the spread of these practices to all regions.

In terms of challenges to the objectives of the European Green Pact, around 50% of agricultural land in the EU is suffering from a shortage of pollination, droughts have led to annual economic losses of 9 billion EUR, and fragmentation of agricultural land and lack of modern infrastructure continue to be barriers for Eastern European Member States such as Romania and Bulgaria to adopt renewable energy and sustainable practices [14].

In terms of the role of support policies, the Common Agricultural Policy 2021–2027 allocates substantial funds for the green transition, including for organic farming, infrastructure investment, and support for small- and medium-sized farmers. These funds are essential for achieving the environmental objectives of the European Green Pact. Thus, the paper aims to analyze the implementation and effectiveness of sustainable energy and environmental policies in agriculture under the European Green Pact, with a special focus on the contribution of the Common Agricultural Policy to the achievement of the set environmental objectives. The goal is to highlight how these policies support the transition to sustainable agricultural practices and contribute to the reduction of greenhouse gas emissions, conservation of natural and energy resources, and protection of biodiversity.

The objectives of the analysis are as follows:

- O1: Analysis of adaptation and emission reduction in agriculture: aims to evaluate the commitments of Member States to reduce emissions in the agricultural and live-stock sectors, examine investments and capacities for renewable energy production in agriculture to reduce dependence on fossil fuels, and identify differences between states in supporting farmers to reduce emissions and adapt to climate change.
- O2: Evaluation of sustainable natural resource management: involves investigating measures to protect soil, water, and air quality through sustainable management policies, analyzing the adoption of sustainable water and pesticide use measures to reduce environmental impact, and identifying the role of sustainable nutrient and water resource management in the context of the European Green Deal and the transition to energy efficient and sustainable agricultural practices.
- O3: Conservation of biodiversity and promotion of organic farming: involves analyzing support for organic farming and its impact on reducing pollution and protecting natural resources, investigating biodiversity and landscape conservation practices through the management of natural features and habitats in European agriculture, and evaluating the support provided to farmers for adopting organic practices and the need for additional measures to support the energy transition in the EU. The paper will provide an in-depth understanding of the efficiency and limitations of energy and environmental policies in agriculture, reflecting the commitments of Member States within the Green Deal, with targets set until 2030. The analysis will also offer recommendations for harmonizing agricultural policies at the EU level and propose support measures for equitable implementation of sustainable practices in all Member States.

2. European Green Deal: A Comprehensive Strategy for Implementing the 2030 Agenda and Transitioning to Sustainability

The European Green Deal supports the implementation of the UN's 2030 Agenda and the Sustainable Development Goals [9]; thus, the implementation of this pact requires significant changes in various policy areas, from energy and industry to agriculture and transport. The objectives include protecting ecosystems, the sustainable use of resources, and improving public health; thus, the interconnected areas of action require integrated policies and, in some cases, compromises between economic, environmental, and social objectives [15–17], and to achieve the pact's objectives [18], specific policies have been established to contribute to improving the natural environment and stabilizing the climate (Figure 1).

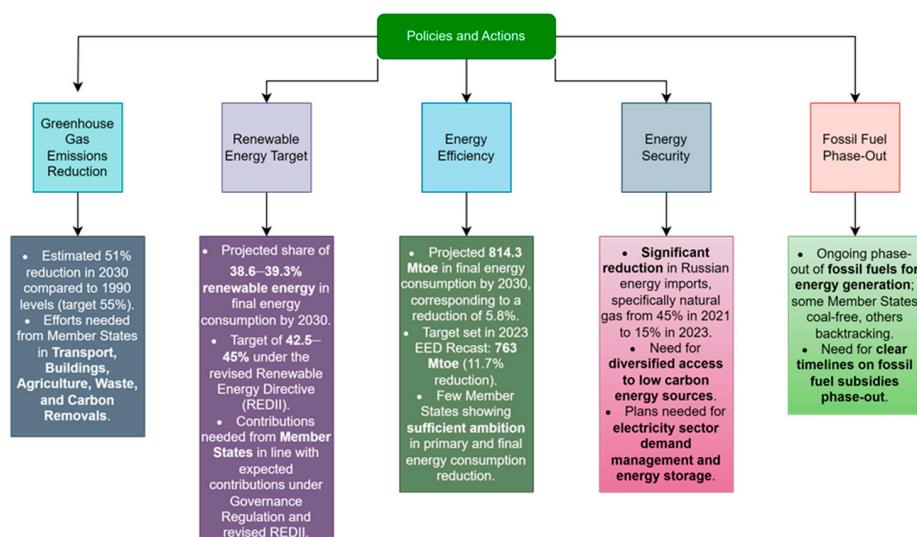


Figure 1. Political measures and actions to achieve energy and climate sustainability goals at the European Union level by 2030. Source: own interpretation based on Regulation (EU) 2018/1999 of the European Parliament and of the Council [19].

Between 2020 and 2021, the European Green Deal initiated multiple major actions to ensure the EU's transition to sustainability. In the agricultural sector, the "Farm to Fork" strategy was adopted, promoting a sustainable food system, reducing the use of pesticides and synthetic fertilizers, and supporting organic farming, while biodiversity was protected by expanding the protected area of EU lands and waters and strengthening the Natura 2000 network of protected areas.

To achieve ambitious climate objectives, the EU has set a goal of climate neutrality by 2050 and a 50–55% reduction in emissions by 2030, compared to 1990 levels [20]. In the energy sector, the focus has been on developing an energy system based on renewable sources, reducing coal, and encouraging the transition to low-carbon energy sources. Additionally, the "zero pollution" goal was established for a cleaner and healthier environment, and the circular economy was promoted to support the EU industry in adopting a sustainable growth model, prioritizing the reuse and recycling of materials [21]. In transport, a 90% reduction in emissions is targeted by 2050, supporting zero emission vehicles and charging infrastructure, with all these measures supporting the transition to a green and sustainable economy (Figure 2).

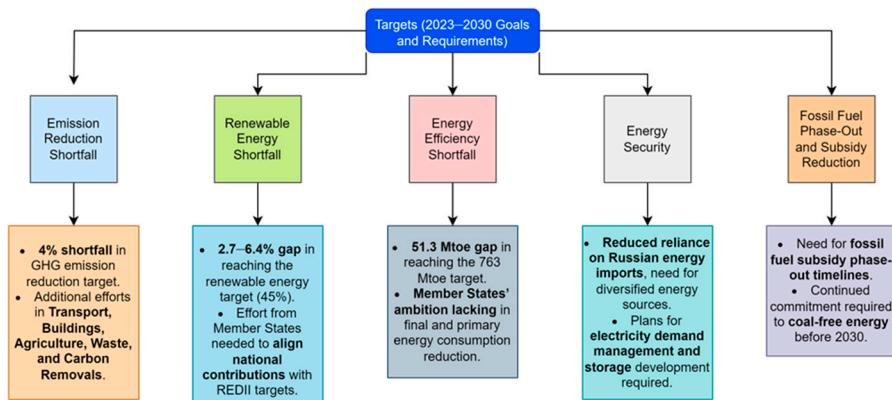


Figure 2. Objectives and requirements for achieving energy and climate sustainability goals in the European Union for the period 2023–2030. Source: own interpretation based on Regulation (EU) 2018/842 of the European Parliament and of the Council [21].

The European Green Deal is based on ambitious objectives and structural reforms that transform the European economy, addressing issues related to climate, energy, and biodiversity. This pact represents a major paradigm shift that will directly influence all sectors of the European economy in the coming decades, and the implementation of the European Green Deal strategy comes with a series of major challenges, both at the European level and in the Member States, challenges that can be grouped into four main categories:

1. Fundamental challenge related to the ambition of the European Green Deal objectives: Between 1990 and 2018, the EU reduced greenhouse gas emissions by 23% [22], while the economy grew by 61%. However, according to estimates, current policies would only ensure a 60% reduction in emissions by 2050, making it necessary to set more ambitious climate and energy objectives [23,24]. Achieving these, however, involves significant risks and requires radical solutions to transform economic sectors in a sustainable direction. To support this transformation, the EU will need to take measures in various areas: climate taxation, development of a circular and climate neutral economy, biodiversity restoration, digitization, and massive investments in new technologies [25] that require sustained effort to integrate these initiatives into a sustainable economic framework.
2. Administrative and legal challenges: The successful implementation of the Green Deal requires adapting the institutional and regulatory framework at European and national levels [26]. Member States must develop their own national energy and climate plans, as well as strategic plans for the Common Agricultural Policy, which

must be in line with European objectives. The European Commission is responsible for evaluating and monitoring the implementation of these plans [27], and Member States must achieve measurable results. Additionally, periodic review of progress in environmental protection will contribute to adjusting strategies and measures to achieve objectives [28].

3. Global challenges in the European context: The EU, being responsible for an increasingly smaller proportion of global emissions [29], needs similar measures from other regions to have a real impact on energy, climate, and the environment globally. The European Green Deal will influence geopolitics and economic and commercial interests, creating new challenges for Member States and international relations. Thus, the EU intends to collaborate with global partners to mitigate risks related to food security, conflicts, and forced migration, placing environmental and climate policy in a central position in common security policy [30].
4. Financial and social challenges: To achieve the ambitious objectives set [31], innovative solutions and massive investments are necessary, which involve significant costs. The question of who is responsible for these costs is essential, given that energy, the environment, and climate are common resources. The EU and Member States must coordinate international actions and attract private capital to support green initiatives [32], and from a social perspective, the success of the Green Deal depends on public support [33]. Although awareness of climate issues has increased, the level of willingness to cover the associated costs of these changes remains limited. Therefore, public education on the importance of the Green Deal and the negative effects of inaction must be intensified to ensure broad support [34]. A large part of the population adopts a passive approach, waiting for others to take the initiative, which reduces the effectiveness of energy and environmental policies and increases the risk of not achieving the set objectives [27–30].

3. Materials and Methods

3.1. Context of the Analysis

The new governance of the Common Agricultural Policy (CAP) marks a transition from compliance to performance, aiming to effectively address current and future challenges. In a rapidly changing global economic context and amid an urgent need for climate action, the CAP must make an essential contribution to achieving an ecological transition and creating a sustainable food system with social, ecological, and economic impact. The budget of over 380 billion EUR for the 2021–2027 period reflects the strategic importance of agriculture, food, and rural areas in today's European Union, ensuring the necessary support for achieving the objectives of the European Green Deal and the Sustainable Development Goals [35]. However, to fully capitalize on these resources, the CAP must simplify governance and modernize its implementation mechanisms, shifting to a policy model focused more on results and performance.

Currently, the CAP relies on a series of complex and detailed requirements at the EU level, applicable to all beneficiaries down to the individual farm level. However, given the significant energy, ecological, and climate diversity across the Union, universal or top-down approaches are no longer effective in achieving the desired results. In response, EU legislators have agreed on a new and more flexible governance based on the introduction of national CAP strategic plans [36]. Starting in 2023, the CAP will, for the first time, integrate the most important support tools into a single programming framework, ensuring a more coherent approach to their implementation.

By including both the first pillar (direct payments and sectoral support) and the second pillar (rural development) in a single strategic plan, Member States will be able to allocate resources more efficiently and tailor measures according to national specifics [37]. This new decentralized approach implies that the EU reduces its prescriptive level and focuses more on strategic objectives and performance, while Member States have increased responsibility for achieving the established objectives. At the same time, fundamental

mandatory requirements remain, ensuring a common ambition across all Member States and a clear direction towards achieving a more sustainable agricultural sector.

The new Common Agricultural Policy brings a programming approach based on detailed analysis and a common set of objectives and indicators, being performance oriented and adapted to the diversity of Member States. The legal framework for the CAP now includes general and specific objectives at the EU level, integrating the three dimensions of sustainability: economic, social, and environmental. These objectives constitute the basis of each national Strategic Plan [38], thus supporting the sustainability ambitions of the CAP and contributing to European priorities, including the Green Deal [39]. Thus, the paper presents the analysis of the projected targets for the relevant indicators regarding energy, environment, and climate within the framework of the European Green Deal regarding agriculture in the EU, with targets expected to be achieved by 2030 [39].

3.2. Analysis Methodology

Regarding performance monitoring and evaluation, the new PMEF (Performance Monitoring and Evaluation Framework) integrates all CAP instruments into a unified monitoring system, based on reliable, comparable, and timely updated indicators. PMEF uses a comprehensive set of indicators: 38 achievement, 44 result, 30 impact, and 49 context, with quantified targets for each CAP Strategic Plan [37].

Member States are required to report annually to the Commission on the progress in implementing their strategic plans, and the evaluation of these reports will allow the Commission to monitor results and expenditures, supporting necessary adjustments.

Every two years, the Commission will conduct a full performance evaluation, which may include improvement requests or financial sanctions for Member States that do not meet the set targets.

Member States are also responsible for evaluating their own strategic plans, while the Commission will provide a synthesis of evaluations at the EU level. In 2026, an interim evaluation will analyze the contribution of strategic plans to the Green Deal ambitions, including the objectives of the Farm to Fork Strategy and the Biodiversity Strategy.

Last but not least, the new CAP introduces core indicators that allow annual reporting at the EU level in the context of the performance of the EU budget under the multiannual financial framework 2021–2027. This indicator structure ensures transparency and efficiency in the dialogue regarding CAP performance between the Commission and other European institutions, including the European Court of Auditors.

The methodology used in this paper combines the monitoring of the progress of agricultural and environmental policies in the European Union with a comparative analysis between Member States; thus, the evaluation is based on the indicators of the new Performance Monitoring and Evaluation Framework (PMEF) of the Common Agricultural Policy for the period 2021–2027. These indicators are categorized into the following: (i) output indicators examining specific interventions at project level; (ii) outcome indicators, looking at the effectiveness of the measures supported by the CAP (e.g., R.12 for climate change adaptation, R.15 for renewable energy); (iii) impact indicators measuring the long-term effects on the environment and the agricultural sector; and (iv) context indicators, used to contextualize the results in relation to economic, social, and environmental conditions.

Benchmarking between Member States focused on their performance in key areas such as emission reduction, organic farming, and the use of renewable resources and highlighted the link between the objectives of the European Green Pact and CAP measures, underlining the degree of support for the green transition.

The analysis will examine the European legislative and policy framework regarding the Green Deal and the Common Agricultural Policy Reform to identify specific measures dedicated to reducing greenhouse gas emissions, promoting renewable energies, and conserving natural resources. The main sources will include policy documents and official strategies [37]. Data will be collected based on the key indicators proposed by the CAP for the period 2023–2030, with a focus on environmental and energy aspects, grouped into three levels:

1. Emission reduction and adaptation to climate and energy changes in agriculture (R.12, R.13, R.14, R.15, R.16, R.25, R.26) [37]: the result indicators are used to measure the effectiveness of CAP supported interventions in reducing emissions and supporting adaptation to climate change in the agricultural sector (Table 1).

Table 1. Analyzed result indicators and types of interventions within the CAP for adaptation to climate change, environmental protection, and sustainable resource management.

Code	Result Indicator	Definition	Purpose	Targeted Intervention Types
R.12	Adaptation to climate change	Percentage of agricultural area in use (UAA) under supported commitments to improve adaptation to climate change.	Measures the coverage of climate adaptation commitments.	Climate, environment, and animal welfare schemes (Article 31) [8] Management commitments related to environment and climate (Article 70) [8]
R.13	Reducing emissions in the livestock sector	Percentage of livestock units (LU) under supported commitments to reduce greenhouse gas and/or ammonia emissions.	Measures progress in reducing emissions in the livestock sector.	Sectoral interventions (climate change adaptation practices: Article 47 (1) (i) [40], Article 47 (1) (a) (iii)) [40] Sectoral interventions to reduce climate change in the livestock sector (Article 47 (1) (a) (ii)) [40]
R.14	Carbon storage in soils and biomass	Percentage of UAA under supported commitments to reduce emissions or maintain/store carbon.	Measures the coverage of commitments for carbon storage in agriculture.	Sectoral interventions (soil conservation practices, carbon sequestration: Article 47 (1) (a) (i) [40], Article 47 (1) (ii)) [40]
R.15	Renewable energy from agriculture	Supported investments for renewable energy production capacity, including biomass (in MW).	Measures the renewable energy capacity supported in the agricultural sector.	Investments (Article 73) [8] Sectoral interventions with an investment component (renewable energy from agriculture, forestry, and other sources)
R.16	Climate-related investments	Percentage of farms benefiting from CAP investment support for climate change mitigation, adaptation, and the production of renewable energy or biomaterials.		Sectoral interventions with an investment component (investments in tangible and intangible assets to save water, energy, ecological packaging: Article 47 (1) (a)) [40]
R.25	Environmental Performance in the livestock sector	Percentage of livestock units (LU) under supported commitments to improve environmental sustainability in the livestock sector.	Measures the progress of ecological commitments in animal husbandry.	Management commitments related to the environment and climate (Article 70, support for endangered species) Sectoral interventions (sustainable practices in the livestock sector: Article 47 (1)) [40]
R.26	Investments related to natural resources	Percentage of farms benefiting from support for CAP investments aimed at the care of natural resources.	Measures the coverage of investments for the protection of natural resources.	Sectoral interventions with an investment component (saving water, energy, ecological packaging: Article 47 (1) (a)) [40]

2. Sustainable management of natural resources and energy efficiency in agriculture to meet the objectives of the European Green Pact (R.19, R.20, R.21, R.22, R.23, R.24) [37]: intended to measure the effectiveness of supported interventions in improving the management of natural resources, energy, and environmental protection in agriculture (Table 2).

Table 2. Analyzed result indicators and types of CAP interventions for sustainable management of energy, soil, air, water, and pesticides.

Code	Result Indicator	Definition	Purpose	Targeted Intervention Types
R.19	Soil improvement and protection	Percentage of UAA under commitments supported for soil management, to improve soil and biota quality.	Measures the coverage of soil conservation commitments.	Climate, environment, and animal welfare schemes (Article 31) [8] Management commitments related to environment and climate (Article 70) [8]
R.20	Improving air quality	Percentage of UAA under supported commitments to reduce ammonia emissions.	Measures the coverage of commitments to improve air quality.	Sectoral interventions (soil conservation practices: Article 47 (1) (a) (ii)) [40]
R.21	Water quality protection	Percentage of UAA under supported commitments for water quality.	Measures the coverage of water quality protection commitments.	Sectoral interventions (organic farming: Article 47 (1) (d)) [40]
R.22	Sustainable nutrient management	Percentage of UAA under supported commitments for sustainable nutrient management.	Measures the coverage of commitments for sustainable nutrient management.	Sectoral interventions (organic and integrated agriculture: Article 47 (1) (d)) [40]
R.23	Sustainable use of water	Percentage of UAA under commitments supported to improve the water balance.	Measures the coverage of commitments for sustainable water use.	Sectoral interventions (sustainable water use practices: Article 47 (1) (a) (ii)) [40]
R.24	Sustainable and reduced use of pesticides	Percentage of UAA under specific commitments for the sustainable use of pesticides, to reduce their risks and impacts.	Measures the coverage of commitments for the sustainable use of pesticides.	Sectoral interventions (organic and integrated agriculture, pest management practices: Article 47 (1) (a) (viii)) [40]

3. Preservation of biodiversity, landscape, and energy efficiency in the promotion of ecological agriculture (R.29, R.31, R.32, R.34) [37]: the result indicators measure the degree of coverage of commitments to support these objectives (Table 3).

Table 3. Analyzed result indicators and types of CAP interventions to promote organic agriculture, energy and biodiversity conservation, and landscape management.

Code	Result Indicator	Definition	Purpose	Targeted Intervention Types
R.29	Development of ecological agriculture	Percentage of utilized agricultural area (UAA) supported by the CAP for organic farming, split between maintenance and conversion.	Measures the coverage of commitments to promote organic agriculture.	Climate, environment, and animal welfare schemes (Article 31) [8] Management commitments related to environment and climate (Article 70) [8] Sectoral interventions (Article 47 (1) (d) and 57 (1) (m)) [40]
R.31	Conservation of habitats and species	Percentage of UAA under commitments for biodiversity conservation/restoration, including agricultural practices of high nature value.	Measures the coverage of biodiversity commitments.	Sectoral interventions, e.g., creation and maintenance of habitats (Article 47 (1) (a) (x)) [40]
R.32	Investments related to biodiversity	Percentage of farms benefiting from CAP investment support in biodiversity.	Measures the coverage of investments to support biodiversity.	Investments (Article 73) [8] Sectoral interventions with an investment component, e.g., investments in tangible and intangible assets for the creation of habitats (Article 47 (1) (a) (x)) [40]
R.34	Conservation of landscape features	Percentage of UAA under commitments for managing landscape features such as hedges and trees.	Measures commitments to manage landscape features.	Sectoral interventions, e.g., preservation/restoration of terraces and walls (Article 58 (1) (a)) [8]

Correlating the objectives of the Green Deal and the Common Agricultural Policy involves a method to analyze to what extent the measures implemented through the CAP support the objectives of the European Green Deal. This method consists of identifying the correspondences between the specific objectives of the Green Pact, such as the achievement of climate neutrality and the national targets adopted by the Member States through the CAP until the year 2030. Thus, by evaluating the common environmental, economic, and sustainability objectives, the analysis allows for the observation of the commitment of each member state to the transition to a more ecological agriculture.

The comparative analysis between the Member States completes this correlation, using comparable indicators to evaluate regional differences and the efficiency of the implemented measures, highlighting the differences between the states according to the local specifics and the capacity to adapt, contributing to a better understanding of the regional needs and challenges in the implementation of the objectives of the Green Pact.

4. Results

4.1. Emission Reduction and Adaptation to Climate and Energy Changes in Agriculture

The European Green Deal includes strategies that call for a significant transition in European agriculture to keep agricultural activities within planetary boundaries and support biodiversity [41]. The “Farm to Fork” and Biodiversity strategies aim to reduce the use of pesticides and fertilizers and restore landscape elements necessary for biodiversity. Although there is a target to reduce food waste, measures to support a transition to healthier and more sustainable diets are insufficient, and the new CAP modifications for the 2023–2027 period [42,43] do not bring major improvements, instead transferring a large part of the implementation responsibilities to the Member States. Without strict reporting requirements on biodiversity impact, the effectiveness of measures remains limited, and in some cases, funding is directed to programs that do not truly contribute to biodiversity, while “enhanced conditionality” is insufficient [44]. For example, only 3% of arable land is allocated to nature, although studies indicate that a minimum of 10% is needed for biodiversity restoration. Moreover, greening measures, which aimed to reduce the impact of agriculture on the environment, have been integrated into conditionality but with weak standards and options that allow intensive exploitation, including supporting intensive animal farming, which negatively impacts biodiversity and climate. Although eco-schemes are allocated a significant budget, they are not directed towards clear environmental

protection measures, allowing Member States to develop schemes that do not produce significant effects [45].

Figure 3 illustrates the commitments (targets) of EU Member States to adapting to energy and climate changes and reducing emissions in agriculture and the livestock sector by 2030, including the percentage of agricultural areas and livestock units involved in climate adaptation initiatives, reducing greenhouse gas emissions, and storing carbon in soils and biomass.

Figure 3a presents the commitments of the European Union member countries within the objective R.12 of the Common Agricultural Policy 2023–2027, which aims to adapt agriculture to climate change. Countries such as France (65.27%), Finland (64.61%), and the Netherlands (64.15%) have set high targets for adapting agriculture to climate change, indicating a deeper integration of sustainable energy policies and an increased willingness to invest in agricultural practices that reduce reliance on fossil fuels and promote renewable resources. For example, in France, although 1.2 billion EUR is earmarked to support renewables, the complexity of administrative requirements and low access for small farms in France limits the expansion of projects [46], but simplifying administrative procedures could accelerate the uptake of green technologies, and the Netherlands has high costs and strict regulations that limit the expansion of biogas and emission reduction projects, requiring more flexible policies [47]. These commitments include energy efficiency technologies, increasing carbon storage capacity in soils, and using solar or bioenergy in agricultural operations, all contributing to the Green Deal objectives. However, the replication of these approaches in other Member States may face significant obstacles, such as lack of financial resources, different climatic conditions, or the difficulty of implementing advanced technologies on small farms.

In contrast, countries such as Estonia (0%) having emission reduction schemes and bioenergy use are supported by national policies, but Estonia faces limited agricultural land and a focus on small farms, making project scalability a major challenge [48]; thus, modernization of agricultural infrastructure could boost the uptake of renewable energy.

Romania (0.01%), with solar and biogas projects held back by lack of technical knowledge and poorly developed infrastructure, affecting small- and medium-sized farmers [49], and Malta (0.04%), with limited land and unfavorable climatic conditions, making the integration of renewables a challenge, despite allocated funds [50], have much lower rates for this indicator, reflecting challenges in financing, infrastructure, and technological support, as well as different priorities in national agricultural policies. This variation can generate an uneven transition to sustainable agricultural practices in Europe and may exacerbate disparities in implementing Green Deal objectives, particularly in the areas of energy efficiency and climate resilience. Analyzing these data suggests that adapting agriculture to climate change is not just a matter of agricultural policies but also of energy policies, which directly influence consumption and energy sources in this sector.

Figure 3b shows the share of livestock units (LU) supported for reducing greenhouse gas (GHG) and/or ammonia emissions by 2030, with Finland having the highest share, with 46.52% of livestock units supported for emission reduction. Thus, it invests considerably in integrating bioenergy on farms, but severe climatic conditions reduce the efficiency of green technologies [51], and thus increasing access to solutions adapted to Nordic conditions is necessary to maximize the use of renewable sources. The next country in terms of share is Croatia with 39.62%, with support to small farms being counteracted by the low implementation rate in the use of renewables due to lack of technological resources, where technological modernization remains an acute need [52], followed by Latvia (29.34%), which is implementing pilot projects for biogas and solar energy [53], but the lack of consistent financial support for farmers and the low level of accessibility to modern technologies are holding back large-scale adoption; thus, strengthening financial schemes could stimulate the use of renewables. These percentages indicate a strong commitment to the transition towards greening agriculture and rigorous management of emissions from the livestock sector, with Austria (28.23%) and Greece (15.71%) also

demonstrating some level of commitment. On the other hand, Spain shows a very low share of only 0.12%; thus, funds for the modernization of irrigation with solar energy are insufficient in the face of frequent droughts and high costs, which reduce the feasibility of projects, which may signal a low priority given to this aspect in its national agricultural policy [54]. In Belgium (Flanders) (2.81%), although 25% of the rural budget is allocated to eco-schemes that include renewable energy, small farmers face difficulties in accessing funding for advanced technologies, requiring no additional support programs [55], and Slovenia (7.91%) has small-scale projects for biomass and solar panels that face a lack of technological support and high up-front costs, requiring more substantial support [56].

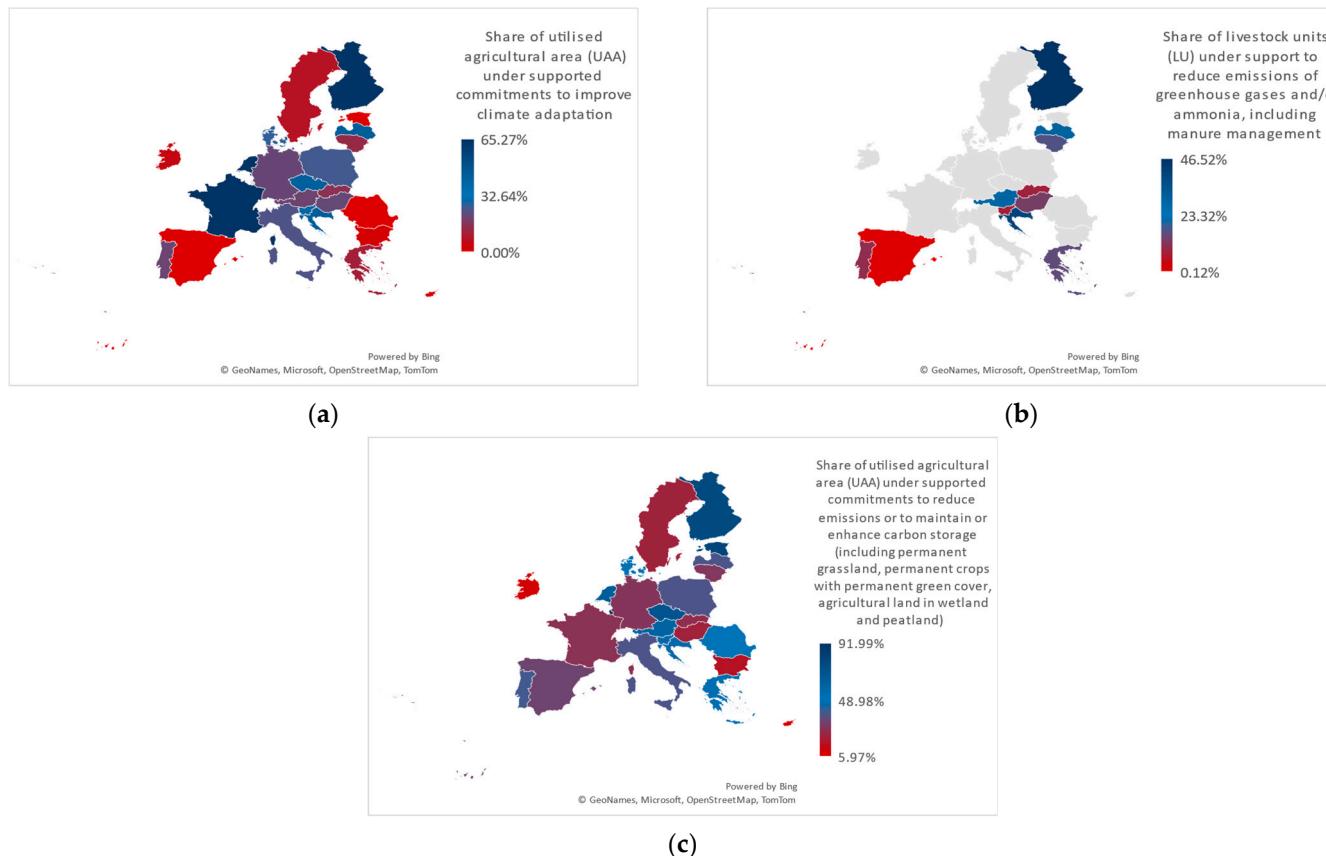


Figure 3. Commitments (targets) for adapting to energy and climate changes and reducing emissions in agriculture and the livestock sector until 2030: (a) R.12: Adapting to climate change, (b) R.13: Reducing emissions in the livestock sector, (c) R.14: Carbon storage in soils and biomass. Source: own interpretation based on CSPs Master file and key data, Publications Office of the European Union [37].

The analysis of this indicator highlights differences in national commitments and underscores the need for a coordinated approach to support a fair and sustainable transition in the European Union. These measures are essential for achieving the Green Deal targets and supporting a sustainable energy policy in agriculture.

Figure 3c illustrates the share of utilized agricultural area (UAA) in each European country benefiting from supported commitments for emission reduction or maintaining and improving carbon storage by 2030. These commitments include sustainable practices on agricultural lands, such as permanent pastures, permanent crops with green cover, and agricultural lands located in wetlands and peatlands. The indicator highlights each country's efforts to contribute to the climate objectives of the European Green Deal by reducing emissions and managing carbon. Luxembourg has the highest share of agricultural land dedicated to emission reduction and carbon storage, with 91.99%, followed by Estonia

(79.22%) and Finland (76.96%). These high values reflect a strong commitment to sustainable agricultural practices and achieving the ecological objectives of the European Union. Other countries with significant shares, such as the Czech Republic (69.89%), Belgium (Wallonia) (68.53%), and the Netherlands (64.18%), demonstrate the implementation of effective agricultural policies in carbon storage and emission reduction during the 2023–2027 period. On the other hand, countries like Malta (5.97%), Cyprus (8.95%), and Ireland (8.88%) have lower shares of agricultural land dedicated to these commitments, suggesting a lower prioritization, while Romania (49.16%) and Greece (47.50%) have medium shares, indicating a moderate interest in promoting emission reduction and carbon storage measures, with potential for expanding these practices by 2030.

Figure 4 presents the overall target value of supported investments in renewable energy production capacity (in MW) in the agricultural sector for each country in the European Union, a target set until 2030. These investments include renewable energy sources such as bioenergy and are essential for achieving the energy sustainability objectives established by the European Green Deal and the Common Agricultural Policy. However, the integration of renewables into farming practices is often hampered by high upfront costs, limited access to advanced technologies, and a lack of adequate infrastructure, especially in rural regions of Eastern Europe.

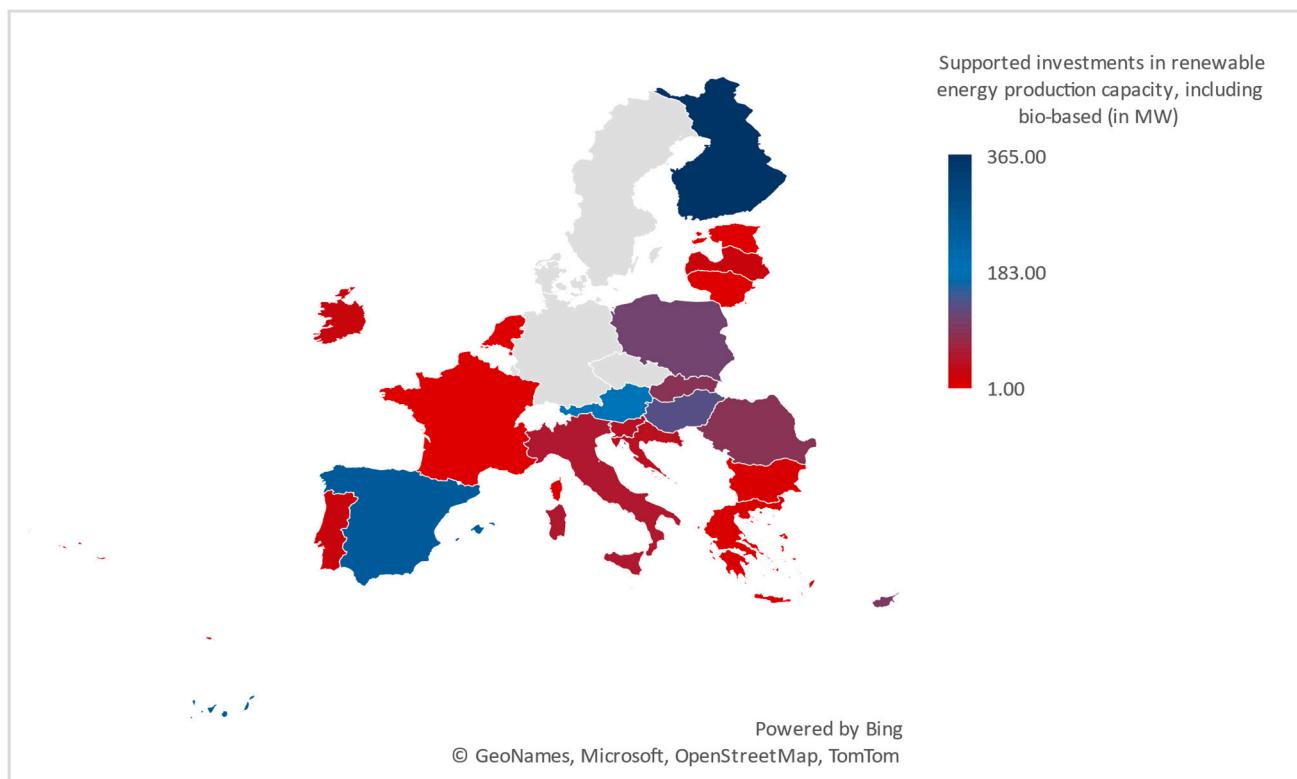


Figure 4. R.15 Renewable energy from agriculture, forestry, and other sources—sustained renewable energy production capacity (in MW). Source: own interpretation based on CSPs Master file and key data, Publications Office of the European Union [37].

Finland has the highest target for supported renewable energy capacity by 2030, with 365 MW, followed by Spain (251 MW) and Austria (182.25 MW). These high values indicate a strong commitment by these countries to invest in renewable energy in the agricultural sector, thus contributing to a transition to a more sustainable and less fossil fuel-dependent agriculture. Other countries with significant investments include Hungary (131.29 MW), Cyprus (101.88 MW), and Romania (89 MW), suggesting a proactive approach to promoting renewable energy at the national level. In contrast, in countries such as Belgium Wallonia (1.26 MW), out of the 132 million EUR allocated to renewable energy

projects, modernized infrastructure and the increased costs reduce the access of small farmers to these technologies, and the infrastructure problem remains one of the most pressing [57]. In Lithuania (1.60 MW), the integration of green technologies is slow due to poor infrastructure, despite funding for solar panels and farm modernization [58], and in France (3.23 MW), although 1.2 billion EUR is allocated to support renewable energy sources, the complexity of administrative requirements and low access for small farms in France limit the expansion of projects [46]. A significant number of countries, including the Czech Republic, Germany, Denmark, Luxembourg, and Sweden, have not provided specific targets for this indicator. Investments in renewable energy production capacity play an essential role in achieving the objectives of the European Green Deal, reducing reliance on conventional energy sources and contributing to the reduction of greenhouse gas emissions. These variations suggest a need for increased coordination at the EU level to ensure a uniform energy transition and to support the Green Deal objectives, aiming to develop a more sustainable and energy efficient agricultural sector.

Figure 5 presents the targets related to the number of farms in each country benefiting from CAP investment support by 2030, aimed at mitigating and adapting to climate change, as well as producing renewable energy or biomaterials.

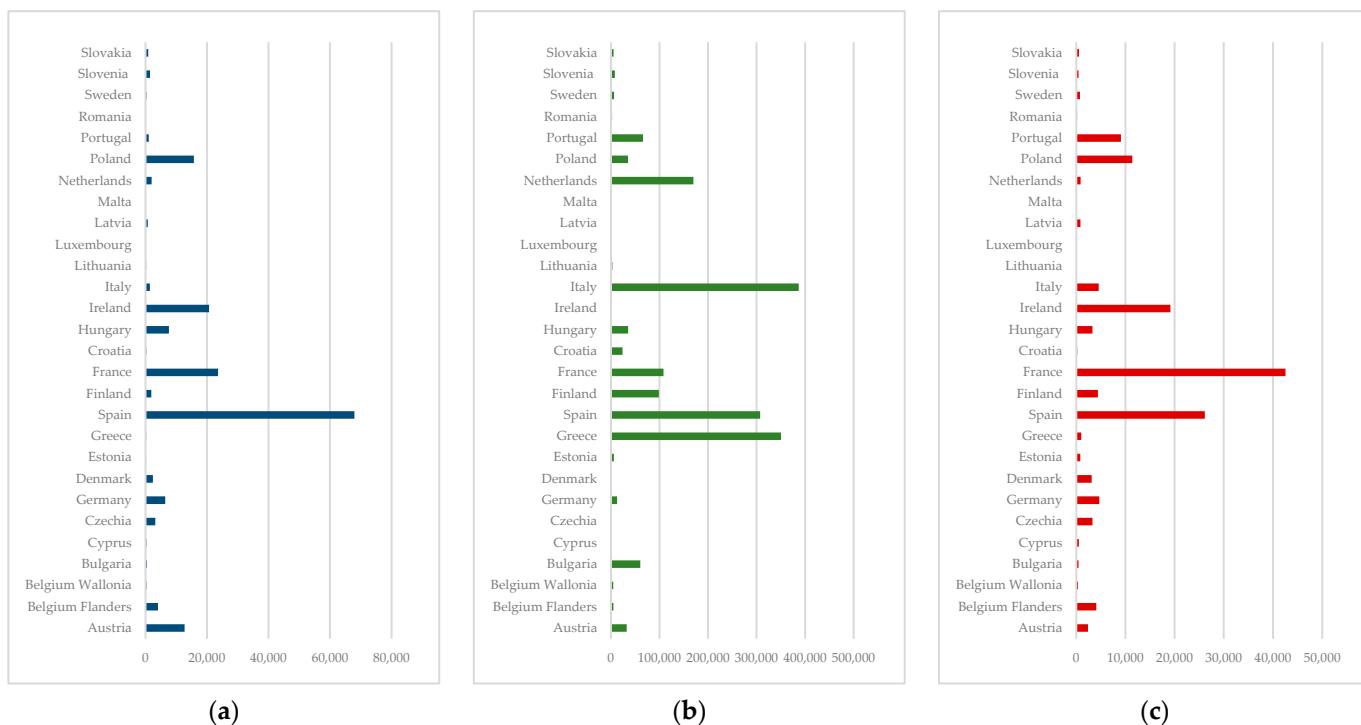


Figure 5. Support for farms and livestock units in the EU Member States for adaptation to climate change, emission reduction, and the production of renewable energy and biomaterials: (a) R.16: Number of farms benefiting from CAP investment support contributing to climate change mitigation and adaptation and to renewable energy or biomaterials production; (b) R.25: Number of livestock units for which a related payment was made; (c) R.26: Number of farms receiving relevant support. Source: own interpretation based on CSPs Master file and key data, Publications Office of the European Union [37].

Spain has the target of the highest number of supported farms by 2030, with 67,937 farms, indicating a considerable commitment of Spanish farmers to adopting sustainability and renewable energy measures, followed by France (23,617 farms) and Ireland (20,700 farms), suggesting an active promotion of these types of investments. Other countries with a significant number of supported farms include Poland (15,731 farms), Hungary (7612 farms), and Germany (6400 farms), showing a moderate involvement in supporting sustainable

investments in agriculture, while countries like Malta (15 farms), Romania (138 farms), and Estonia (153 farms) have a very low number of supported farms, suggesting either a lack of sufficient support programs or a limited adoption of these measures by farmers by 2030.

Support for CAP investments that help farms mitigate the impact of climate change and contribute to the production of renewable energy (R.16) is essential for achieving the European Green Deal objectives. These investments help create a resilient and energy-efficient agricultural sector, promoting environmentally friendly practices. Countries with a large number of supported farms demonstrate a strong commitment to sustainability, being better positioned to meet the EU's climate targets. In contrast, countries with a low number of supported farms may need additional support or better structured policies to increase the adoption rate of sustainable measures in agriculture. This aspect highlights the need for efficient coordination at the EU level to ensure a uniform transition to sustainable agricultural practices in all Member States.

Regarding indicator R.25 (number of livestock units for which a related payment was made), Italy has the highest supported value, with 386,968 units, followed by Greece (350,404 units) and Spain (307,415.2 units), indicating a substantial commitment of these countries to implementing agricultural sustainability measures. Other countries with significant values include Finland (98,750 units), France (108,196 units), and the Netherlands (170,000 units), while countries with lower values include Malta (2133 units), Luxembourg (194 units), and Romania (2382 units).

Indicator R.26, "Number of farms receiving relevant support", reflects the importance of supporting the transition to greener agricultural and energy practices. France is in first place with 42,534 farms supported, followed by Spain (26,143 farms) and Ireland (19,167 farms), which highlights a high commitment to promoting sustainability measures. Other countries with a significant number of supported farms include Poland (11,426 farms) and Portugal (9101 farms), suggesting an increased degree of involvement in adopting sustainable practices. On the other hand, countries with a low number of supported farms, such as Malta (50 farms), Luxembourg (56 farms), and Lithuania (33 farms), may require additional attention to stimulate the transition to ecological agricultural practices.

Supporting a large number of farms in the implementation of sustainable practices is essential for achieving the objectives of the European Green Deal. Thus, countries with a large number of supported farms demonstrate a strong alignment with the environmental objectives of the European Union, promoting the reduction in emissions, the conservation of biodiversity, and the protection of natural resources; on the other hand, countries with a small number of supported farms could benefit from additional programs to encourage farmers to adopt ecological practices.

Under the European Green Pact, EU Member States have adopted policies and strategies tailored to national specificities, depending on existing infrastructure, local challenges, and economic priorities [59]. Thus, countries with significant budgetary allocations and advanced strategies, such as Austria, France, and Germany, stand out with generous financial allocations and complex plans to reduce carbon emissions and protect biodiversity. Austria is investing 3.4 billion EUR to preserve mountain pastures and support organic farming [60], while France is devoting 26% of its Common Agricultural Policy budget to reducing emissions and expanding organic areas [46]. Germany, with an ambitious target to increase organic farming to 30% by 2030, supports soil management and natural habitat conservation through well-defined financial schemes [61].

Countries such as Cyprus, Malta, and Greece, faced with the challenges of limited water resources, have adopted climate-adapted strategies. Cyprus and Malta are promoting water efficiency and the expansion of organic farming [50,62–64], while Greece is investing 1.4 billion EUR in reducing pesticide use and crop rotation, thus addressing the specific environmental problems of the Mediterranean region [63].

Bulgaria, Croatia, Latvia, and Lithuania are examples of countries in a transition process towards sustainability, with Bulgaria, for example, aiming to increase the former organic farming area to 200,380 ha [64] and Croatia supporting organic management of 12%

of its agricultural area [52]. In practice, these countries allocate resources to modernizing irrigation, reducing pesticides, and supporting less favored areas, while the Netherlands and Denmark stand out for policies that encourage the use of advanced technologies in agriculture. The Netherlands, with its intensive agriculture, is investing in precision farming and reducing emissions [47], while Denmark is prioritizing the development of biorefineries and crop diversification to reduce emissions by 55–65% by 2030 [65].

Countries such as Luxembourg, Portugal, and Slovakia are putting particular emphasis on supporting small farmers and rural areas. Luxembourg invests in schemes to preserve biodiversity and support small farmers [66], while Portugal promotes sustainable irrigation and soil protection [67].

4.2. Sustainable Management of Natural Resources and Energy Efficiency in Agriculture to Meet the Objectives of the European Green Deal

Implementing the Green Deal objectives in agriculture largely depends on the CAP's ability to support clear energy and environmental measures, backed by efficient national strategic plans [46], and to achieve the EU's ambition to become the first climate neutral bloc by 2050 and to reduce greenhouse gas emissions by 55% by 2030. It is essential to intensify efforts to improve energy efficiency [59,68]. In this regard, the European Commission has committed to reviewing the current legislation, including the Energy Efficiency Directive (EED) [69], to adapt it to the new 2030 target. The review process was initiated in the summer of 2020 with the launch of the roadmap and the initial impact assessment, providing the public with an opportunity to give feedback. In parallel, a series of stakeholder workshops were organized, held from September to November 2020, to collect suggestions related to the evaluation of the existing Directive and potential improvement solutions. The Commission is currently analyzing these contributions, which will be integrated into the preparations for the future review of the Energy Efficiency Directive [70].

Figure 6 illustrates the commitments (targets) of EU Member States regarding sustainability in agriculture by 2030, focusing on the protection of essential natural resources. It presents four key indicators of agricultural sustainability, according to the Common Agricultural Policy and the European Green Deal objectives [71]: indicator R.19 reflects each country's efforts to improve and protect soils, including through sustainable land management practices; R.20 highlights commitments to reduce ammonia emissions, a major air pollutant; R.21 aims to protect water quality by implementing agricultural practices that reduce water pollution; and R.22 focuses on sustainable nutrient management to reduce soil and water pollution and maintain fertility. These indicators underline the diversity of Member States' approaches to environmental protection and alignment with the EU's sustainability objectives.

Figure 6a presents the percentage of utilized agricultural area (UAA) in each European country that benefits from commitments to sustainable soil management, including measures to improve soil quality and biodiversity by 2030. Such practices are essential not only for sustainable agricultural policies but also for the European Green Deal, having a positive impact on energy consumption in agriculture. Thus, countries like Luxembourg (91.99%), Czech Republic (85.07%), and Estonia (79.62%) have the highest projected targets by 2030, and France (74.07%), Finland (73.93%), and Latvia (69.73%) also show significant commitment. In contrast, Ireland (10.61%), Malta (11.04%), and Cyprus (21.47%) have low values. Sustainable soil management is important not only for soil health and biodiversity but also for energy efficiency, as practices that improve soil structure and fertility can reduce the need for energy inputs such as fertilizers and intensive labor, thus contributing to the EU's sustainability objectives. Therefore, coordination at the EU level can support all Member States in the transition to a more energy efficient and ecologically sound agricultural sector. In Ireland, although biogas and solar panels are supported, large-scale uptake is limited by high costs and lack of technical expertise [72], while in Malta, constraints related to small

land area and unfavorable climatic conditions are significant barriers to the integration of renewable sources, despite available funding [72].

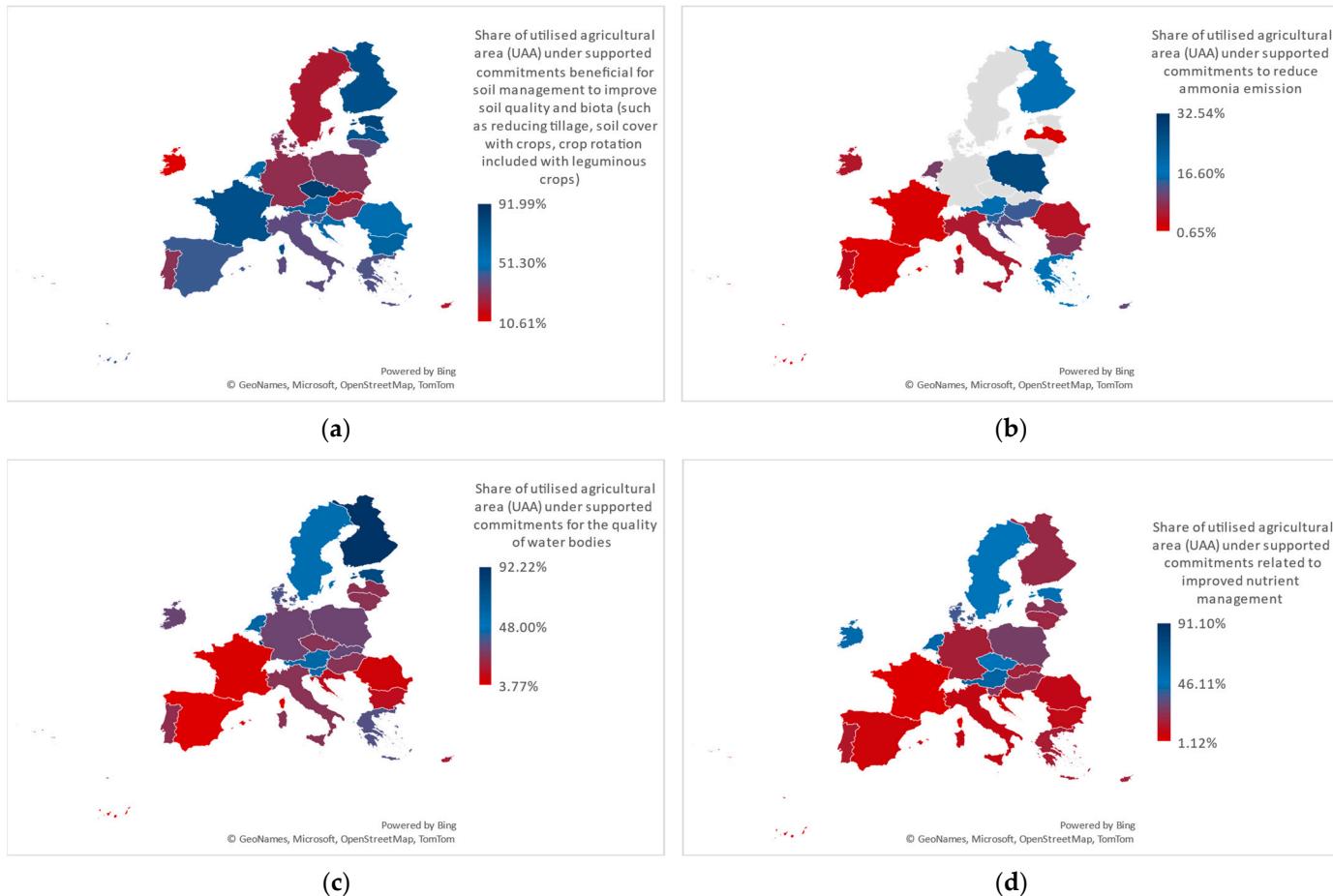


Figure 6. The sustainability commitments (targets) in the agriculture of the EU Member States for the protection of natural resources until 2030: (a) R.19: Improving and protecting soils, (b) R.20: Improving air quality by reducing ammonia emissions, (c) R.21: Water quality protection, (d) R.22: Sustainable nutrient management. Source: own interpretation based on CSPs Master file and key data, Publications Office of the European Union [37].

Figure 6b illustrates the share of utilized agricultural area (UAA) benefiting from commitments to reduce ammonia emissions, a key element of the European Union's environmental policies due to ammonia's impact on air quality and atmospheric pollution. Luxembourg leads with 32.54% of agricultural land dedicated to these measures, followed by Poland (26.81%) and Belgium (Wallonia) (22.41%), reflecting significant commitment to reducing emissions. Finland (17.59%), Greece (16.87%), and Slovenia (14.30%) have moderate values, demonstrating involvement, while Spain (0.65%), France (1.12%), and Ireland (4.88%) have smaller shares, which may suggest the prioritization of other objectives or difficulties in implementation by 2030. Reducing ammonia emissions also has a positive impact on energy efficiency in agriculture, as practices such as efficient manure management and the use of controlled-release fertilizers help reduce energy inputs by minimizing nutrient losses. These measures support the European Green Deal objectives, promoting more sustainable agriculture and reducing energy costs associated with intensive fertilization.

Figure 6c shows the percentage of utilized agricultural area (UAA) in each European country engaged in measures to improve water quality, essential for reducing pollution and sustainably using water resources, thus contributing to the European Green Deal objectives. Finland (92.22%), Luxembourg (91.99%), and Estonia (77.70%) have the highest

shares of agricultural land dedicated to water protection, suggesting a high commitment to conserving water resources. Other countries with significant shares, such as the Netherlands (57.81%), Austria (56.65%), and Sweden (51.75%), demonstrate substantial involvement in maintaining water quality through sustainable agricultural practices. In contrast, Spain (3.77%), France (4.98%), and Romania (8.09%) have low shares. Water protection measures have a positive impact on energy efficiency by reducing the need for intensive inputs such as fertilizers and limiting the energy consumption associated with treating contaminated water.

Figure 6d presents the share of utilized agricultural area (UAA) in each country benefiting from commitments to improved nutrient management, an essential element for reducing pollution, improving soil fertility, and minimizing environmental impact, according to the European Green Deal objectives. Luxembourg has the highest share (91.10%) of agricultural land dedicated to sustainable nutrient management, suggesting a significant commitment to these practices. Other countries with high values include Austria (58.09%), the Netherlands (55.06%), and the Czech Republic (45.99%), highlighting the adoption of practices that reduce the use of chemical fertilizers and runoff into surface waters. Ireland (42.44%) and Sweden (46.63%) also have important shares, suggesting active support for maintaining soil fertility and reducing pollution. In contrast, France (1.12%), Spain (5.61%), and Croatia (5.91%) have lower shares, indicating either limited adoption of these measures or the prioritization of other environmental objectives by 2030.

Improved nutrient management directly contributes to energy efficiency in agriculture by reducing dependence on synthetic fertilizers, which involve high energy consumption, and through sustainable nutrient use practices, thus not only supporting soil and water health but also reducing energy costs associated with agricultural production.

Figure 7 highlights the commitments (targets) of the Member States of the European Union for the sustainable use of resources in agriculture until 2030, focused on two critical aspects of sustainable management: R.23—sustainable use of water, aiming at improving the water balance and reducing excessive water consumption, and R.24—the sustainable use of pesticides, aimed at reducing the risks and the negative impact on the environment.

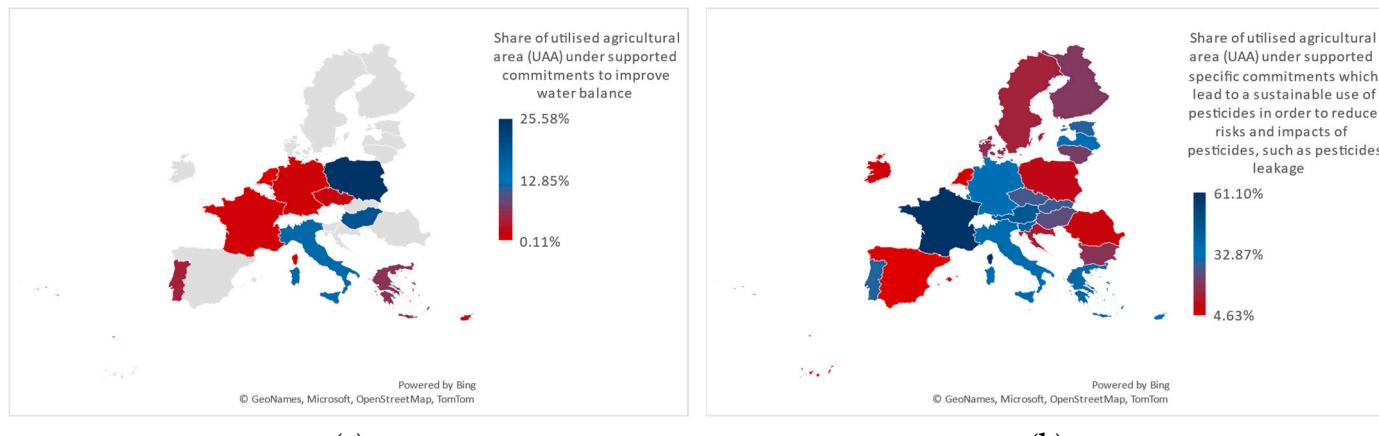


Figure 7. The commitments (targets) of EU Member States for the sustainable use of resources in agriculture until 2030: (a) R.23: Sustainable use of water to improve the water balance, (b) R.24: Sustainable use of pesticides to reduce risks and the impact on the environment. Source: own interpretation based on CSPs Master file and key data, Publications Office of the European Union [37].

These commitments are essential for achieving the environmental objectives of the European Green Deal, contributing to the protection of natural resources and the promotion of ecological agricultural practices. Responsible use of water in agriculture prevents water scarcity and conserves resources in the long term, while sustainable pesticide management reduces soil and water contamination and protects biodiversity.

Figure 7 highlights the variability of national approaches to adopting these sustainable practices and underlines the importance of a coordinated strategy at EU level to uniformly support the transition to a greener, more energetic, and resilient agriculture by 2030.

Figure 7a presents the share of utilized agricultural area (UAA) in each country benefiting from commitments to improve water balance. These commitments are essential for the sustainable management of water resources, reducing excessive consumption, and preventing pollution, contributing to the European Green Deal objectives and energy efficiency. Poland (25.58%), Hungary (18.94%), and Italy (11.81%) show a strong commitment to these practices, limiting water consumption and the energy needed for intensive irrigation. Countries with lower shares, such as the Netherlands (0.11%) and Germany (1.21%), could benefit from additional support to adopt similar measures, ensuring a sustainable and equitable use of water resources at the European level by 2030.

Figure 7b shows the percentage of utilized agricultural area (UAA) in each country engaged in the sustainable use of pesticides to reduce their risks and impact on the environment. France (61.10%), Austria (44.78%), and Slovenia (40.24%) have the highest shares, reflecting concern for reducing the impact of pesticides and protecting the environment. Italy (36.21%), Luxembourg (36.36%), and Latvia (34.82%) also demonstrate a significant commitment to these sustainable practices by 2030. The sustainable use of pesticides supports not only soil and water protection but also energy efficiency, as reducing repeated applications of chemicals decreases energy consumption. Countries with lower shares, such as Spain (4.63%) and the Netherlands (6.50%), could benefit from additional support to adopt similar practices.

4.3. Conservation of Biodiversity, Landscape, and Energy Efficiency in the Promotion of Ecological Agriculture

The new Common Agricultural Policy offers opportunities for European agriculture to actively contribute to achieving the ambitious objectives of the European Green Deal [73], but success depends on several factors, including implementation at the national and regional levels, funding availability, and effective monitoring. The European Commission launched the proposal to reshape the post-2020 CAP with the aim of aligning EU agriculture with the objectives set out in the Paris Agreement and the United Nations Sustainable Development Goals [74]. The proposal also reflects the EU's commitment to reducing greenhouse gas emissions, aiming for a 40% reduction by 2030 compared to 1990 levels. This modernization is essential to increase the added value of the CAP and to respond to concerns related to the sustainability of agricultural production.

In 2019, the European Green Deal introduced a new framework for the sustainable transformation of the economy, setting the EU to achieve climate neutrality by 2050, with a 55% reduction in emissions by 2030. The Green Deal includes the "Farm to Fork" Strategy and the Biodiversity Strategy, which aim to integrate economic, environmental, and social aspects across the entire food chain and ensure the sustainability of agriculture. The new CAP framework includes a flexible delivery model, giving Member States the possibility to develop national strategic plans adapted to their needs [75]. This model encourages ecological agricultural practices through mandatory standards and eco-schemes designed to support the transition of farmers to more environmentally friendly practices. However, many of these initial proposals have been diluted, and the eco-schemes risk being perceived more as income support than as tools for ecological transition. The CAP's effectiveness in supporting the Green Deal will largely depend on the ambition of each member state's strategic plans, the resources allocated, and their monitoring capacity. The European Commission will review and approve these strategic plans, although it relies more on dialogue than on coercive measures, raising concerns about the effectiveness of this model and the fact that Member States might view CAP funds as "national property", without considering ecological performance standards.

Figure 8 illustrates the percentage of utilized agricultural area (UAA) in each country, supported by the Common Agricultural Policy for the development of organic farming,

differentiated between the maintenance of already organic lands and the conversion of conventional lands to organic practices. CAP support for organic farming plays a central role in creating a sustainable agricultural system, reducing the use of pesticides and synthetic fertilizers, protecting biodiversity, and promoting environmentally friendly practices. This support contributes to achieving the environmental objectives of the European Green Deal, facilitating the transition to agricultural practices with a lower impact on ecosystems and natural and energy resources.

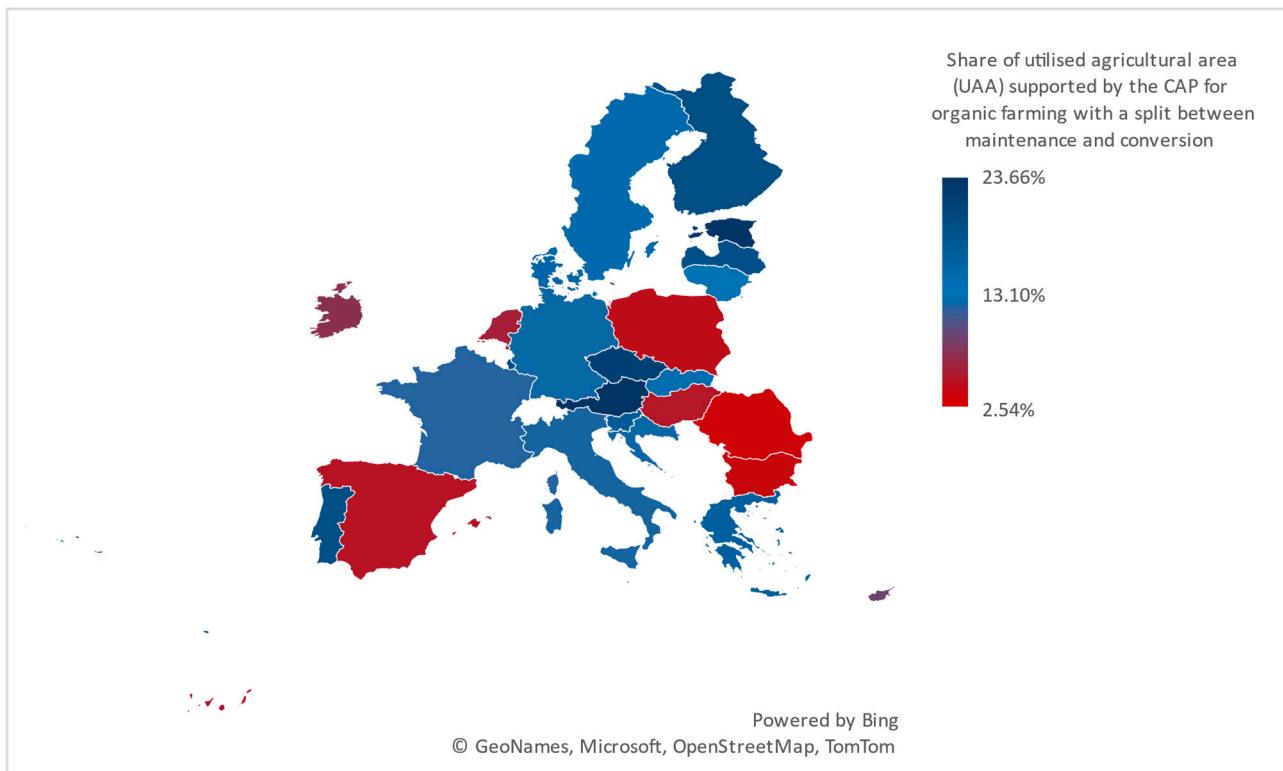


Figure 8. R.29: Development of organic agriculture—percentage of UAA supported by the CAP for organic agriculture, differentiated between maintenance and conversion. Source: own interpretation based on CSPs Master file and key data, Publications Office of the European Union [37].

Indicator R.29 presents the share of utilized agricultural area (UAA) in each country, supported by the Common Agricultural Policy for organic farming, divided between the maintenance of already organic lands and the conversion of conventional lands to organic practices. This support contributes to a more sustainable agricultural system, reducing reliance on pesticides and synthetic fertilizers, protecting biodiversity, and promoting ecological and energy efficient practices.

Organic farming has a positive impact on energy consumption by reducing chemical inputs and resources needed in intensive agricultural processes. Austria (23.66%) and Estonia (23.27%) have the highest shares dedicated to organic farming, reflecting strong commitment, while the Czech Republic (21.28%), Luxembourg (19.84%), and Finland (19.44%) also have high shares, demonstrating active support. Austria has allocated approximately 3 billion EUR for biodiversity conservation measures, a significant investment in protecting mountain pastures and agricultural land [60]. More than 76,000 hectares of pastures and about 30% of agricultural land are included in eco-schemes to protect biodiversity. In practice, these measures have had a positive impact on the conservation of natural habitats and reduced pressures on vulnerable ecosystems; however, challenges remain in the effective management of mountainous land where accessibility conditions and agricultural infrastructure are limited.

Estonia has allocated 456 million EUR for environmental and biodiversity measures; 23% of agricultural land is managed organically, and over 70,000 hectares of grassland are supported for conservation [48]. Through these measures, Estonia has supported the protection of biodiversity and the improvement of soil quality, but their effectiveness depends on continued financial support and working with local farmers.

Countries such as Malta (2.54%), Poland (4.53%), and Romania (3.53%) have low shares, indicating either limited uptake of environmentally friendly practices or the need for additional transition stimulus by 2030. Malta faces significant challenges in biodiversity conservation due to the country's small size and limited natural resources. However, 10 million EUR has been allocated annually for biodiversity conservation projects, focusing on the protection of endemic species and the conservation of water resources [50]. Measures adopted include the protection of natural areas and the promotion of organic farming, especially for small farms, but their implementation is limited by the small agricultural area and the climatic conditions, which are drier and less favorable for agricultural diversification. Some progress has been made in protecting endemic species and managing water resources, but further strategies are needed to address the challenges of limited land and drought.

Poland has earmarked 860 million EUR for biodiversity conservation measures, including schemes to reduce pesticides and support the expansion of organic farming [76]. Almost 15% of Polish farms are involved in ecological farming practices, and various organic schemes are aimed at protecting natural habitats and vulnerable species. Poland has also implemented measures to protect aquatic ecosystems and forests, and the effectiveness of the measures has been visible in reducing pesticide use and promoting more sustainable farming practices. However, difficulties stem from the underdeveloped agricultural infrastructure in many rural regions and the resistance of small farmers to change traditional production methods. In addition, Poland faces significant land fragmentation, which makes it difficult to implement measures on a large scale.

Romania has included around 2 million hectares in biodiversity conservation schemes, with a strong focus on less favored areas, which account for a significant percentage of the country's agricultural land [49]. The measures adopted include eco-schemes for crop rotation, soil protection, and conservation of protected areas, as well as support for farmers adopting sustainable farming methods. These schemes are essential for the conservation of biodiversity in mountainous regions and ecologically fragile land areas, and the effectiveness of these measures can be seen in protecting natural habitats and reducing soil erosion. However, Romania faces major challenges related to weak agricultural infrastructure, lack of technical knowledge among small farmers, and the need for additional incentives to integrate these sustainable practices in all regions of the country. In addition, the large scale implementation of conservation measures in disadvantaged regions may be hampered by economic conditions and farmers' lack of access to EU funds dedicated to the implementation of these projects.

Organic farming plays a key role in achieving the objectives of the European Green Deal by protecting natural resources and reducing the energy footprint. Thus, extended support for organic farming can contribute to a fair transition and a more resilient and sustainable European agricultural sector by 2030. These commitments highlight the differences between Member States in adopting organic farming, suggesting the need for a coordinated EU strategy to encourage equitable expansion of land dedicated to organic farming. Such an approach would support Europe's green transition and contribute to a more sustainable and environmentally friendly agricultural system by 2030.

Figure 9 presents the commitments of EU Member States for the conservation of biodiversity and landscape in agriculture, highlighting two essential aspects: R.31—Conservation of habitats and species, which promotes agricultural practices that protect local ecosystems and species, and R.34—Conservation of landscape features, including natural elements such as hedges and trees, contributing to biodiversity maintenance and the improvement of agricultural habitat quality. These commitments supported by the Common Agricultural

Policy are essential for achieving the objectives of the European Green Deal, promoting environmentally friendly agriculture and supporting the stability of ecosystems and natural resources in European agricultural landscapes.

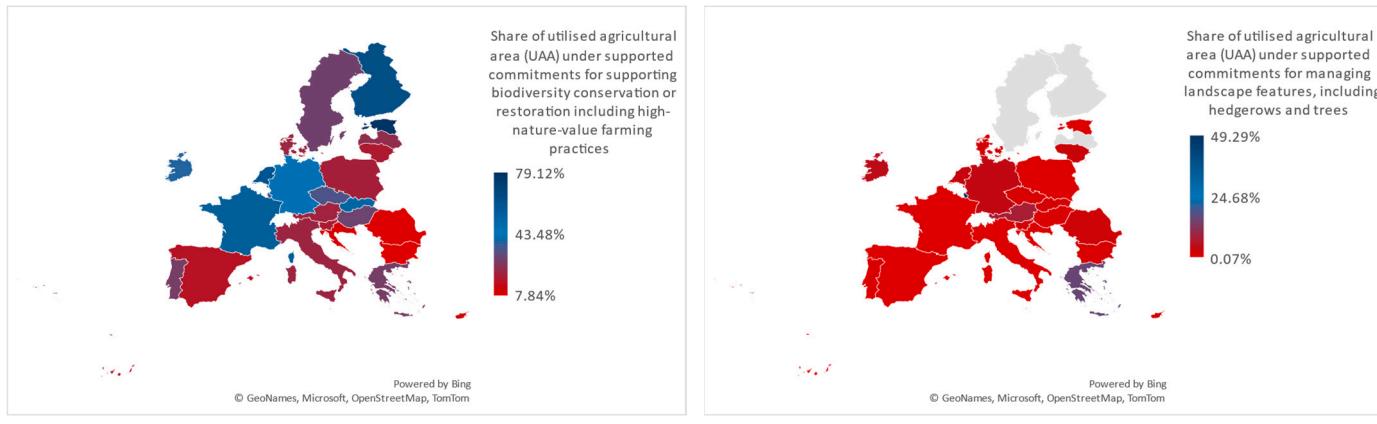


Figure 9. Commitments (targets) for biodiversity and landscape conservation in agriculture until 2030: (a) R.31: Conservation of habitats and species, (b) R.34: Conservation of landscape characteristics. Source: own interpretation based on CSPs Master file and key data, Publications Office of the European Union [37].

Figure 9a indicates the proportion of utilized agricultural area (UAA) in each country engaged in the conservation and restoration of biodiversity by 2030, through high ecological value agricultural practices supported by the Common Agricultural Policy. These commitments contribute essentially to maintaining ecological diversity, protecting natural habitats, and supporting a healthy environment while reducing dependence on intensive energy inputs such as chemical fertilizers and pesticides. However, in less developed regions, the implementation of these measures remains limited, due to insufficient resources and economic priorities that often take precedence over environmental ones. The impact of these measures on ecosystems needs to be monitored, given the risk of unexpected ecological imbalances.

Estonia leads with 79.12% of agricultural land dedicated to biodiversity, followed by Finland (64.12%) and the Netherlands (60.56%), values that underline these countries' commitment to sustainable agricultural practices. France (55.67%), Slovakia (50.94%), and Germany (45.19%) also demonstrate significant involvement, contributing to reducing the agricultural impact on ecosystems. Countries with lower shares, such as Romania (7.93%), Bulgaria (7.84%), and Malta (10.59%), could benefit from additional support to expand ecological areas and align with the European Green Deal standards.

France has earmarked 26% of the CAP budget for biodiversity protection [46], so eco schemes include Natura 2000 areas, supporting the protection of natural habitats on 2.4 million hectares. The effectiveness of the measures is visible in diversifying habitats and reducing soil erosion; however, in intensive agricultural regions, their integration can be more difficult due to costs and farmers' resistance. While Germany has dedicated 1.7 billion EUR to biodiversity conservation, and grassland protection and soil management schemes cover 1.9 million hectares, the measures have had a significant impact on biodiversity protection and reducing the use of fertilizers [61].

Supporting biodiversity in agriculture not only protects ecosystems but also increases energy efficiency by reducing the use of intensive external resources. Thus, an equitable distribution of these measures would contribute to a more sustainable and energy-efficient European agricultural system. The EU strategy could stimulate Member States to adopt uniform conservation measures, benefiting a stable ecological balance and a more resilient

agricultural sector, efforts that support Europe's transition to a green agricultural system, aligned with the European Union's environmental objectives.

Figure 9b shows the share of utilized agricultural area (UAA) in each country dedicated to landscape feature management commitments, such as hedges and trees. These natural elements play an essential role in biodiversity conservation, improving the quality of agricultural habitats, and soil protection, in line with the European Green Deal objectives and supported by the Common Agricultural Policy. Luxembourg, with a share of 49.29% of UAA dedicated to landscape management, shows major involvement in biodiversity conservation and agricultural ecosystem protection. Other countries, such as Greece (15.84%) and Ireland (4.69%), also have notable values, suggesting an interest in maintaining the natural features of the agricultural landscape. In contrast, Belgium (Flanders), Poland, and Spain have shares below 0.5%, which may indicate either low prioritization of these measures or the need for additional support to promote landscape management.

Greece has earmarked 425 million EUR for biodiversity eco-schemes, which include crop rotation and the protection of mountain regions [63]. These measures have had a positive impact in protecting biodiversity, but their large-scale integration in less developed regions remains a challenge due to high costs and limited infrastructure, while Ireland has allocated 1.4 billion EUR to support biodiversity and 32% of agricultural land benefits from conservation schemes [72]. Over 50,000 farmers are involved in these schemes, and their effectiveness can be seen in improving soil quality and protecting natural habitats.

Managing agricultural landscape features indirectly contributes to energy efficiency, as hedgerows and trees reduce soil erosion and protect local ecosystems, minimizing the need for energy inputs associated with soil restoration and intensive fertilizer application. Additionally, conserving the agricultural landscape contributes to ecosystem stability, reducing agricultural impact on the climate and supporting a more sustainable agriculture. Expanding the management of agricultural landscapes can contribute to an ecological, environmentally friendly, and energy-efficient agriculture, aligned with the European Green Deal objectives.

Figure 10 illustrates the support provided by the Common Agricultural Policy for biodiversity conservation and the promotion of organic farming in the European Union by 2030. This includes three key aspects: (a) the number of farms benefiting from biodiversity investments, (b) the area of land dedicated to organic farming (in paid hectares), and (c) the area of land supported for habitat and species conservation. This support is essential for achieving the environmental objectives of the European Green Deal by encouraging farmers to adopt sustainable and ecological practices. The figure highlights the different commitments (targets) of EU countries in implementing these measures, emphasizing the importance of a coordinated strategy to support a greener, more resilient, and environmentally friendly agricultural sector across the European Union by 2030.

Figure 10a presents the number of farms in each country benefiting from CAP support for biodiversity investments by 2030. This support helps farmers adopt environmentally friendly practices, contributing to biodiversity conservation and achieving the European Green Deal objectives. Supporting biodiversity not only protects ecosystems but also reduces the need for energy inputs in agriculture, as farms that integrate natural elements benefit from greater resistance to diseases and pests, diminishing the use of pesticides and fertilizers. Ireland records the highest number of supported farms (19,733), reflecting a strong commitment to ecological farming practices. Poland (5420), France (5190), and Italy (3754) also demonstrate substantial involvement, while Malta (25 farms), Romania (62), and Sweden (83) have a low number of beneficiary farms, suggesting either a different prioritization of resources or a need for additional support.

Figure 10b shows the number of hectares supported for the development of organic farming. France stands out with the largest area (approximately 3,398,864 hectares), followed by Germany, Spain, and Italy. These values reflect major investments in organic farming, which contribute to reducing the use of pesticides and synthetic fertilizers, supporting biodiversity and environmental protection. In contrast, countries like Malta and

Cyprus have small areas dedicated to organic farming, suggesting a potential need for additional support by 2030.

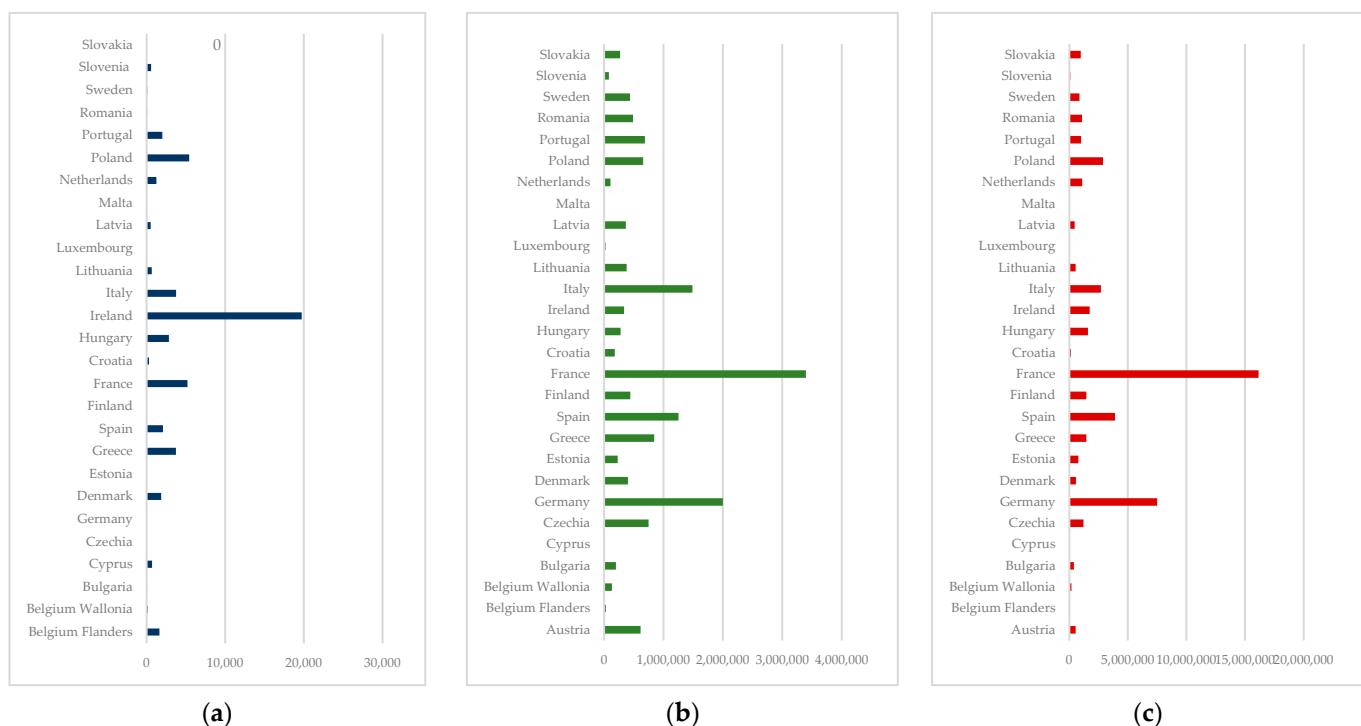


Figure 10. CAP support for the conservation of biodiversity and the development of organic agriculture until 2030: (a) Investments in biodiversity—the number of beneficiary farms, (b) Development of organic agriculture—the number of hectares paid, (c) Conservation of habitats and species—the number of hectares paid. Source: own interpretation based on CSPs Master file and key data, Publications Office of the European Union [37].

Figure 10c presents the number of hectares supported for habitat and species conservation. France leads with 16,157,172 hectares, followed by Germany and Spain with considerable areas. This support is vital for maintaining biodiversity, protecting natural habitats, and reducing the agricultural impact on the environment. Countries with small areas, such as Malta and Cyprus, could benefit from additional resources to expand these conservation measures.

The figures underline the EU's commitment to biodiversity conservation, landscape protection, and energy efficiency in agriculture. By supporting organic farming and habitat conservation, the CAP promotes a sustainable agricultural sector, reducing dependence on intensive energy inputs and supporting biodiversity, and the differences between Member States suggest the need for coordinated support to expand these practices, ensuring equitable application of environmental measures throughout the European Union.

5. Discussion

The new Common Agricultural Policy brings a more pronounced ecological orientation, part of the European Union's sustained efforts to manage climate, energy, and biodiversity crises [77]. The European Green Deal includes all economic sectors in the transition to sustainability, but agriculture plays an essential role. With a contribution of approximately 10% to greenhouse gas emissions and being a significant factor in biodiversity loss, this sector must respond to sustainability needs through new practices and policies [70,78]. European agriculture, although it has massively contributed to the continent's food security, now faces the challenge of adapting to a changing environment and, implicitly, the need to implement more sustainable practices [79]. The new CAP proposes

a performance-based model, evaluating and rewarding farmers not only for production but also for their contributions to climate, energy, and biodiversity [80]. This transition to a performance-based system is thus necessary and urgent, considering its impact on the environment, energy, and natural resources essential for agriculture. Farmers need a CAP that genuinely supports them in facing climate, energy, and biodiversity challenges, rewarding them for their efforts in environmental and energy conservation and emission reduction. These measures will bring long-term benefits to both agriculture and society, contributing to food security and protecting Europe's natural resources.

For the CAP to effectively contribute to the European Green Deal objectives, a much more ambitious approach is needed regarding the implementation and evaluation of environmental and energy impacts. Despite greening intentions, as highlighted by the European Court of Auditors (ECA) [81], many of the measures introduced so far have not produced the desired effects on biodiversity and reducing energy and climate impact. A significant issue is that farmers have continued to apply the same practices without being encouraged to adopt more sustainable methods, as the sanctions for non-compliance with energy and environmental requirements have not been sufficiently dissuasive. A major point of interest in the new CAP is the flexibility granted to Member States, which have the freedom to define their own objectives and measures through national strategic plans [82]. This degree of autonomy, while allowing adaptation to each state's specifics, also brings the risk that environmental and energy ambitions may fall short of the expectations set at the European level.

Agriculture and climate change are closely interconnected, and the data show that the agricultural sector in the EU is responsible for approximately 15% of greenhouse gas emissions [83]. Thus, measures within the Common Agricultural Policy must actively contribute to achieving the EU's environmental, energy, and climate objectives, from reducing GHG emissions to protecting biodiversity and energy efficiency. A central aspect of the European Green Deal is the evaluation of Member States' CAP strategic plans to ensure that they align with the pact's objectives [84]. In the Special Report 5/2018 [85], the ECA emphasized the importance of renewable energy in reducing GHG emissions, encouraging its integration into sustainable rural development through support from the European Agricultural Fund for Rural Development. Although renewable energy has the potential to support rural development, the report revealed that synergies between renewable energy policies and rural development remain insufficiently exploited [86].

Within the CAP, EU Member States have set national targets for reducing emissions in the agricultural sector [87]; however, the analysis results highlight considerable variations in the level of commitment and the capacity to implement these measures, reflecting an unequal situation between Member States. In Western and Northern European states, such as France, Finland, and the Netherlands, commitments to reducing agricultural emissions are higher. Indicator R.12 shows that France has allocated 65.27% of its UAA for climate adaptation measures. This substantial value is partly due to investments in energy efficiency technologies and agricultural practices that contribute to carbon capture and storage in soils. Finland and the Netherlands also present high values of 64.61% and 64.15%, respectively, reflecting a solid integration of climate adaptation policies into national agricultural strategies. These states are characterized by policies that support the transition to sustainable agricultural practices and the allocation of significant financial resources to improve agricultural capacity to reduce emissions. In contrast, Eastern European countries, such as Romania and Estonia, face major challenges in implementing measures to adapt agriculture to climate change. For example, Estonia has allocated only 0.01% of its UAA for climate adaptation measures, and Romania records a similar value, indicating a considerably lower allocation of resources compared to other Member States. This discrepancy can be explained by the lack of support infrastructure, adequate funding, and national agricultural policies that actively support climate adaptation objectives.

Another essential aspect of reducing emissions in the agricultural sector is investments in renewable energy capacities. Indicator R.15 within the CAP measures the renewable en-

ergy production capacity supported in agriculture, showing significant differences between Member States in terms of commitments and results achieved.

Finland and Spain stand out for notable investments in renewable energy within the agricultural sector, with the renewable energy capacity supported being in Finland 365 MW and in Spain 251 MW, reflecting strong commitments to developing sustainable energy in agriculture. In Finland, for example, investments in bioenergy and solar energy on farms have been promoted, thus contributing to reducing dependency on fossil fuels and the GHG emissions associated with using conventional energy resources. In Spain, investments in renewable energy are integrated into the national strategy for reducing emissions and supporting the transition to sustainable agriculture, and the 251 MW production capacity supported by the CAP includes sources such as solar energy and biomass, which are essential for achieving the environmental targets set at the European level. Thus, Spanish investments in agricultural energy infrastructure directly contribute to the Green Deal objectives, ensuring the transition to a low-carbon agricultural sector. However, in other Member States, such as Belgium (Flanders) and Lithuania, renewable energy production capacities in agriculture remain at extremely low levels. Belgium (Flanders) has a supported capacity of only 1.26 MW, and Lithuania's capacity is 1.60 MW, these values being negligible compared to the investments made by Finland and Spain. In these countries, the implementation of renewable energy infrastructure is limited by economic factors and the lack of adequate infrastructure, making it difficult to achieve national environmental objectives.

EU Member States are implementing diverse strategies, tailored to their specific contexts, to meet these ambitious targets, taking into account economic, social, and geographical challenges. For example, Austria is allocating 3.4 billion EUR to reduce carbon emissions, focusing on preserving mountain landscapes and biodiversity. Thus, by supporting farmers in disadvantaged areas, including eco-schemes and incentives for organic farming, Austria is addressing the challenges of soil protection and reducing greenhouse gas emissions, and mountain pasture conservation plays a key role by providing natural solutions for carbon storage and habitat protection [60].

Belgian strategies emphasize the need for integrated regional approaches adapted to geographical and socio-economic diversity. Thus, in Wallonia [57], 56% of the rural development budget is dedicated to environmental protection, with measures to conserve biodiversity in protected areas and promote organic farming, and in Flanders [55], 25% of direct payments are reserved for eco-schemes, with a focus on reducing chemical fertilizers and preserving biodiversity.

With only 2.25% of the agricultural area managed organically [64], Bulgaria aims to expand this to 200,380 hectares. The strategy includes the modernization of irrigation systems, pesticide reduction, and crop rotation with the aim of protecting water and soil resources, while investment in agricultural infrastructure and the promotion of sustainable practices will enable Bulgaria to meet its environmental targets, while Croatia plans to devote 12% of its agricultural area to organic farming methods [52]. Supporting extensive grassland and permanent crops is a priority, thus addressing biodiversity loss and soil degradation, and support programs for farmers are key in this process, providing financial and technical incentives for the transition to sustainable practices.

In an arid climate, water resources in Cyprus are critical, so the national treaties include the promotion of water efficiency and conversion of agricultural land to organic methods, which are essential to protect fragile ecosystems and ensure climate resilient agriculture, while Denmark aims to reduce emissions by 55–65% by 2030, focusing on biorefinery development and crop diversification, which help reduce dependence on fossil fuels and promote circular and sustainable farming patterns.

With 23% of agricultural land managed organically, Estonia supports agricultural cooperatives to increase farmers' competitiveness, and sustainable grassland management is another priority, helping to preserve biodiversity and store carbon in soils [48], while France devotes 26% of its CAP budget to reducing carbon emissions and protecting bio-

diversity, with schemes to protect wetlands and expand organic farming central to its strategies [46]. These measures reflect France's commitment to improving soil and water quality, contributing to the ecological transition.

Greece, with a budget of 1.4 billion EUR allocated to organic farming, focuses on reducing pesticides and implementing crop rotation. These measures address soil degradation and biodiversity loss, facilitating the transition to sustainable farming practices [63]. Romania faces significant challenges, with 57% of its agricultural land in disadvantaged areas [49]; thus, strategies include schemes for rural infrastructure development and biodiversity conservation that aim to reduce economic and social gaps between rural and urban areas while promoting environmental sustainability.

In Spain, 86% of agricultural land already complies with environmental conditions [54], so modernizing irrigation and supporting farmers to reduce greenhouse gas emissions are key priorities, measures that will help make Spanish agriculture resilient to climate change, while Sweden supports crop rotation and reduced pesticide use on 19% of organically managed agricultural land [88], thus contributing to the protection of biodiversity and the promotion of nature friendly farming practices.

These discrepancies in investments in renewable energy capacities indicate the need for better targeted policies to facilitate fund absorption and the development of necessary infrastructure in less performing states. A relevant proposal would be the consolidation of a European fund dedicated to supporting renewable energy in the agricultural sector, to be distributed especially to states with low investment capacity, thus ensuring a more balanced transition across the Union.

With regard to sustainable management of essential natural resources, this assessment focuses on soil conservation measures, reducing ammonia emissions, and protecting water quality, all essential for achieving the European Green Deal objectives. Although many countries have made significant commitments, there are notable variations in the implementation of these measures, suggesting the need for a more equitable and coordinated support strategy at the EU level. Countries like Luxembourg and Estonia stand out for strong commitments in this regard, reporting a share of 91.99% and 79.22%, respectively, of their UAA dedicated to soil conservation measures. Luxembourg has consolidated its commitments by adopting ecological practices, including crop rotation, soil cover crops, and reduced tillage intensity, approaches that contribute to maintaining a stable ecological balance and reducing the use of chemical inputs. Estonia, with a similar approach, has placed a strong emphasis on soil conservation practices, which help achieve biodiversity objectives and increase the soil's capacity to capture carbon. In other states, such as Ireland and Malta, the recorded values are significantly lower, at 10.61% and 11.04%, respectively, suggesting either a low prioritization of soil conservation practices or structural and economic difficulties in their implementation. A possible explanation for these low values may be associated with the lack of adequate local support or infrastructural limitations that hinder the adoption of these ecological practices, and this significant difference between states highlights the need for a more coordinated approach at the European level to ensure soil conservation in all EU regions.

Ammonia emissions represent a major challenge for air quality and a significant pollution factor for the environment. Indicator R.20 highlights large discrepancies between Member States in terms of air pollution reduction measures. Luxembourg and Poland stand out positively in this regard, with shares of 32.54% and 26.81% of UAA dedicated to ammonia emission reduction measures, respectively. Luxembourg has implemented proactive policies for ammonia emissions control, including the use of technologies for manure management and reducing the use of quick release fertilizers. In Poland, the measures implemented for emissions control in the agricultural sector are closely linked to national air pollution reduction objectives, thus promoting agricultural sustainability in the region. On the other hand, Spain and France have much lower values for this indicator, 0.65% and 1.12%, respectively, which may suggest either a lower priority given to ammonia

emission reduction or challenges encountered in implementing the necessary measures to achieve these objectives.

The differences in agricultural policies between these countries suggest that there is a need for more uniform integration of ammonia reduction practices at the European level through the adoption of common regulations, as well as more consistent and targeted financial support for the implementation of technologies and agricultural practices that contribute to ammonia reduction. In order to achieve the European Green Deal objectives, the CAP aims to encourage the adoption of organic farming and to preserve the natural features of the agricultural landscape. However, the analysis shows significant variations between Member States, suggesting the need for a more coordinated approach to supporting biodiversity protection measures and promoting ecological and energy-efficient agricultural practices. EU Member States have recorded significant differences in the implementation of organic farming. Austria and Estonia, for example, are among the states with the highest shares of agricultural areas dedicated to organic farming. In Austria, approximately 23.66% of UAA is dedicated to this type of agriculture, and in Estonia, the percentage is 23.27%. These values reflect a strong commitment to the transition to sustainable agricultural practices. Austria, in particular, is known for its consistent support for organic farms, and Estonia has significantly invested in policies to support organic farming and soil conservation, contributing to the consolidation of a sustainable agricultural system.

In contrast, countries like Malta and Poland have recorded much lower values of approximately 2.54% and 4.53% of UAA for organic farming. Thus, financial support for organic farming should be better adapted to the needs of each member state, and support measures should be better targeted based on local conditions and the specifics of national agriculture.

To ensure biodiversity protection, the CAP includes measures for the conservation of natural habitats and the management of agricultural landscape features. Indicators R.31 and R.34 measure the percentage of agricultural areas involved in commitments for biodiversity conservation and the natural elements of the agricultural landscape. Thus, countries like Estonia and Finland have demonstrated a remarkable commitment to biodiversity conservation, recording high values for indicators R.31 and R.34. In Estonia, approximately 79.12% of UAA is dedicated to the conservation of habitats and local species, reflecting an active policy of protecting natural ecosystems in agriculture. Finland, with a percentage of 64.12%, has focused its efforts on managing the natural features of the agricultural landscape, thus supporting biodiversity stability and reducing the negative impact of agriculture on the environment. These states have implemented consistent support measures for farmers involved in habitat conservation and have integrated policies that promote agricultural landscapes with high ecological value. In contrast, Romania and Bulgaria have recorded much lower values, of 7.93% and 7.84% of UAA, respectively, suggesting limited attention to biodiversity and habitat protection.

The significant differences between these countries suggest the need for a more coordinated approach at the European level to expand biodiversity conservation measures. The European Union should increase support for states facing economic and structural difficulties, thus facilitating the adoption of biodiversity protection measures and natural habitat management. Additionally, training programs for farmers in biodiversity conservation techniques and ecological management could contribute to the wider adoption of these practices in Member States facing challenges.

6. Conclusions

The study demonstrated that the Common Agricultural Policy significantly contributes to the implementation of the environmental objectives set by the European Green Deal, but differences in implementation and prioritization between Member States highlight the need for adjustments for a more equitable and effective application. Countries such as France, Finland, and the Netherlands have shown a strong commitment to transitioning to greener agricultural practices, significantly investing in technologies and methods for

reducing emissions and using renewable energy in agriculture. The progress of these states indicates a high potential for the CAP to support the transition to a less energy-dependent agricultural sector and to contribute to achieving the European Green Deal objectives. Additionally, some countries, such as Luxembourg and Estonia, have made remarkable progress in soil conservation and ammonia emission reduction by implementing effective measures for the sustainable management of natural resources. These practices contribute to maintaining biodiversity and improving air and soil quality, thus supporting long-term sustainable agriculture.

The example of these countries can serve as a model for other Member States facing difficulties in the sustainable management of resources. Thus, Austria and Estonia, among others, have allocated significant percentages of agricultural areas to organic farming and have promoted measures for the conservation of natural habitats and landscapes. These initiatives not only contribute to environmental protection but also support a sustainable food system by reducing the use of pesticides and synthetic fertilizers. Thus, the CAP becomes a valuable instrument for implementing ecological and environmentally friendly agriculture.

A major limitation of the current implementation of the CAP is represented by the significant discrepancies between Member States. Countries in Eastern and Southern Europe, such as Romania, Bulgaria, and Malta, have encountered difficulties in adapting to ecological measures and will record limited progress in achieving the Green Deal objectives. These discrepancies highlight an acute need for additional support and more efficient coordination to ensure a fair transition at the European level. Although states like Finland and Spain have made notable progress in investments in renewable energy, other states, such as Belgium (Flanders) and Lithuania, remain at a very low level of use of renewable energy sources in agriculture. The lack of adequate infrastructure and sustained financial support limits these states' capacity to reduce emissions and align with the EU's ecological objectives. States with low adoption rates of organic farming, such as Poland and Malta, and those recording low values for biodiversity conservation indicators, such as Romania and Bulgaria, face major challenges in implementing these practices. Without financial incentives and accessible training programs, these states risk falling behind in their efforts to transition to ecological agriculture.

The paper achieves its goal of highlighting both the progress and the difficulties encountered in implementing sustainable energy and environmental policies within the CAP by 2030. The Common Agricultural Policy plays an essential role in supporting the transition to sustainable agricultural practices and can significantly contribute to achieving the European Green Deal objectives. However, the differences between Member States in terms of implementing ecological and energy measures suggest that a review of support strategies is necessary, with an emphasis on standardizing support and adapting funding measures to the needs of each country. To maximize the efficiency of these policies and reduce regional disparities, it is recommended to increase financial and technical support for less performing states, create stricter monitoring mechanisms, and stimulate cooperation between Member States. These adjustments will facilitate a fair transition, ensuring the achievement of the ambitious environmental objectives of the European Green Deal and contributing to the development of a sustainable agricultural sector across the European Union.

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