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Reimbursable Advisory Services Agreement on Romania Common Agriculture Policy (CAP) Programming Support (P173505)

Output No. 4

Inputs to the preparation of the CAP Strategic Plan

December 2022

MINISTERUL AGRICULTURII ŞI DEZVOLTĂRII RURALE

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Table of Contents

This report has been delivered under the Reimbursable Advisory Services Agreement on Romania Common Agriculture Policy (CAP) Programming Support (P173505) signed between the Ministry of Agriculture and Rural Development (MARD) and the International Bank for Reconstruction and Development (the World Bank) on 29th of June 2020. It corresponds to Output No. 4 under the above-mentioned agreement.

1. Introduction

Output 4, "Inputs to the preparation of the CAP Strategic Plan", was delivered under the Reimbursable Advisory Services Agreement on Romania Common Agriculture Policy (CAP) Programming Support (P173505) signed between the Ministry of Agriculture and Rural Development (MARD) and the International Bank for Reconstruction and Development (the World Bank) on June 29, 2020. Under this output, the World Bank team has been supporting the MARD technical team with flexible and demand-driven, just-in-time capacity building activities aimed at contributing to the development of the CAP National Strategic Plan (NSP). This was achieved through technical meetings and workshops.

This report provides summaries of the four workshops and details of the technical meetings, including the lists of participants and presentations made, that have been conducted under this output.

2. Context

The European Union (EU) has embarked on reforming and modernizing the Common Agriculture Policy (CAP). Since 2013, the general objectives of the CAP have been: viable food production, sustainable management of natural resources and climate action and balanced territorial development. The CAP 2021-2027 is closely associated with the overarching European Green Deal that sets out the EC's commitment to tackling climate and environmental challenges as "the current generation's defining task" (European Commission, 2019). It reflects the EU's ambition to achieve – concurrently – economic prosperity, environmental and resources sustainability, and climate neutrality (by 2050) by fundamentally transforming its economic and industrial model through decarbonization, adaptation to climate change, and a sustainability transition across all sectors. The Green Deal stipulates for the agriculture sector a "Farm to Fork Strategy (F2F)" with the broad objective of supporting the transition towards a fair, healthy and environmentally friendly food system, emphasizing a strong consumer orientation. Member States designed the interventions that are appropriate to their specific circumstances and formulate CAP Strategic Plans. Through the CAP Strategic Plans, the Member States will set targets on what they want to achieve in the programming period based on a coherent intervention strategy and a commonly defined set of indicators across the EU.

Romania has favorable conditions for agriculture. More than 40 percent of the total surface of the country can be used for agriculture. The CAP is especially significant for Romania as agriculture still accounts for 4.2 percent of total gross value added (as compared to 1.9 percent in the EU) and 19.5 percent of total employment (as compared to 4.0 percent in the EU). In the past 17 years since joining the EU in 2007, the value of Romanian agri-food trade has increased continuously. Exports are growing but not as fast as imports, resulting in a negative agri-food trade balance. Most of the export growth has come from a small number of primary commodities (72 percent of agri-food exports). While Romanian farmers have full access to the Common Market, and the existence of a common EU approach to agriculture support provides a level playing field for farmers operating on the European and international markets, Romania has not yet made full use of these opportunities.

Romania ranks 8th in GHG emissions from the agriculture sector in the EU. Emissions are mostly N2O from managed soils (for which Romania accounts for 5% of EU emissions), CH4 from pig & poultry manure, sheep (11% of EU emissions) and cattle. CH4 and N2O emissions are on a marked declining trend (respectively -51% and -33% compared to 1990). The Government of Romania's National Strategy on Climate Change and Low-carbon Economic Growth (2016-2030) specifies several priority areas: (a) maintenance/adoption of extensive agricultural practices; (b) increasing the degree of carbon sequestration in agricultural land; (c) adoption of practices/use of forestry equipment for combat climate change; (d) improving forestry and supporting sustainable forest management; and

(e) adaptation of agricultural practices in areas with climate risks caused by climate change. These priority areas are partly addressed through NSP interventions.

The CAP 2021-2027 therefore provides a critical opportunity for Romania to program and channel substantial financial resources into its agriculture and rural sectors to tackle these long-standing structural constraints, inject economic dynamism into the lagging regions, address environmental and climate change-related challenges, and achieve convergence with other more advanced European countries. The significant investment resources provided through the CAP may allow Romania to capitalize on its agriculture and natural resources much more effectively and more sustainably for multiple purposes. In recognition of the importance of climate action and climate mainstreaming in government programs, MARD has recently been assigned a leadership role in addressing the consequences of climate change in Romania. The Ministry, through its Managing Authority in charge of designing and implementing the CAP NSP, and its climate change technical unit in charge of coordinating the Inter-ministerial Committee for the Management of the Effects produced by Climate Change in Agriculture, is in the process of defining specific priorities and institutional arrangements for improved planning and implementation of actions related to climate change.

3. Summary of Activities under Output 4: "Inputs to the preparation of the CAP Strategic Plan"

The RAS on Romania Common Agriculture Policy (CAP) Programming Support has provided a contribution by the World Bank to the Government's sector programming efforts through developing the analytical underpinnings for CAP strategy formulation (through Outputs 1, 2, and 3) and supporting the MARD technical team with flexible and demand-driven, just-in-time capacity building activities aimed at contributing to the development of the NSP (Output 4).

Through various consultations with MARD, the areas of interest for workshops that were initially identified included: (a) eco-schemes in agriculture – approaches and experience in EU member states; (b) earth observation for agriculture (including crop and irrigation suitability mapping); and (c) digital applications in the agriculture and food system. Following the second workshop on eco-schemes in October 2021, MARD requested to postpone further workshops until April 2022, which resulted in an extension to the RAS Legal Agreement. Following the third and fourth workshops on Earth Observation for Crop and Irrigation Suitability Mapping, and Digital Applications in the Agriculture and Food System in June 2022, MARD requested an extension to the RAS Legal Agreement to accommodate additional knowledge sharing events, which resulted in a workshop on Climate Action in Agriculture, held in November 2022. This workshop concluded the activities under Output 4. Summaries of the workshops are presented below. Workshop participants are listed in Annex 1, and workshop presentations are attached in Annex 2.

3.1. Workshop on Earth Observation for Agriculture

On October 1, 2020, the World Bank team organized a technical workshop with the objective of introducing the potential use and applicability of remote sensing technology to the leadership and technical team of MARD, as well as the representatives of the Romanian Meteorological Institute and the National Digitalization Agency. The workshop included technical presentations that demonstrated the capabilities of the World Bank's Agriculture Observatory for harnessing big data and machine learning for increasing productivity and resilience in agriculture. The main idea behind the themes addressed in the workshop were to seek pathways for potentially supporting the irrigation study work, and more broadly, support decision-making and policies aimed at reducing climate vulnerability in the sector beyond the scope of the RAS activities.

More specifically, the topics covered in the workshop related to:

(i) The potential support the World Bank (and partners) could provide in accessing and deploying high-resolution and near real-time geospatial agro-meteorological data;

(ii) The advanced weather products that can enable operational programs for strategic, proactive and timely decision-making in crop production:

- Environmental Trend Analysis
- Site Similarity and Crop Suitability
- Pest and Disease Prediction
- Irrigation Management
- Identify Environmental Anomalies (droughts, floods, heat stress)
- Planting and Fertilizer Recommendations (timing)
- Food security early warning

(iii) Local monitoring of agriculture value by evaluating and understanding farm operations and returns on public investments by:

- Confirm or reject weather related news and rumors
- Unlock predictive analytics and machine learning
- Inform – and alert - your farmers/producers
- Evaluate weather event impact of crop production
- Manage commodity risks and speculative opportunities
- Visualize environmental impacts across global markets
- Utilize crop-specific models and consider all growing regions

It was concluded that Romania has strong meteorology operational capacity and a clear opportunity to expand societal benefits from weather science to help adapt to climate change. The use of high-resolution and geospatial agro-meteorological data would allow Romania to augment its national ground station network through virtual stations: 3,980 complete virtual weather stations for Romania – daily data from 2006, updated to 'yesterday' and available on-line at any time; period comparisons through GIS ready files each day – last 30 days, last 7 days, next 7 and next 15 days; and mappable data showing weather anomalies and freely available analytical scrips provide near real time decision support capabilities to every user.

The outcome of the workshop was an enhanced understanding of the utility of earth observation in agricultural planning, and assisted in formulating the study on irrigation (Output 2).

3.2. Workshop on Eco-schemes – Sharing Views on National Strategies and Implementation Challenges

On October 21, 2021, the World Bank team together with MARD organized an international workshop entitled "Eco-schemes: Sharing Views on National Strategies and Implementation Challenges". Eco-schemes are an innovative component of the new CAP, for which MARD was interested to learn from the operational experiences of other European Union member states. The objective of the workshop was to identify technical options and choices that Managing Authorities need to consider for the eco-schemes section of their respective National Strategic Plans. These options and choices relate to designing eco-schemes, strategic directions, preparedness for design, delivery, and monitoring of eco-schemes. Participants in the workshop included experts and researchers from five member states:

Hungary, Poland, Croatia, France, and Germany, all of which were identified as having experience of special relevance for Romania. The workshop also served as a follow-up to interviews carried out with representatives of these member states during the implementation of the Study on Family Farms, further strengthening Romania's network of EU peer countries. A summary of the discussion is provided below:

a) **Designing Eco-schemes: Strategic Choices:** Participants were invited to contribute their views, taking into account the following questions:
   - How does one define differences and complementarity between environmental and climate commitments (Pillar 2) and eco-schemes?
   - Promoting improved practices versus supporting maintenance of existing practices: what balance between these two types of actions in your eco-schemes?
   - Production types without stable land ownership, e.g., pastoral herding: have you identified a way to secure their access to eco-schemes?
   - Organic agriculture: how are you ensuring that eco-schemes have added value for farmers engaged in organic farming?
   - Biodiversity, landscapes, carbon sequestration: through crop diversification, other actions? Difference between mountain areas, lowland areas?
   - Climate change adaptation: which actions in your eco-schemes?

Contribution from Hungary: In Hungary, an eco-scheme model was defined before selecting the beneficial practices themselves. To define this model, four decisions were made. First, a choice was made between eco-schemes as compensation of the commitment made by beneficiaries, or eco-schemes as an incentive, similar to the greening scheme in the previous CAP period. The second option, which is called "top-up", was selected. Second, an important choice was whether to define one large eco-scheme or a variety of smaller ones. The first option was taken: a single eco-scheme will cover Hungary's entire territory and its diversified types of farms and land. The third choice was between a whole farm approach, with the definition of eligibility criteria, and eco-schemes covering only a commitment area on beneficiary holdings. The first option was selected. Finally, rather than different rates depending on the level of ambition, eco-schemes in Hungary will be based on a single rate. This guarantees that there will be no discrimination between farms. The farmer has to pick at least one beneficial practice for each land use type (arable land, grassland, permanent crops) from a list of 22 beneficial practices. This starts from 5 ha of arable land or grassland, and from 1 ha of permanent crops. If the farmer has less than 10 hectares altogether, he/she has to select at least one practice for the dominant land use type. If arable land or permanent crops within the holding exceed 75 per cent, the farmer has to pick at least two practices for that dominant land use type. The primary tool for carbon sequestration will be farm level maintenance of permanent pasture. The "no bare soil" principle also contributes to carbon sequestration.

Contribution from Poland: To reach as many farmers as possible, a large range of beneficial practices – more than 12 – are defined. Their definition is currently in a draft form, it may evolve since many comments were received from public consultation. The beneficial practices were defined on the basis of a needs analysis. Each practice contributes to two environmental/climate objectives. The practices include: integrated pest management and biological protection; reduction of nutrient losses through a fertilizer plan; agroecological infrastructure; melliferous plans. The organic farming measures and animal welfare measures are moved from Pillar II to Pillar I.

Contribution from France: The Ministry of Agriculture, taking into account stakeholder consultations, has defined three entry points to the eco-schemes: (1) agro-ecology practice (crop diversity; no bare soil); (2) ecological infrastructure (hedges, grass strips) and (3) organic farming certification or high environmental value (HVE) certification. The target is that 80% of farmers would reach HVE

certification. There is however an ongoing debate on this certification and its eligibility criteria, currently defined as a ratio between the value of agricultural inputs and gross farm output. An earlier analysis conducted by researchers of the Centre d'Analyse Stratégique, the Prime Minister's think tank, had recommended more ambitious, results-oriented eco-schemes supporting three types of critical improvements: diversified landscapes; agroecological biodiversity reserves (since there is a deficit in France in the supply of land available to serve as biodiversity offset to urbanization); and reduction of pesticide use.

Contribution from Croatia: Environment-related measures should first be defined regardless of whether they are under Pillar I or Pillar II. The pillar should be selected after this first step of definition. Measures are appropriate for the first pillar if they only require a simple control mechanism, and if they ensure annual achievement of the environmental objective. A good SWOT analysis is the basis for the definition of the eco-schemes. Communication with potential eco-scheme beneficiaries will be necessary, emphasizing that eco-schemes should be useful to beneficiaries and are not impositions from the EU in Brussels. A flat rate for the whole national territory makes farmers' engagement into the eco-schemes easier, and the scheme will be easier to implement and easier to control. The IFOAM reports on eco-schemes are a valuable reference source of information.

Contribution from Germany: Eco-schemes will be a federal top-up mechanism. From the point of view of the Federal government; the eco-scheme is not only a compensation, but also includes an income component. Agri-environment and climate commitments (Pillar II) will remain decentralized. There will be no eco-schemes for the maintenance of existing good practices in Germany. However, maintenance-oriented eco-schemes could be an important option for Romania.

b) **Getting ready to deliver and monitor eco-schemes:** In this second part of the discussion, participants were invited to present how the implementation of eco-schemes will be anticipated in their Member State, with a focus to the following points currently under discussion in Romania's NSP:
   - Scoring and rating system: on what basis are you defining this system? (which may be difficult for animal producers)
   - If additional payments to BISS: what evidence are you preparing to use in order to justify payment levels?
   - Transaction costs: what do you plan to include as transaction costs, at what rate?
   - Monitoring: are you considering a specific monitoring system for the eco-schemes?
   - Controls: how are you preparing for specific cases (e.g., monitoring animal welfare)

Contribution from Hungary: For simplification purposes, only agricultural land is eligible to eco-schemes, not animals. Individual payments are calculated on the basis of a national envelope: 15% of the overall budget. Unspent budget for AECMs will be transferred from Pillar II to Pillar I. As a result, the eco-scheme payment would be around 100 Euros per ha, which is appropriate to create an incentive function. This amount is close to the current amount of Greening payment. Electronic farm records will be the primary compliance verification tool.

Contribution from Poland: The current implementation system for Pillar I will be maintained and applied to the eco-schemes. The Paying Agency is in charge of controls.

Contribution from France: There is an important difference between Pillar I and Pillar II: Pillar I is designed to be accessible to all farmers and therefore Pillar I schemes should be simple. For Pillar II there was major criticism on the AECMs that were seen as very complex measures. The NSP is a national document, which will tend to centralize the definition and implementation of the eco-schemes. Member States such as France, which have largely decentralized the implementation of

Pillar II, now need to return towards more centralization. Therefore, implementation needs to be redefined. A lesson learned from Pillar II is that the required very strict monitoring generates important management overhead costs. Instead, monitoring costs for the eco-schemes should be limited.

Contribution from Croatia: For simplification purposes, no new monitoring system should be created for the eco-schemes. A significant change in the new CAP period is that the Payment agency becomes responsible for monitoring, whereas previously the Managing authority was in charge. Information already available in the Payment agency should be used for monitoring purposes. FADN could be mobilized as a complement, to monitor sample farms. The cost of controls should be limited. Results-based eco-schemes would generate important costs.

Conclusion for Romania: MARD will try and keep the eco-schemes as simple as possible and accessible to all farmers. A challenge will be to explain the eco-schemes to farmers in an understandable way, starting from the NSP's public consultation stage. What is important is to ensure consistency between the budget allocated to eco-schemes and actual uptake by farmers in the form of applications to the eco-schemes. Farmers need to be interested and willing to apply and therefore a clear communication strategy needs to assure farmers awareness and readiness for applications.

3.3. Workshop on Earth Observation for Crop and Irrigation Suitability Mapping

On June 16, 2022, the World Bank team together with MARD organized an international workshop on earth observation for crop and irrigation suitability mapping to inform Romania's National Strategic Plan (NSP) for the post-2021 Common Agricultural Policy (CAP). Irrigation investments and digital applications in agriculture development are important elements of the new CAP, for which the Ministry needs to build capacity through learning and partnering with institutions within and outside the country. The purpose of the workshop was to bring key stakeholders together to discuss how data generated using remote sensing, including soil, crop, and agro-meteorological data, can be used to inform policies and investments related to crop production, water and irrigation, and related action plans. Among other contributions, the workshop drew from the Study on the Irrigation Sector, delivered as Output 2 of this RAS (Romania Common Agriculture Policy (CAP) Programming Support). A summary of the discussion is provided below:

Meteorological Agency (NMA)

The main role of the NMA is to monitor weather and climate as well as provide weather forecasts and advisories to central, regional and local authorities, and other stakeholders in sustainable development of the country. NMA has its headquarters in Bucharest, including the National Weather Forecasting Centre, and has seven Regional Meteorological Centers. NMA is a Regional Agrometeorological Centre for RAVI-Europe.

The main goals of the Centre are to support sustainable agricultural production by conducting soil health and soil moisture research; phenology research and development; research across the agriculture value chain as it relates to weather and climate; monitoring extreme weather events and food security; development of weather/climate-agricultural decision support systems and further development of more effective transfer and training mechanisms associated with workshops, field days, and online resources.

For Romania, projections are showing significant changes in climate over the coming decades:

- Near-medium future (2021-2050): mean annual increase of temperature (up to 3 degrees C in summer); mean reduction in summer precipitation amount (from 8% to 9%); changes in

extreme phenomena statistics (such as increases in frequency and intensity of heat waves, increases in intensity of precipitation).

- Future 2061-2090: reduction of mean rainfall in summer months, more pronounced for higher emission scenarios and stronger as we approach the end of the 21st century.
- Worst-case scenario 2061-2090 (baseline 1961-1990) : Mean summer temperature about 6 degrees C+. Mean rainfall reduction in summer months up to 20% - 30%.

Important agrometeorological indicators for which data are available include: soil moisture, heat intensity, spring index, winter severity, rainfall, soil temperature, potential and real evapotranspiration, and number of days with precipitation under 1 l/mp.). The most important public beneficiary of agrometeorological indicators are the Ministry of Environment, Water and Forests, and the Ministry of Agriculture and Rural Development. Going forward, data sharing and collaboration in using available data for agriculture planning will be key.

Earth observation data for irrigation suitability mapping (drawing from the Study on Irrigation Sector, delivered as Output 2 of this RAS)

Addressing constraints in the irrigation sector in Romania requires not only economically viable, but also nature-friendly, sustainable solutions (World Bank, 2018), which are framed in the context of the European Green Deal, the new European strategies “From Farm to Fork” and “Biodiversity 2030”, and the overarching Common Agricultural Policy (CAP) (Ossewaarde and Ossewaarde-Lowtoo, 2020; European Commission, 2017). There is an urgent need for adapted products and their harmonization with the CAP and the objectives of the Commission Strategies. In this regard, Regulation (EU) 2020/2220 of The European Parliament and of the European Council of 23 December 2020 aims to provide Member States the time and framework to prepare their Strategic Plans, by establishing a 2-year transition period and extending the applicability of the current Rural Development Plans (RDP). This provides an opportunity for Romania, through a possible amended National Resilience and Recovery Plan, to identify irrigable area potential in Romania and prepare a strategic vision for irrigation at national level with a strong emphasis on water use efficiency and water saving infrastructure and technologies.

Against this background it is important to develop, upgrade and modernize the knowledge base and system for the identification of solutions for irrigation infrastructure development and management in Romania. Satellite-based remote sensing can be an important tool in identifying, monitoring and analyzing irrigated crop production over large areas and periods of time, and also for identifying which areas present high potential when it comes to implementation of solutions for water storage and irrigation. Moreover, modern geospatial technologies allow the integration of several parameters in the analysis of irrigation potential (soil moisture, vegetation activity, crop type, water resources, etc.), such that the end-users can benefit from modern and effective near real-time services, based on the principles of sustainable agriculture.

Geospatial analysis based on Earth Observation (EO) data represents an effective tool for irrigation planning, mapping and monitoring, over a variety of natural conditions (such as climate and soil) and can be useful for large areas of interest, where in-situ sampling becomes either too expensive or impossible. The objective of the recently completed Study on the Irrigation Sector was to support mapping and estimating the suitability and potential of Romania’s agricultural land for the implementation of irrigation projects.

The subordinated objectives of the study aimed to support the MARD – Management Authority:

- To identify and map the status regarding cultivated crops, irrigated areas and irrigated crops (2016 to 2020) for the whole agricultural land of Romania;

- To compute a set of indicators and decision markers related to vulnerability in relation to climate change factors such as water deficit, water availability and irrigation potential;
- To identify the critical and most vulnerable areas in terms of water demand / irrigation needs.

The analysis is based on combined free and open Sentinel-2 and Landsat-8 Earth Observation data image processing, combined with ancillary data used for calibration. A web portal has been developed for the delivery of data and results.

For all the indicators and variables computed within the study, statistics have been generated at two spatial levels: counties and local administrative units (LAU). These statistics were delivered as both ESRI Shapefiles and Microsoft Excel documents.

The developed products show promising potential in the field, as they provide a background for the irrigation mapping, as well as change-detection analysis. The proposed approach can be replicated and implemented for any area of interest, and is time- and cost-saving alternative to traditional field surveys. However, field level verification will always be needed to ensure that EO data are interpreted correctly. The current version of the model can answer important questions related to irrigation in Romania and provide a broad overview on the extent of irrigation usage and targeted crops. Also, by analyzing past distribution of drought events and through correlation with soil suitability and water supply resources, informed decisions can be taken in order to shape new policies and action plans.

The workshop confirmed that collaboration and coordination can be enhanced between the Ministry of Environment, Water and Forests, the Meteorological Agency, and the Ministry of Agriculture and Rural Development. Data sharing and collaboration in using available data for agriculture investment planning will be important.

3.4. Workshop on Digital Applications in the Agriculture and Food System

The purpose of the workshop was to expose participants to new approaches to incorporating digital technology in agriculture development and to discuss how to foster such innovation in the Romanian context. Some of this innovation is happening in Romania under the leadership of MARD, which was shared during the workshop. Recent experience from Uruguay was also shared, where digital technologies and applications contributed to linking policymaking to information systems, developing new approaches to productive ecosystems, adaptation and mitigation against climate change, and contributing to policies and actions to promote food security and ensuring food safety and quality.

Agri-food information and data systems: Examples of Digital Agriculture in Uruguay

The scope of the presentation was to share the experience of Uruguay, and from the exchange to be able to contribute to the development of policies linked to information systems, approaches to productive ecosystems, adaptation and mitigation against climate change, and contribute to policies and actions to promote food security and ensuring food safety and quality. In this framework, a series of policy instruments implemented in Uruguay were presented that have allowed progress in promotion, controls/enforcement, competitiveness, and adaptation to climate change.

Traceability systems allow the origin, attributes, and location of products in the value chain to be traced through organized, reliable and secure records of information, and checked against sanitary, phytosanitary risks or non-compliance with established requirements, providing transparency on attributes of the process that are valued by final consumers or specific markets, thus guaranteeing the safety and quality of final products.

Five fundamental pillars for its development include: (1) Information: Detailed rural plot, semi-detailed soil mapping, precise and quality geographic information (topology, consistency), rainfall, water balance, temperatures, etc. and exclusion zones, (2) Records: Individuals and Companies, Single User within the state ID Uruguay, Professionals Accredited by University and Phytosanitary Applicators (companies and teams), (3) Normative: Laws that regulate soil care and phytosanitary applications, Ministerial Decrees of sustainability of RRNN, Homologation of satellite tracking equipment, (4) Academia: Sustainability (USLE RUSLE), Training of professionals – Accreditation, (5) Tools: Solid team to ensure compliance – supervise, remote census tools and machine learning, IOT in application equipment.

Presentation of different examples of information systems for decision making:

- Soil use and management plans to minimize the degradation of soils
- Monitoring of application of agrochemicals to minimize contamination of water resources
- Traceability of livestock, to ensure health status and ensure food quality
- "Fenoteca", spectral images from satellites to monitor production and land use
- Certification system for seeds and propagation materials to ensure quality and certify origin
- Single national registry of companies and producers (REUNE), in order to have a single unified and binding registry between all national and territorial sources
- Sustainable dairy plans, to ensure the non-contamination of soil, groundwater tables and water sources
- Indexed climatic livestock insurance, to transfer climatic risks through financial instruments
- Single window for foreign trade (VUCE), to digitize and facilitate export procedures

Over a period of ten years, the Government of Uruguay developed the above digital based approach to green growth and competitive agriculture with a strong emphasis on data, standards, enforcement, and transparency. Romania could learn directly from the experience in Uruguay and design a Romania-relevant model.

National Agency of Financing Rural Investments: Strengthening MARD capacity to develop policies and regulations – Traceability

The implementation of a national strategic system for traceability and integrity of agri-food products involves the development of an integrated information management and agri-food monitoring system (which is an IT system providing data on production, processing, storage, marketing, consumption, import/export balance sheet, forecasts internal consumption and supply and demand on the internal market as well as on new markets, etc. – SIIMM). The information system will be designed to offer a simplified and integrated public service for the benefit of citizens. As a first phase, the National Information System will be developed as a first module of the Management of Conformity Controls in the sector of Vegetables and Fresh Fruit.

National Agency of Financing Rural Investments: Mountain-specific products and points of interest – mobile application

The development of a mobile application allows the publication, by manufacturer or supplier, of products and agro-food services in order to obtain information and/or marketing to the consumer.

Some examples of categories of products and services were presented like food, accommodation services, services related to the accommodation activity, the products and services of the craftsmen, fairs, tourist attractions.

Directorate for Land Improvements and Land Fund – Workshop Summary

A short summary was provided of the workshops on earth observation for irrigation planning and digital applications in agriculture. The objective of MARD in terms of implementing Romania's National Strategic Plan is to invest in climate adaptation and mitigation measures, preventing and managing climate-related risks, and increase the capacity to enhance resource efficiency. This will include adaptation of infrastructure, land improvements, and "greening" of agriculture production. The experience presented by the Uruguay team, including the digital tools, are of great interest and very relevant to what MARD envisions to develop in the near future.

3.5. Workshop on Climate Action in Agriculture

At the suggestion of MARD, a workshop on mainstreaming climate action in agriculture was held on November 15, 2022. The purpose of the workshop was to allow the CAP Managing Authority, the MARD climate change technical unit, and other departments within MARD to gain from the experience by another EU Member State, which would confirm and inform strategic priorities and approaches for climate action in Romania's agricultural sector.

The Ministry of Agriculture and Rural Development (MARD) plays a pivotal role in addressing the consequences of climate change in Romania. The Ministry, through its Managing Authority in charge of designing and implementing the CAP NSP, and its climate change technical unit in charge of coordinating the Inter-ministerial Committee for the Management of the Effects produced by Climate Change in Agriculture, is in the process of defining priorities and institutional arrangements for its actions related to climate change. This committee, established in July 2022, includes representatives from MARD; the Ministry of Finance; the Ministry of Internal Affairs; the Ministry of Environment, Water and Forests; the Ministry of Investment and European Projects; the Ministry of Energy; the Ministry of Economy; the Ministry of Transport and Infrastructure; the Ministry of Labor and Social Solidarity; and the Ministry of Entrepreneurship and Tourism (Prime Minister's Decision No. 415, July 18, 2022).

France was identified as being of high relevance for a knowledge sharing discussion, and senior staff of France's main agricultural research institute, INRAE (French Research Institute for Agriculture, Food and the Environment) participated in the workshop. INRAE plays an important role in climate policy research in France and has substantial expertise in mountain area development, making them a key knowledge resource for policymakers in Romania. Participating representatives from MARD confirmed how direct discussions with stakeholders from other Member States were effective and inspirational for Romania.

A background note on climate action in agriculture in the EU was prepared and is included in Annex 3 of this report. The note provides a summary of the strategy framework at the EU level, and for Romania, Spain and France, including the Common Agricultural Policy (CAP). Lessons learned from Spain and France are identified, and information sources are listed.

A list of participants is included in Annex 1. Mr. Sylvain Pellerin (INRAE Deputy Director of the Agroecosystem Department, Head of INRAE's metaprogram on climate change), Mr. José Martinez (INRAE Public Policy Support Division), and Mr. Charles Mathiaux (Partnerships and Innovation

Transfer Division) made contributions and engaged in an active dialogue that can be summarized as follows:

France's strategic approach to climate action in the agricultural and food sector

Agriculture in France is impacted by climate change while also being a contributor. It is the second greenhouse gas (GHG) emitting sector after transportation. Agriculture and forestry in France are increasingly impacted by climate change. There are more frequent and more damaging episodes of drought and frost, evidenced by devastating forest fires during the summer of 2022.

The majority of emissions in the agricultural sector in France are in the form of methane (CH4, 51%), followed by nitrous oxide (N2O, from Nitrogen fertilizer). Carbon dioxide emissions (CO2) only account for 3% of the sector's GHGs. LULUCF (Land use, land use change and forestry) emissions are overall negative, which means that carbon sinks are increasing, due to the expansion of forest.

France's low-carbon national strategy calls for reaching carbon neutrality in 2050. This requires cutting overall emissions to one sixth, and doubling carbon sinks. The agricultural sector must take its share and reduce emissions. The strategy defines a lower level of effort for the agricultural sector in order to maintain its contribution to food security: GHG emissions should be halved. Agriculture is also expected to increase carbon storage in soils and in biomass.

There are three main levers in this strategy:

- **To promote demand-led changes,** reducing meat consumption in people's diets is a lever. Better informed consumers can be expected to shift from animal products to more plant-based diets, which can be promoted through information campaigns. INRAE is involved in the development of labelling system of food products that indicated carbon footprint levels and other environmental impacts, due to start in 2023-2024.
- **To reduce emissions at farm level,** especially methane due to the storage of manure, and increase renewable energy production, especially biogas on livestock farms. Efforts for reducing the use of N fertilizers are also promoted (such as adjustment of fertilizer doses, more legumes in crop rotations, among others).
- **To promote carbon storage in soils.** There is potential to compensate France's GHG emissions by 6-7% through increased carbon storage in agricultural land, by promoting carbon storage at farm level (e.g., adjusting cropping patterns to include cover crops and agroforestry) and certifying carbon storage levels, thus generating carbon credits for farmers.

France is implementing the "4 per thousand" initiative launched in 2015 at COP21 and has since then been supporting initiatives to increase carbon storage in soils. INRAE led a research project to identify practices that increase carbon storage (Pellerin et al 2022). "4 per 1000" is a voluntary action plan with 40 participating countries including Spain, and 200 entities having signed the action plan. It calls for increasing the soil carbon stocks by 0.4% annually, see https://sdgs.un.org/partnerships/4-1000-initiative-and-its-implementation.

France's low-carbon national strategy is part of a general objective in France to succeed in the agroecological transition, i.e., to shift from systems based on pesticides and chemicals to less dependence on inputs. This shift requires need more nature-based processes in agriculture, and therefore the introduction of more diversity in farming systems.

Towards carbon neutrality in mountain areas

Research shows that carbon stocks are higher under pasture (70-80 tons/ha) than on cropped land (50 tons/ha), and that they are especially high in mountains.

In France's strategy, the objective in areas with pasture is to protect carbon stocks, preventing the plowing of pasture. Livestock needs to be maintained for that purpose. Since the EU is a net importer of meat from outside the EU, the consumption of meat products can be reduced without necessarily reducing livestock numbers in France.

In Romania, there is a concern that carbon credits might be a trap because of limited awareness of the importance of pasture, and the search for short financial returns. There are negatively biased messages that animals are causing a high GHG impact. If livestock herds are reduced, there is a risk of abandonment of agriculture in mountain areas. Mountain areas in Romania account for 15% of the country's agricultural land, and 50% of that land is permanent pasture. Romanian policymakers may require empirical evidence to support policy-making decisions that are supportive of mountain agriculture, including measures on climate change. Given that mountain areas in Romania increasingly face issues of drought and have limited water resources, climate adaptation should be an important part of the climate agenda.

The Romanian team confirmed that, from a scientific point of view, reducing meat in diets should not lead to reducing livestock numbers. Animals are needed to maintain pastures. Pastures also contributes to biodiversity preservation and landscapes. Animals provide organic manure, therefore allowing production of biogas.

France's strategy is to encourage self-sufficient forage systems. France's farming systems are nowadays highly specialized either in crop production (the Paris basin region) or in animal products (production being concentrated in the Northwest). It is considered that this geographical segregation is not efficient for the recycling of effluents. There is a need to develop mixed farming systems with a higher diversity of plants and animals/livestock.

Progress in operational solutions for climate-smart agriculture

The French Ministry in charge of agriculture and food security is working with INRAE on a future carbon footprint labelling scheme for food products (from A to E, with colors). The scheme is expected to be operational in 2023-24. Quality labels are well established in France. They allow consumers to know which products originate from low-input agriculture and therefore justify higher prices.

The Ministry in charge of agriculture is developing a low carbon certification scheme: farmers will earn carbon credits that can be traded on the free market with companies for the compensation of their emissions. Areas with pasture can increase carbon storage through improved pasture management practices. Pastures can become more productive without using chemicals, if they have a higher share of nitrogen fixing species.

Optimizing the use of nitrogen fertilizers is an important solution. Although farmers in France are used to calculating nitrogen budgets to prevent leaching and preserving water quality, there is room for further improvement to reduce GHGs.

Institutional coordination for climate action

INRAE is the leading applied research institute with 10,000 staff. CLIMAE (Agriculture and forestry in the face of climate change: adaptation and mitigation) is INRAE's metaprogram on the joint effects of the various dimensions of climate change on agricultural activities and natural resources. It proposes adaptation strategies and assesses their sustainability and environmental and socioeconomic implications, consistent with society's demand (http://www.accaf.inra.fr/). INRAE's Public Policy Department works with the Ministry in charge of agriculture and with non-academic partners to promote innovation in the agrifood sector and to support policymakers. The ministry frequently calls upon INRAE to undertake specific reviews or to provide expertise.

Public agricultural advisory services are present, but their staff is increasingly limited. Research and advisory services are working jointly to develop new tools for the reduction of fertilizers.

Main lessons and conclusions by workshop participants

All economic sectors need to reduce GHG emissions. Agriculture can contribute to reducing GHG emissions but is only part of the solution.

When farmers become aware that they can contribute to carbon neutrality, they will be able to seize this as an economic opportunity. This applies to all EU member states.

Agricultural policies will increasingly promote effective climate action and link subsidies/incentives to such action. This is a long-term trend that requires negotiations with farmer unions.

Adaptation to climate change is an important concern in Romania. Romanian decision-makers require references to good practice on how to work with farmers on this subject. Research projects and good adaptation practice from France are of interest to them.

4. Conclusion

The post-2020 CAP focuses on the development of a climate smart, green, competitive, resilient and diversified agricultural sector that would ensure long-term food security. Considering Romania's agriculture potential and structure of the sector, interventions could be targeted to address the diverse needs, seize the opportunities, and ensure fairness of support. CAP interventions have the potential to increase competitiveness and sustainability of the sector as a whole, and strengthen farmers' roles in key value chains – not only large farmers but also small and medium farmers who make up the majority of farms in Romania. The NSP provides an opportunity to formulate programs that meet these various objectives.

The workshops held under Output 4 of this RAS program focused on eco-schemes, earth observation for sector investment planning, the integration of climate change, and integrated management of green and competitive agriculture. The workshops and discussions have also demonstrated how learning from other EU member states, from best practice experiences outside the EU, and from technical experts within Romania can inspire and inform policymaking and program design. An important conclusion is that competitiveness of agricultural products is intrinsically linked with environmental and social objectives, and that digital tools can be applied to manage an integrated set of support activities in the agriculture and food sector. The recently formed climate change technical unit at MARD that is in charge of coordinating the Inter-ministerial Committee for the Management of the Effects produced by Climate Change in Agriculture, will have an opportunity to prioritize climate action in the NSP and mainstream climate action in rural development activities.

Annex 1. Lists of Workshop Participants

Workshop on Earth Observation for Agriculture

- Adrian Oros (then Minister of Agriculture)
- George Scarlat
- Elena Filip – Director - Directorate for Land Improvements and Land Fund
- Dana Rebega, Director MARD Managing authority
- Angelica Covrig, MARD Managing authority
- Liviu Bodolan, MARD Managing authority
- Lucian Constantinescu, Agency for Rural Investment Financing (AFIR)
- Catalin Grigore, AFIR
- Mihai Moraru, AFIR
- Elena Mateescu, Nat. Met. Agency
- ANIF representatives
- National Digitalization Agency representatives
- World Bank experts and facilitators:
    - Dr. Erick Fernandes
    - Mr. Anatol Gobjila
    - Ms. Adina Pasarel
    - Olimpia Copăcenaru
    - Sorin Constantin

Workshop on Eco-schemes – Sharing Views on National Strategies and Implementation Challenges

- Hungary - Mr. Istvan Madarasz, Ministry of Agriculture
- Poland - Ms. Joanna Lasocka, Ministry of Agriculture
- Germany - Prof. Dr. Theodor Fock, University of Applied Sciences Neubrandenburg, Mecklenburg-West Pomerania Region
- France - Prof. Jean-Christophe Bureau, National Research Institute for Agriculture, Food and the Environment (INRAE)
- Croatia - Mr. Ivancic Kresimir, former Head of Managing Authority, World Bank expert
- Romania - Ms. Dana Rebega, Ms. Adela Ștefan, Mr. Andrei Bălan, Mr. Bogdan Alecu and other experts, Ministry of Agriculture and Rural Development
- World Bank - Mr. Jan Joost Nijhoff, Mr. Anatol Gobjila, Ms. Claude Saint-Pierre, Ms. Adina Pasarel, Ms. Daniela Giurca, Ms. Cristina Cionga, Mr. Laurent Barbut

Workshop on Earth Observation for Crop and Irrigation Suitability Mapping

- Mr. Sorin Moise - State secretary – Ministry of Agriculture and Rural Development
- Mr. Aurel Simion - State secretary - Ministry of Agriculture and Rural Development
- Mr. Iulian BUCUR- State secretary - Ministry of Agriculture and Rural Development
- Ms. Mateescu Elena – National Meteorological Agency – General Director - European Center of Agrometeorology
- Mr. Constantin Sorin – World Bank expert
- Ms. Elena Filip – Director - Directorate for Land Improvements and Land Fund
- Ms. Dana Rebega – Director MARD Managing authority
- Mr. Bogdan Dumitrescu – AFIR
- Mr. Iulian Serban – AFIR

- Mr. Liviu Bodolan
- Mr. Andrei Balan
- World Bank experts and facilitators:
    - Mr. Jan Joost Nijhoff
    - Mr. Anatol Gobjila
    - Ms. Luz Dias
    - Ms. Adina Pasarel
    - Mr Mihai Preda

Workshop on Digital Applications in the Agriculture and Food System

- Mr. – Sorin Moise - State secretary – Ministry of Agriculture and Rural Development
- Mr. Aurel Simion - State secretary - Ministry of Agriculture and Rural Development
- Mr. Iulian BUCUR- State secretary - Ministry of Agriculture and Rural Development
- Ms. Mateescu Elena – National Meteorological Agency – General Director - European Center of Agrometeorology
- Ms. Elena Filip – Director - Directorate for Land Improvements and Land Fund
- Mr. Jorge Marzaroli – International expert on agri-food information and data systems- Uruguay best practice
- Ms. Julieta Souza Soler – agronomy engineer Uruguay best practice
- Mr. Fabián Dávila – IT developer Uruguay best practice
- Mr. Bogdan Tulbure – National Agency of Financing Rural Investments -
- Mr. Iulian Serban - – National Agency of Financing Rural Investments -
- MARD experts and facilitators:
- Ms. Dana Rebega
- Mr. Bogdan Dumitrescu
- Mr. Liviu Bodolan
- Mr. Andrei Balan
- World Bank experts and facilitators:
    - Mr. Jan Joost Nijhoff
    - Mr. Anatol Gobjila
    - Ms. Luz Dias
    - Ms. Adina Pasarel
    - Mr. Mihai Preda
    - Mr. Constantin Sorin

Workshop on Climate Action in Agriculture

- Mr. Sylvain Pellerin, INRAE, Deputy Director of the Agroecosystem Department, Head of INRAE's Metaprogram on Climate Change
- Mr. José Martinez, Public Policy Support Division, INRAE
- Mr. Charles Mathiaux, Partnerships and Innovation Transfer Division, INRAE
- Mr. Tiberiu Stef, Advisor to the Minister of Agriculture and Rural Development on Mountain Policies
- Ms. Elena Philip, Head of Land management Department, in charge of the Climate Working Group of the Ministry of Agriculture and Rural Development

- Ms. Claudia Pocsoara, Project coordinator for the Development of the National Mountain Strategy, Ministry of Agriculture and Rural development
- World Bank experts and facilitators
    - Mr. Jan Joost Nijhoff
    - Ms. Adina Pasarel.
    - Ms. Daniela Giurca
    - Ms. Claude Saint-Pierre

Annex 2. Workshop Presentations

Workshop presentations are provided under separate cover, to be inserted here.

Annex 3. Background Note for Discussions on Climate Action in Agriculture

1. Introduction

This background note was prepared in support of the workshop and discussion on Climate Action in Agriculture, a summary of which is provided in section 3.5 of this report.

The Ministry of Agriculture and Rural Development (MARD) has a pivotal role in addressing the consequences of climate change in Romania. The Ministry, through its Managing Authority in charge of designing and implementing the CAP NSP, and its climate change technical unit in charge of coordinating the Inter-ministerial Committee for the Management of the Effects produced by Climate Change in Agriculture, is in the process of defining priorities and institutional arrangements for its action in the scope of climate change. This committee, established in July 2022, includes representatives from MARD; the Ministry of Finance; the Ministry of Internal Affairs; the Ministry of Environment, Water and Forests; the Ministry of Investment and European Projects; the Ministry of Energy; the Ministry of Economy; the Ministry of Transport and Infrastructure; the Ministry of Labor and Social Solidarity; and the Ministry of Entrepreneurship and Tourism (Prime Minister's Decision No. 415, July 18, 2022).

This background note on climate action in agriculture was produced for knowledge sharing discussions with experts from individual EU member states and for internal discussion within MARD. The note provides a summary of the strategy framework at the EU level, and for Romania, Spain, and France, including the Common Agricultural Policy (CAP). Lessons learned from Spain and France are identified, and information sources are listed.

Spain and France were identified as Member States of high relevance for a knowledge sharing exercise, with a focus on large-scale field crops, horticulture, irrigation and solar power for Spain, climate-smart livestock production, carbon sinks, biogas and food markets for France. Member States in Eastern Europe are equally relevant for future exchanges. For example, Poland is expected to be a source of experience for Romania on the implementation of the CAP NSP measures related to climate action.

Climate action is a key global public good, requiring major new financing. Sound diagnostics, clear identification of impactful programs and projects, improved public policies and incentive structures, and coordination of multiple donors and funding sources are all key building blocks of this mission.

In this note, the term strategy refers to policy decisions made at national level. This includes but is not limited to the CAP NSP statement of strategy.

2. Key Concepts

Climate action: The EU's Common agricultural (CAP) policy framework has been using the term "climate action" since the 2014-2020 period. This phrase highlights the need for actual action in relation to climate change.

Three dimensions of climate action - mitigation, adaptation, and carbon sinks: agriculture is impacted by climate change, so that adaptation to climate change is a critical part of climate action. Agriculture is also an emitter of greenhouse gases (GHG). The agricultural sector must reduce these emissions, thus contributing to mitigation of climate change. An additional contribution from the sector to climate change mitigation is the preservation and enhancement of carbon sinks. Carbon sinks are of critical importance in agriculture, and are therefore considered as a third dimension of climate

action. Carbon sinks are the LULUCF (land use, land use change and forestry) component of the United Nations Conference on Climate Change (UNFCCC).

Broader agricultural sector: climate action in the agricultural sector can take place on agricultural holdings, in value chains and at the level of consumers. The relevant sector is therefore the agrifood sector. The forestry sector is an equally critical element of climate action since forests and farmland should be jointly considered when it comes to carbon sinks.

Climate-smart agriculture: climate action is defined as actions that contribute to any of the three above dimensions. In the agricultural sector, a range of activities can jointly contribute to adaptation, mitigation and/or carbon sinks. The term climate-smart agriculture describes these win-win situations.

Climate resilience. Resilience to climate change means not only capacity to recover from impacts such as extreme climatic events, but also operating significant changes to reduce the vulnerability of agricultural systems, farms and food systems. Many of these changes increase resilience to climate change as well as resilience to economic external shocks and crisis.

3. Climate Action in the EU, National Frameworks, and the CAP NSPs

EU level

The European Green Deal (December 2019) is the overarching framework for climate action in the post-2020 period. The Green Deal incorporates several strategies that govern decarbonization, adaptation to climate change, and the transition towards sustainability across all sectors in the European Union.

The European Climate Law (July 2021) defines a legally binding target of neutrality for the combined emissions of various GHGs by 2050, all sectors included. Each Member State must take necessary measures to meet this target. The law takes into account fairness and solidarity among Member States, as mandated under the **Effort Sharing regulation (ESR)** (2018). This regulation, which is now part of the Green Deal, sets national targets for the reduction of emissions from, inter alia, the agriculture sector.

In line with the Climate Law, the European Commission has proposed in 2021 a **Regulation on Climate-Neutral Land Use, Forestry and Agriculture**, in order to provide more powerful incentives for Member States to grow and improve their natural carbon sinks. This regulation would define binding national-level targets to increase net carbon removals in the agricultural and forestry sectors. It would set up an "EU-level objective to reach climate neutrality in the combined land use, forestry and agriculture sector by 2035, including non-CO2 agricultural emissions, such as those from fertilizer use and livestock". This means that, in each Member State, GHG emissions from land use, land use change or forestry are balanced by at least an equivalent accounted removal of CO2 from the atmosphere in the period 2021 to 2030.

As a result of this upcoming new regulation, **each Member State is expected to present by mid-2024 in their National Energy and Climate Plans how they would achieve this neutrality objective for the combined land, agriculture and forestry sectors.** Significant change is expected to take place for farmers starting from 2026.

The European Green Deal includes an updated **EU Adaptation Strategy** (2021). Priorities in this strategy are to (i) improve knowledge and availability of data, (ii) make adaptation more systemic in all sectors and in the whole society, and (iii) accelerate the roll out of adaptation solutions. The

strategy promotes knowledge sharing. It calls for attention to fair and just transition, taking into account vulnerable groups.

The post-2021 CAP is a tool to make progress towards this neutrality and in adaptation to climate change. The framework of objectives reconfirms how climate action is a compulsory part of CAP support measures for each Member State. This covers both the pillars of the CAP, and both area-based and non-area based measures. The CAP's second objective (out of three objectives) is "strengthening the environmental protection actions and those that fight climate changes, and contributing to the environmental- and climate-related objectives of the European Union". The CAP is further structured around 10 key objectives, out of which key objective 4 is climate action: "to contribute to climate change mitigation and adaptation, including by reducing greenhouse gas emissions and enhancing carbon sequestration, as well as promoting sustainable energy".

In addition to the CAP, financial support for climate change adaptation and mitigation is available from the European Structural and Investment Funds, the LIFE Program, the Recovery and Resilience Facility and the proposed Horizon Europe Mission on Adaptation to Climate Change. Specifically, "a greener, low-carbon transitioning towards a net zero carbon economy and resilient Europe by promoting clean and fair energy transition, green and blue investment, the circular economy, climate change mitigation and adaptation, risk prevention and management, and sustainable urban mobility" is the second policy objective of the EU Cohesion Policy funds.

As part of the Green Deal, the **Farm to Fork strategy** announced a new **EU Carbon Farming initiative**. "Carbon farming refers to the management of carbon pools, flows and GHG fluxes at farm level, with the purpose of mitigating climate change" (COWI 2021 for DG Climate). Farmers would obtain certificates of carbon removal. This is an opportunity to provide farmers with a new source of income, and to develop a new business model. In November 2022, the European Commission announced a regulation proposal "establishing a Union regulatory framework for the certification of carbon removals". The proposed regulation states that "by 2028, all land managers should have access to verified emission and removal data to measure carbon farming practices."

Member State level

The effort mandated by the ESR after the proposed 2021 revision across all sectors is -37.7% in Spain, -47.5% in France and -12.7% in Romania, compared to 2005. The lower effort required from Romania results from the already sharp decline in emissions that has taken place in recent years, and from a lower GDP level. Emissions remain however at a relatively high level (Box 1).

Spain and France have contrasting profiles in terms of GHG emissions: contributions from field crops are important in France when emissions from livestock production are especially high in Spain. Emissions were increasing until recently in Spain, while emissions were on a declining trend in France.

Spain and France have recently defined national strategies towards carbon neutrality by 2050. These strategies cut across all sectors. In France, the strategy includes a specific chapter on agriculture, and another one on forestry and soils. Spain has defined a comprehensive strategy towards resilience. In this strategy, the climate change chapter covers mitigation, adaptation and carbon sinks. In France, the national carbon neutral strategy covers only mitigation, including carbon sinks. The national climate change adaptation strategies in France and Spain, first issued in the mid-2010s and updated on a regular basis as is the case in Romania, cover all sectors. Their content on the agrifood sector is limited.

Box 1. Context: GHG Emissions from the Agricultural Sector in 3 Countries (2019 data)

Romania	Spain	France
Romania ranks 8th in GHG emissions from the agriculture sector in the EU. Emissions are mostly N2O from managed soils (for which Romania accounts for 5% of EU emissions), CH4 from pig & poultry manure, sheep (11% of EU emissions) and cattle. CH4 and N2O emissions are on a marked declining trend (respectively -51% and -33% compared to 1990).	Spain's agriculture ranks 4th in GHG emissions in the EU. Spain is the only Member State with increased N2O emissions compared to 1990 (+16%) although these have stabilized in recent years. Spain is the 3rd contributor to CH4 emissions in the EU's livestock sector, and the first CH4 contributor from animal manure and from pig production.	France's agricultural sector is the highest emitter of GHGs in the EU in absolute value due to the size of the sector. It ranks 18th in GHG emissions per unit of value of the production. Crop production is a much higher emitter (ranking 12th per hectare) than animal production (ranking 24th per cattle unit).

Sources: (1) European Environmental Agency 2021. Annual European Union greenhouse gas inventory 1990–2019 and inventory report 2021 Submission to the UNFCCC Secretariat. (2) France CAP NSP.

In France and Spain, the national carbon-neutral strategies are reader-friendly documents explaining strategic choices to the general public, whereas their National Energy and Climate Plans (NECP), mandated by the EU, are administrative documents whose purpose is to confirm compliance and on-going national reforms. This differs from Romania where the 2016-2030 strategy on climate change and low-carbon economic growth is largely similar, in its agricultural sector section, to the NECP. Spain's NECP has dedicated sections for the agricultural sector, France's NECP does not.

Spain's carbon neutral and resilient strategy is based on foresight scenarios (the most plausible future) and is conveyed through a document describing consensus in the Spanish society. France's carbon neutral strategy is based on quantitative scenarios that combine several public policy levers. One of these levers is consumers' demand for less animal products in diets, to be replaced by legumes.

Box 2. Agriculture in national low-carbon strategies

Romania National strategy on climate change and low-carbon economic growth (2016-2030)

The strategy states that the promotion of knowledge transfer is a priority, as well as the development of organic farming and the reduction of fertilizers.

The reduction of emissions and fostering of carbon sequestration are to be achieved through extensification of grazing, the use of nitrogen fixing crops and crop residues' return to soil.

Energy efficiency is to be improved through modernization investments, and small-scale renewable energy production can be developed.

Spain (2021)

The "Spain 2050 strategy", based on a foresight exercise cutting across all sectors, defines becoming "a carbon neutral, sustainable and climate resilient society" as the 4th challenge of the Spanish society.

The strategy addresses jointly agricultural production, the food sector and food consumption. It sets joint priorities for adaptation to climate change, for shifting towards low-carbon agriculture and food, and for enhancing the absorption capacity of croplands and pasture.

The strategy highlights the following changes in agricultural practices:

- Gradually replacing synthetic fertilizers with improved fertilizer and animal manure,
- Large-scale development of hydroponic crops,
- Smart agriculture, and agricultural machinery not requiring fossil fuels,
- The modernization of irrigation and the development of alternative sources of water supply.

This will require enhanced R&D resources and reskilling of those working in agriculture including workers.

"Agro-ecological systems based on traditional knowledge and innovation" are highlighted as an important alternative for producers and consumers.

France (2020)

The National Low Carbon Strategy to 2050, in its agricultural sector section, defines reduction targets for GHG emissions by 2030: -19%, and by 2050: - 46 % compared to 2015.

Priorities include:

- Developing agro-ecology, agroforestry and precision agriculture, in particular to reduce surpluses of nitrogen fertilizer to a minimum.,
- Developing the bio-economy to provide France's economy with energy and materials that emit less GHGls,
- Changing demand for food (to better quality or organic products, taking into account nutritional recommendations) and reducing food waste.

The strategy also defines the target of storing 90% of residual emissions from all sectors into forests and soils by 2050. Increasing carbon storage in agricultural soils is to take place changes in farming practices.

In their National Strategic Plans (NSPs) under the CAP, Spain and France have chosen a different architecture of needs (Box 3). In Spain, the NSP clearly gives equal priority to mitigation, adaptation and carbon sinks. France's NSP puts energy efficiency and production of renewable energy on an equal footing with these three components, and defines the transition to more resilient and less emitting systems as a general, overarching need. Romania's NSP defines the reduction of GHG emissions as having highest priority.

In this architecture, France's NSP clearly gives a balanced role to agriculture proper and to the forestry sector. This is also the case in Romania's NSP. Spain's NSP covers the forestry sector, but this is not visible in the architecture of needs.

Box 3. CAP Strategy Needs under Key Objective 4 (climate action) in three Member States

Romania

High degree of priority:

- Maintenance/adoption of extensive agricultural practices and the use of ESR for GHG reduction (partially addressed through NSP interventions)

Medium degree of priorities:

- Increasing the degree of carbon sequestration in agricultural land (fully addressed through NSP interventions)
- Adoption of practices/use of forestry equipment for combat climate change (fully addressed through NSP interventions)
- Securing capital, technology in forestry and supporting sustainable forest management (partially addressed through NSP interventions).

Low degree of priority

- Adaptation of agricultural practices in areas with climate risks determined by climate change (partially addressed through NSP interventions)

Spain

3 priority needs:

- Minimizing GHG emissions
- Increasing carbon capture
- Reducing the impact of climate change.

Other priorities

- Promoting adaptation to climate change
- Increasing renewables
- Energy Efficiency
- Reduction and optimization of inputs.

Other needs

- Research, development and innovation in mitigation and adaptation to climate change
- Knowledge transfer in mitigation and adaptation
- Minimizing risks due to extreme climatic events.

France

General needs

- Creating general conditions to allow farms to engage into the transition (towards improved production systems)
- Supporting global levers (beyond climate change).

Specific needs

- Reducing GHG emissions in the agricultural sector

- Reducing energy consumption in agriculture and forestry
- Supporting carbon storage in soils and in agricultural and forest biomass
- Promoting production of renewable energy and of agriculture and forestry bioproducts
- Make systems more resilient.

Source: national strategic plans (Romania: version 1.1, October 2022; Spain: version 1.2, August 2022; France: validated version).

A rapid comparison between some salient features of the stated strategy under Key Objective 4 in the three CSPs allows to highlight several shared features (Box 4). First, the NSPs devote equal weight to mitigation, adaptation and carbon sinks. This is a marked change compared to the 2014-2020 period. Second, the agricultural practices that are promoted are largely similar in the three countries. Many of these practices are climate-smart: they contribute to mitigation, adaptation and enhancement of carbon sinks. This reflects the growing scientific and technical consensus on climate action priorities. Third, the NSPs mobilize the CAP's various tools (conditionality, eco-schemes, agri-environmental and climate measures (AECMs) and farm investment measures towards climate action).

Spain's NSP includes a single eco-scheme called "carbon farming and agroecology" with several modalities. This opens carbon farming certification to diversified production systems. This reflects a stated dual strategy that combines the digitalization of climate action commitments with the maintenance of some extensive systems. AECMs are mobilized for the enhancement of carbon sinks, targeting equally crops and pasture. The NSP highlights regulatory measures towards the reduction of emissions from livestock farms.

France's NSP defines a set of three eco-schemes (practices, environmental certification, and ecological infrastructure). It puts priority on permanent pasture both as a carbon sink and for the other environmental benefits that permanent pasture generates. Payments for environmental services (PES) are created to promote the maintenance of permanent pasture. The development of nitrogen-fixing legumes is another clear priority. These crops are targeted for carbon farming along with woody crops, and supported via coupled aid.

Irrigation may be funded under the farm investment measure in France's NSP in specific regions, as an adaptation measure. One of the conditions is to achieve 50% of effective water saving. In Spain, conditions include water saving and energy efficiency.

Romania's NSP defines an eco-scheme dedicated to small farms under Key objective 4. Spain's NSP defines measures targeting small farms but not under Key objective 4. France's NSP makes no mention of small farms – targeting of small and medium farms is expected to be defined in the regional subplans for non-area based measures. Instead, the overall strategy of France's NSP is to target fragile value chains (livestock) and fragile territories (mountains). A specific coupled aid for legume crops in mountain areas is created.

The agricultural knowledge and information system (AKIS) is mobilized under the climate action objective in the three NSPs. In Spain's NSP document, capacity building is linked to AECMs and to the new compulsory system of digital registries on fertilizer use. France highlights the need for cooperation between researchers, advisory services and farmers, that goes beyond the NSP.

In accordance with their architecture of needs, the NSPs also include measures for the development of renewable energy and energy efficiency. These are not reviewed in this note.

Box 4. Specific Elements of the NSP for Mitigation, Adaptation, Carbon Sinks and AKIS in three Member States

Romania

Mitigation:

The expansion and maintenance of ecological agriculture (i.e., organic farming) is listed first, reflecting how this is a priority.

AECMs will be granted for voluntary commitments (1) on permanent grasslands to encourage environmentally friendly agricultural practices, reduce the use of mechanized equipment, prohibit the application of chemical fertilizers, at the same time reducing the livestock load, (2) on arable land for minimum tillage, soil cover crops and legume crops, and (3) on forests for enhancing consistency of stands.

An eco-scheme specifically supports environment-friendly agriculture on small farms, with at least 10% of legume crops.

Modernization investments in livestock farms, including small farms, will cover proper manure management.

Adaptation:

The inclusion of drought-resistant crops and varieties through AECMs on arable land contribute to reducing the effects of climate change.

By protecting soil resources, the support provided through the forestry environment intervention will also contribute to the reduction of GHG emissions.

Nitrogen fixing crops, prohibition of applications of chemical fertilizers and increased use of organic fertilizers will contribute to maintaining a low level of greenhouse gas concentrations in the atmosphere.

Carbon sinks:

Three eco-schemes respectively promote (1) minimal tillage and conservation agriculture as an active measure for carbon sequestration and the efficient use of soil water resources, (2) planting at least two trees per hectare, or (3) interplanting grass in orchards and vineyards on at least 75% of the area.

AECMs on permanent grassland and arable land also contribute to enhancing carbon sinks.

Support provided through environmental forestry measures will help protect soil resources.

Incorporating crop residues into the soil contributes to carbon sequestration.

AKIS

Knowledge transfer and exchange programs will be consistent with the scope of the Green Deal. They will address climate and resource use efficiency, including eco-schemes, sustainable development, use of resources, digitalization, innovation, biodiversity, animal welfare, renewable energy sources, increasing efficiency and competitiveness in agriculture.

Spain

Mitigation

Main measures for crop production are: reinforced conditionality on nitrogen fertilizer use in vulnerable areas; the carbon farming and agroecology eco-scheme promoting crop rotations and no tillage (with a different definition for irrigated agriculture, drylands and other non-irrigated areas).

Specific measures are defined for the fruit and vegetable sector and for the wine sector at production stage (investments, R&D, renewable energy, energy efficiency) as well as for fruit and vegetable transportation and storage, and for wine production by-products and waste recovery.

The ECOGAN computerized system, set up to accurately assess GHGs and other pollutants from livestock farms, is a linked regulatory measure.

Adaptation

Support to productive investment on farms addresses jointly mitigation, adaptation, increase carbon storage through a change of crops, modernization of irrigation infrastructure to for water saving and energy efficiency, and animal welfare.

Diversification of production and the inclusion of crops and breeds with greater potential for adaptation to climate change is promoted. Related AECM commitments are defined for agriculture and forestry.

Specific measures are defined for the wine sector (restructuring and conversion of vineyards).

In addition to agricultural insurance, minimizing vulnerability to extreme climatic events is addressed through support to sustainable pasture management, and to water supply for extensive livestock systems.

Conservation of plant genetic diversity and support to genetic improvement are a linked initiative.

Carbon sinks This is supported through reinforced conditionality, carbon farming and agroecology eco-schemes to improve the state of pastures (extensive grazing and biodiversity, rotation and no tillage); AECMs including on organic farms, forest management commitments, commitment to maintain agroforestry systems; and investment measures for the restoration of grasslands, reforestation and the restoration of damaged forests. **AKIS** Capacity building will be linked to AECMs and will specifically relate to pasture management, soil improvement, the fight against erosion, and organic farming. Linked regulatory measure: to further reduce nitrogen applications, farmers must maintain a digital notebook and prepare a prescription plan with technical support from advisory services.
France **Crosscutting** Eco-schemes, based on (1) agroecological practices (crop rotation with legumes, maintenance of permanent pasture), (2) certification in organic agriculture or other environmental certification, or (3) agroecological infrastructure, e.g. hedges and trees. **Mitigation** Main measures for crop production include: precision agriculture to reduce fertilizer use; systems approach (organic farming, other agroecology, longer rotations, legume crops); carbon farming (legume crops, woody crops). Main measures for livestock production are: R&D to reduce enteric emissions; improved management and storage of animal waste; synergy contracts with crop producers to grow legume crops and enhance farm autonomy in feed sources; support to mixed crop-livestock systems, with the use of organic fertilizers, and to permanent pasture. These will allow a reduced carbon footprint including reduced imported deforestation. Related measures include conditionality, eco-schemes, AECMs focused on soil, and coupled aid on legume crops. Mitigating national emissions requires improved energy efficiency in farm buildings and mechanized equipment and the use of renewable energy sources, as well as a reduction in food waste. **Adaptation** Farmers are encouraged to reduce production costs, shift to lower-input and more diversified systems, and maximize synergies between crops and animals. New varieties will be available from research and dissemination channels. Adaptation also requires reducing risks through investment, water conservancy and irrigation infrastructure, and other risk management tools such as insurance against multiple climate risks, and mutual funds. **Carbon sinks** Carbon storage is one of the main contributions from agriculture and forestry to climate action. This is supported through (1) conditionality, (2) eco-schemes (crop diversification, the rehabilitation of legume crops, cover crops in wine production and horticulture, no tillage, and farm certification - organic agriculture or other certification schemes), (3) several AECMs at system and local levels, (4) revised coupled aid to cattle production with a ceiling on animal densities, and (5) implementation modalities for compensatory payments to areas with natural constraints. Maintaining permanent pastures is a priority. A related dedicated eco-scheme providing payments for environmental services (PES) on a large scale is an important new measure. Outside the CAP, reducing land takes out of agriculture is critical. **AKIS** Innovation/R&D and advisory services are an important need. They will be supported partly through CAP measures, partly through EAP-AGRI, other EU programs and national policies.

Source: National Strategic Plans (Romania: version 1.1, October 2022; Spain: version 1.2, August 2022; France: validated version).

Finally, Spain and France have mobilized their national Recovery and Resilience Plans (RRP) to support specific aspects of climate action. The Spain RRP has a component dedicated to environmental and digital transformation of the agrifood and fisheries system. Measures relate to manure management systems, precision agriculture, and further modernization of irrigation systems for water saving and higher energy efficiency. France's RRP focuses on the development of a plant protein sector, as part of a national protein strategy launched in 2020; investments will take place on farms or in value chains.

The plan funds adaptation to climate change in the forestry sector. In addition, agricultural holdings are eligible to various measures in favor of the ecological transition.

4. Taking into account Findings from P173505 - Common Agriculture Policy (CAP) Programming Support RAS, Outputs 1, 2 and 3

The Sectors in difficulty study (Output 1), based on an in-depth review of existing research and data, highlighted how several of the crop and livestock categories that were categorized as in difficulty in Romania during the 2014-2020 period carried benefits for the environment, and specifically for climate change mitigation. Legumes (alfalfa, soybeans and beans) contribute to climate change mitigation via carbon sequestration and a reduction in application of fossil-fuel-based chemicals, although drought reduces nitrogen production by alfalfa, and areas under beans had fallen since 2010 due to drought and heat. A number of other sectors, such as hemp, vegetables, fruits, and sugar beets, provide many environmental benefits through their by-products – such as hemp in housing renovation – or their potential for sustainable land use systems – such as agroforestry for fruit. Hemp also stands out for being an ideal carbon sink, at a level equivalent to forests. While livestock production, in general, is a negative contributor to climate change by emitting greenhouse gas emission, either directly (from enteric fermentation) or indirectly (from feed-production activities and deforestation), a well-managed crop-livestock integrated system has many environmental benefits, and livestock waste can be used.

The Irrigation study (Output 2), based on combined analysis of satellite imagery and plot data from CAP area-based payments, computed a set of indicators / decision markers related to vulnerability in relation to climate change factors, i.e., water deficit and water availability. It provided a broad overview on the extent of irrigation usage and targeted crops. By analyzing the past distribution of drought events and through correlation with soil suitability and water supply resources, it provided a basis for informed decisions to shape new policies and action plans. The study identified areas with soil irrigation potential, that can be irrigated on a sustainable basis, and located the most vulnerable areas in terms of water demand and irrigation needs, therefore allowing to prioritize irrigation infrastructure projects. It provided detailed maps on all these indicators as well as on the actual location of cultivated crops (for 32 crop classes), irrigated areas and irrigated crops, thus lifting uncertainties regarding the exact location of plots that were irrigated. Finally, through the study, a Near Real Time system was developed to allow users to promptly identify, with delays of less than one week, hot spots where water demand for irrigation might exceed water resource availability, for better decision-making and action. An indirect result was the mapping of crops of interest as carbon sinks: pasture was mapped via satellite imagery with the highest accuracy, 99 percent compared to in-situ data.

The Family farms study (Output 3), through combined quantitative and qualitative modules, confirmed that small and medium-size farms in Romania fulfil an environmental function. This is especially the case in the mountain area where diversified landscapes and permanent pasture are two key assets for climate action, jointly with the preservation of biodiversity. Although small and medium farms had good access to agri-environmental-climate measures (AECM) during the 2014-2020 CAP programming period, and the numbers of farms with AECM was growing at the end of that period, only a small proportion of interviewed farmers perceived climate change in the mountains. Conversely most lowland farmers were aware of the impacts of climate change, although they mostly mentioned drought and water shortages. Lowland farmers had started to adapt. They were already adjusting cropping patterns. For example, rapeseed production was declining. The engagement of interviewed farmers in climate change mitigation was very limited, only one of them mentioning an interest in solar power. The family farms study identified a knowledge gap on permanent pasture and related climate action. What is known is that mountain pastures are fragile environments and that land tenure

modalities on these lands is a major obstacle to sustainable pasture management. Finally, the family farms study highlighted how Romania was the only one among six reviewed Member States where small and medium-size farms have very limited access to agricultural knowledge and information system (AKIS) service providers, with the exception of a small number of counties.

5. Lessons Learned from Other EU Member States

Strategic approach to climate action

There is no one-size fits all strategy for climate action. Differences among Member States and among regions within a country relate, among other factors, to dominant regional production types and to climatic conditions. Society's demand is an important factor in the definition of national strategies. In France for example, with growing societal demand to decrease environmental impacts from food consumption, there is an opportunity to create a carbon footprint labelling scheme. Also in France, there is strong consensus on the value of the environmental services produced by permanent pasture, and therefore on the relevance of supporting farmers to maintain areas under permanent pasture, including pastoral systems in mountain areas.

The three dimensions of climate action – mitigation, adaptation and carbon sinks – can be addressed jointly in the agricultural sector. The European Common Agricultural Policy encourages this combined climate-smart approach through a single objective for climate action. Addressing adaptation as a specific public policy field is needed in the UNFCCC, less so in climate-smart agriculture strategies. While carbon farming will generate a focus on mitigation and carbon sinks, win-win solutions that enhance carbon storage while supporting adaptation must be prioritized.

Adaptation to climate change nevertheless requires specific capacity-building and tools, as highlighted in the EU's climate change adaptation strategy. The "Climate change adaptation in the agriculture sector in Europe" report (EEA, 2019) provides an excellent overview. It also lists confirmed operational solutions.

Recent mitigation strategies focus on confirmed main GHGs in the agricultural sector: methane (CH4) and nitrous oxide (N2O). The production of renewables on farms is an income generation opportunity, and contributes to reducing energy-related emissions from the sector. In the case of biogas an additional important contribution is methane emissions reductions from animal waste. Elsewhere CO2 emissions are only a minor contributor to GHGs in the agricultural sector.

Combining several public policy levers is likely to be more effective. In France, the climate action strategy, as described during the discussion with INRAE, combines three levers: (1) promoting demand-led changes driven by consumers, (2) reducing emissions at farm level, especially methane due to the storage of manure, and increasing renewable energy production, and (3) promoting carbon storage in soils.

Reducing the carbon footprint of food, feed and bioenergy, i.e., reducing supply chain sourcing from high emitter operators, is as important as reducing emissions from national production, and therefore deserves being part of the strategy. For example, importing animal products from Brazil can (and will) be conditioned to commitment by value chain operators to source products that do not come from forest land recently cleared for agriculture.

Mountain areas deserve specific attention in climate action. This is part of the national strategies in France and Spain even though the format of the NSP is not conducive to making specific mention of mountain areas under the Climate action objective. Based on recent scientific evidence, the priority

in mountain areas is to preserve permanent pasture and forests. Pastoral areas can only be maintained if they continue to be used for livestock grazing. Carbon storage in pastoral areas is already high so that additional carbon storage should not be used as a rationale for reducing commitments for shifting to low carbon farming. Ensuring the resilience of farming systems to climate shocks, including through preserving diversified agri-food systems is also a priority in mountain areas.

There is a risk of exclusion of weaker producers. Carbon farming can benefit small and medium farms if payments relate not only to additional carbon sequestration, but also to maintaining existing carbon sinks. Technical and administrative solutions to monitor carbon farming should be designed to allow monitoring of small and medium farms. New solutions are also needed to allow small and medium farms to improve their practices without investing into expensive technical solutions such as individual equipment for precision farming.

Engagement with stakeholders is a strategic lever at national and local levels. Communication is critical to explain why the consumption of animal products must decline, but livestock farms should be maintained. Several solutions for adaptation and low-carbon agriculture and forestry may create environmental risks, for example large biogas facilities, or winter water storage reservoirs. Environmental impact assessments and engagement with the local population during these assessments will be critical to the successful design of such projects.

Insights on operational solutions for climate-smart agriculture

There is consensus on the climate-smart effectiveness of three agricultural practices: (1) **improved manure management**, to reduce methane emissions, (2) **precision farming** and other means to optimize quantities of chemical nitrogen fertilizer and therefore reduce N2O emissions, and (3) including **legumes** in the crop rotation, or in pastures as grass mixes. These solutions both reduce GHG emissions and support a shift to more resilient systems.

Similarly, **reducing waste** in the production and post-production stages and in food supply chains is a well-recognized means of reducing GHG emissions in the agrifood sector.

Minimum tillage has mixed effectiveness in increasing carbon sinks under field crops, and lower effectiveness than what was initially assessed. Recent research finds that, in temperate climates, e.g., in Northern France, the main region for field crop production, there is no significant effect of no-tillage on carbon storage. On the other hand, minimum tillage has positive effects in dry climates in Spain (Pellerin 2022).

Box 5. Enhancing Carbon Sinks: France's Experience

In France's context, three improved practices can best increase carbon storage under field crops:

- Adding intermediary crops in the crop rotation,
- Developing agroforestry (planting trees and hedges in field crops), and
- Incorporating temporary pasture in the crop rotation.

In livestock production, increasing direct grazing and reducing hay production can best increase carbon storage under permanent pasture. Preventing that permanent pasture is turned into field crops is a priority.

These practices are economically viable since their cost is lower than the current nominal value of the carbon that they allow to store. They also generate environmental co-benefits for biodiversity and water quality. They can be monitored via satellite imagery and are therefore good candidates for carbon farming certification.

Source: Pellerin et al 2022, as per discussion with Dr. Pellerin during the workshop on Climate Action in Agriculture.

Nitrification inhibitors or **feed additives** are among the new solutions with potential broad dissemination and high effectiveness in reducing GHG emissions (DG Agri 2021). Nitrification inhibitors

are already available. Linseed is an existing feed additive while other additives are under development. However, moving towards climate smart agriculture will require other changes in the production systems in order to increase resilience, going beyond the use of these new inputs.

Tailored solutions are required to incorporate this small number of confirmed climate-smart solutions into farming practices and production systems. Practical solutions differ across agroecological regions, agricultural holding structures and value chains., taking into account agricultural holdings' contrasted capacity to invest and to access information. Tailored solutions are also needed to design **advance warning systems** of extreme climatic events and other **emergency planning measures** to address the impact of these events.

Mixed farming systems have an advantage in climate-smart agriculture. They increase availability of organic fertilizer for crops and reduce vulnerability to climate shocks. They also generate co-benefits in terms of biodiversity. These systems deserve being preserved when they are still present. When they have mostly disappeared (as it is the case in France), their redevelopment is encouraged. Contractual arrangements between field crop farms and livestock farms is an alternative option supported in the CAP NSP in France.

Irrigation is one among several climate change adaptation solutions, and a major one in Mediterranean climates. In the absence of irrigation, increasing the share of resilient crops and turning to new varieties is critical (World Bank 2015). Irrigation systems will only be economically viable if cropping systems and irrigation techniques evolve, and this evolution must contribute to improving the GHG balance of irrigated agriculture. Well-known solutions include: lining irrigation canals, phasing out flood irrigation, and improving reservoir management. Transfers to deficit-areas from other basins, and mixed use of underground and surface water sources are two other solutions (World Bank 2015). New solutions are available to reduce energy consumption and costs and increase water use efficiency. In Spain, solar power is already associated with irrigation systems on a broad scale (Sanchis-Ibor et al. 2021).

Box 6. Adaptation to climate change in irrigated systems: Spain's experience

In Spain's context, climate action in irrigated agriculture is challenging. Agriculture accounts for 80% of water consumption in the country. The modernization of irrigation systems has mobilized national and regional public budgets for several decades. However, as a result, irrigated areas increased, and crops with a greater water footprint were introduced as well as double cropping. This has led to an increase in water use in some regions. In addition, the cost of water in Spain is lowest in the EU, so that there is no economic signal on water use.

Reducing energy costs is critical in areas that do not use gravity irrigation. Drip irrigation was developed on a large scale but it requires pressurized water sources. The cost of electricity for irrigation has markedly increased, adding to the investment currently needed to renew ageing drip irrigation equipment. Solar power is a confirmed viable source of energy in drip irrigation regions. However, land availability may be a limiting factor to install solar power capacity, so that a shift towards other renewables is being considered.

Spain is a leader of seawater desalination in the EU. Irrigation from desalinized seawater is a typical example of maladaptation when fossil fuels are used since it results in increased GHG emissions. Desalination through renewable energies is an option that is actively promoted not only for Spain but also other countries with a Mediterranean climate.

Spain is also leading in the EU for the reuse of treated wastewater (TWW) in irrigation, having encouraged this alternative water source since the end 2010s. Two regions that specialize in fruit and vegetables, Valencia and Murcia, account for two thirds of this use. Main challenges in expanding the use of TWW in agriculture include consumer perceptions and farmers' reluctance.

Sources: Government of Spain 2021, Blanco et al 2021, Sanchis-Ibor et al. 2021.

Institutional coordination for climate action

It is well known that climate action is an all-government action, requiring coordination between several ministries. In France, the national multisector low-carbon strategy provides a strong basis for this coordination. Preserving and enhancing carbon sinks further requires a coordinated approach between agriculture and forestry, and between these sectors and urban-rural planning.

Setting up a mechanism for carbon farming certification may require the involvement of ministries other than agriculture. In France, a low-carbon certification scheme is being launched through local projects targeting various sectors, including agriculture. Certification is awarded by the ministry in charge of the ecological transition. Coordination between ministries and research institutes is seen as important in the case of France to prepare for carbon farming.

Actions targeting the food system and food consumers require institutional coordination beyond the agricultural sector proper. In France, ADEME, the ecological transition agency under the dual mandate of the ministry in charge of environment and the ministry in charge of research, was influential in the promotion of a shift in food diets as a key lever for climate action in agriculture. France is preparing for the introduction of environmental labelling for various consumer goods, including carbon labelling for food products.

Box 7. Towards carbon labelling on food products: France's experience

The labelling of food products according to environmental impacts is expected to become operational in France in 2023-2024, in application of the 2021 French law on environmental labelling of foods. The objective is to encourage better choices of consumers, generating a pull effect for producers and value chain operators. Dimensions of environmental impact include at least the carbon footprint, damage to biodiversity, and impact on water consumption.

A trial phase took place in 2021, steered by ADEME. The French Ministry in charge of agriculture and food security is now working with INRAE, the national research institute, on the operational development of this labelling scheme.

The Eco-Score will be a rating that goes from A to E. Basing this rating on average life-cycle assessment data proved to be too expensive. This also failed to consider the ecosystem services provided by some types of production such as extensive livestock raising. Conversely, variations in soil carbon stocks are an easily available indicator that can be associated with land uses having positive environmental impact.

Sources: Hellias et al. 2022, as per discussion during the workshop on Climate Action in Agriculture.

Addressing barriers to change through AKIS and partnerships

The CAP NSPs of Romania, Spain and France all point out to the importance of knowledge transfer, training and farmer advisory services in relation to climate action. Climate action is a field in which partnerships between researchers, advisors, farmers and other stakeholders bring added value, given the need for further developing scientific knowledge, for designing new management tools, and for adapting existing solutions to local contexts. This is the approach promoted under the European Innovation Partnership for Agriculture (EIP-AGRI).

There are also social and economic barriers for farmers to shift towards climate-smart agriculture and carbon farming. As mentioned in the conclusion of the interview with INRAE, good practice in interacting with farmers, to facilitate attitude change, is an area for future knowledge exchange between Romania and Member States with a stronger AKIS system.

Recommended References

This section provides a selection of recent documents and reports that summarize legal and strategy frameworks, current research and operational solutions.

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