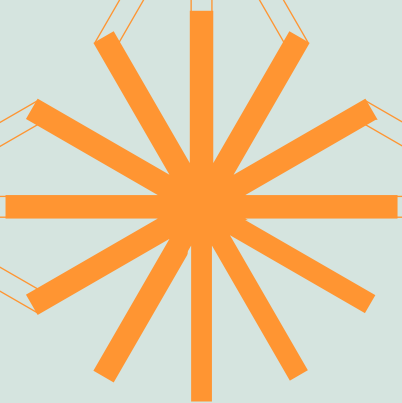




Driving the green transition through
food, land use and water management

Analysis of the agri-food value chain:
current status, key challenges and
proposals to enhance the sector's
climate resilience.

Results of the Food and Climate Change Working Group led by **alinnea**

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alinnea has been a key player in Spain's climate action ecosystem since mid-2024. As part of IE University and supported by the European Climate Foundation, **alinnea** specializes in comparative analysis, identification, and articulation of climate change measures and actions that engage the public and private sectors, as well as civil society.

Operating under a multi-stakeholder, dialogue-research-action framework, **alinnea** seeks to develop solutions that overcome climate action barriers while ensuring they are socially just, economically viable, and beneficial for the environment and biodiversity protection.

Between May and July 2024, **alinnea** conducted interviews and workshops with over seventy key stakeholders from the private sector, public administration, NGOs, trade unions, and academia, gathering insights on their concerns and priorities. Based on these discussions, a working group was formed to develop proposals to advance the mitigation and adaptation objectives of the agri-food sector.





Introduction

This report presents the main conclusions of the working group created by **alinea** whose main objective is to identify the challenges in the agri-food sector linked to climate action.

This report is based on an analysis of the food chain, defined here as the full value chain of the agri-food sector as a whole, which covers economic activities upstream and downstream of the primary sector, including 1) the production and supply of inputs, 2) the primary sector , 3) the agri-food industry, 4) food distribution, and 5) consumption.

The objective of this approach is to highlight synergies and opportunities for strengthening information exchange and accountability among the various actors involved in promoting climate transition in the Spanish agri-food sector.

The deliberations of this working group are reflected in the key challenges and recommendations sections and aim to contribute to a fair and competitive transition of the agri-food sector in line with the objectives set out in the National Integrated Energy and Climate Plan (PNIEC) for 2030. We would especially like to thank the members of this working group for sharing their ideas, reflections and time with the group.

Table 1: Members of the alinea working group - agri-food sector and climate change.

NAME	SURNAME	ORGANISATION	POSITION
Alejandro	Martinez Berriochoa	Eroski	General Manager of the Eroski Foundation / Director of Health, Sustainability and Quality in Strategic Marketing
Almudena	Gómez Ramos	IEGD-CSIC	Professor
Ana	Iglesias	Polytechnic University of Madrid	Prof. Environmental Policy
Blanca	Casares Guillén	AEIDL (European Association for Innovation in Local Development)	Project Manager and Policy Expert
Chiara	De Tomassi	BC3	Researcher - PhD
Cristina	Monge	Political scientist consulting	Political Analyst
Daniel	de la Nogal Fernández	EIT FOOD	Key Account Manager
Daniel	González	HINTDECIDE SNLE	Consultant
Diego	Garcia Vega	IDDRI	Consultant
Eva	Torremocha Bouchet	Daniel and Nina Carasso Foundation	Responsible for the sustainable food program of the Daniel and Nina Carasso Foundation in Spain.
Francisco	Sanz Piedrafita	Ibercaja	Head of Sustainable Finance Solutions
Fernando	Moraleda Quílez	LLYC	Senior Advisor
Gaia	Maridati	Consultant	Consultant
Gonzalo	De la Camara	IE University	Director, Centre for Water & Climate Adaptation
Irene	Pérez Beltrán	Researcher	Researcher

1. Within the economic activities of the primary sector, this working group focused solely on agriculture and livestock farming, without delving into other economic sectors such as fishing and forestry.

NAME	SURNAME	ORGANISATION	POSITION
Inmaculada	Batalla	BC3	Fellow
Javier	López	PROVACUNO	Manager
Jon	Ruiz Infante	Centre for Environmental Studies	Project Technician
Jordi	Domingo Calabuig	Global Nature Foundation	Sustainable Agriculture Project Coordinator
José	Castro León	THE LLAURADORA I RAMADERS UNION	Project Manager
Koldo	Rey	Fundación Espigoladors	Harvest Technician in Baix Llobregat and Metropolitan Area
Lola	Berna	ECODES	Public Policy and Climate Governance Technician
Manuel	Linares	COAG	Policy officer Climate Change and Rural Development.
Maria Jose	Alonso Moya	Spanish Climate Change Office	Senior Advisor on Climate Change
María	Coto Sauras	ECF	Senior Associate, Spain Programme Madrid
Mario	Rodriguez	ECODES	Associate Director of Just Transition and Global Partnerships
Nieves	Álvarez	LLYC	Senior Director
Paul	Iano	CoopCycle	President of the board
Teresa	Moran	Madrid City Council	Head of the Diagnostic and Analysis Service of the General Plan Office
Tomas	García Azcarate	IEGD-CSIC and CEIGRAM	Vice-Director of the Institute of Economics, Geography and Demography (IEGD-CSIC), associate researcher at CEIGRAM, member of the French Academy of Agriculture and the Accademia dei Georgofili.
Víctor	Martínez Cano	BC3	Researcher - PhD
Luis	Tejero	Madrid City Council	Head of Technical Studies, Planning and Development

The working group received technical support from researchers Inma Batalla, Chiara De Tomassi and Víctor Martínez Cano from the Basque Centre for Climate Change (BC3) along with Cristina Monge Lasierra who facilitated the working sessions in collaboration with BC3.

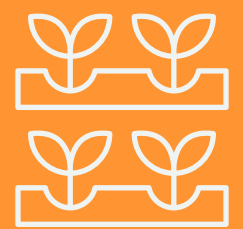
Three dialogue sessions were held between June 2024 and January 2025. We extend our gratitude for the time and contributions of the individuals and organizations listed below, who presented on the following topics during these sessions:

- Guiding policy principles and recommendations of the strategic dialogue on the future of EU Agriculture in relation to climate action. By Ricard Ramon, DG Agri and Tomás García Azcárate, IEGD-CSIC & CEIGRAM
- CROPS4LIFE Project – reducing the environmental footprint of the agri-food system in Vitoria-Gasteiz, Jon Ruiz de Infante, Technician at the Environmental Studies Centre.
- Food traceability - Eroski's experience. By Alejandro Martinez, Eroski Foundation.





Relevance of the Agri-Food Sector



The Spanish agri-food sector is a key pillar of the national economy, encompassing a wide and diverse range of activities. It contributes significantly to the country's Gross Domestic Product (GDP), accounting for 9%, while also playing a crucial role in employment generation (11.3%) and influencing the trade balance (Cajamar, 2024a).

Spain leads Europe in agricultural income², reaching €32,433 million in 2023 (16.3% of the EU-27 total). The value of agricultural production hit a record €65,513 million in 2023, positioning Spain as the fourth-largest producer in the EU (ENA, 2025). The country is the world's top producer of olive oil, the second-largest producer of wine, the third in pigmeat production, and the leading aquaculture producer in Europe. However, Spain is among the European countries most vulnerable to climate change (EEA, 2024). The climate debate in the Spanish agri-food sector is a topic of interest, due to its direct impact on the economy, the environment and food security. Given Spain's climatic and geographical diversity, the agri-food chain faces unique challenges in adapting to these changing conditions.

According to data provided by Agroseguro³, agricultural insurance claims in 2023 reached €1,241 million, confirming the markedly negative climatic trends of the past decade. The period from 2017 to 2023 stands as the most damaging in the 43-year history of agricultural insurance, with unprecedented compensation figures. Drought was the leading cause of insurance claims in 2023, with losses affecting nearly 60% of the total insured agricultural area.

This climate threat of increasingly frequent droughts makes Spain's farming and livestock sectors highly vulnerable. Water demand is concentrated in the most arid regions, where many river basins suffer from water stress or are over-exploited (Pulido Velázquez et al., 2020).

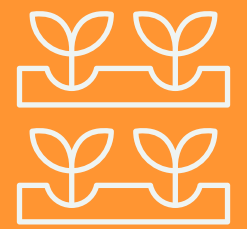
Paradoxically, despite being one of the value chains most exposed to climate change, the agri-food sector is also one of the largest contributors to its causes. According to a recent study (Crippa et al., 2021), the sector accounts for 34% of global greenhouse gas (GHG) emissions and around 30% of GHG emissions in Europe. The majority of these emissions, 71%, originate from agricultural activities and land use or land-use changes, while the remaining share stems from value chain activities such as industry, distribution, consumption, and waste management.

The Spanish agri-food sector is at a critical juncture, where the measures taken today will determine its ability to maintain its economic and environmental relevance while adapting to and mitigating the effects of climate change. This challenge drives the need to transform food production and consumption systems, ensuring a supply capable of feeding the entire population with a diverse range of high-quality, safe, and healthy foods, while also contributing to the regeneration of the natural resources and ecosystems that sustain them. This requires the agri-food sector to be competitive, efficient, and deeply committed to innovation and embracing new technologies, integrated strategies, and practices with significant environmental benefits.

2. Agricultural income represents the value generated by agriculture and livestock, i.e., it measures the remuneration of all factors of production (land, capital and labour).
3. Agroseguro. <https://agroseguro.es/la-siniestralidad-del-seguro-agrario-marca-record-historico-en-2023-1-241-millones-de-euros/>



The Agri-Food sector in the context of climate change



What follows is a brief overview of each stage of the food supply chain, highlighting data relevant to assessing both its contribution to and vulnerability in the face of ongoing climate change.

Emissions from the agri-food sector are not reported at the chain level. Disaggregated information is available for some economic activities (agriculture, livestock, agri-food industry), but no accurate quantitative information has been obtained on emissions from input production, food distribution, or consumption. In addition, many emissions, especially those linked to food inputs (e.g., animal feed, health products) and agricultural inputs (fertilizers, plant protection products, energy, etc.), often come from non-EU countries, which are referred to as scope 3 emissions, which hinders data collection therein.

In addition to the descriptions for each link provided below, the Annex includes the regulatory framework for the agrifood sector in the context of climate change.

1. PRODUCTION AND SUPPLY OF INPUTS

The growth in agricultural production experienced in recent decades can be explained largely by intensive use of inputs. This section provides information on two of these inputs: nitrogen fertilizers and plant protection products, which account for much higher consumption volumes than the rest and therefore have a significant climate impact compared to

other inputs such as phosphate and potash fertilizers, livestock hygiene and health products, etc

According to Menagat et al. (2022), industrial synthesis of nitrogen fertilizers alone generates 0.8% of global GHGs due to the intensive use of energy in ammonia synthesis through the Haber Bosch process. In addition, a large proportion of GHG emissions from nitrogen fertilizers occur after application, as we will see in the next section. Phosphate and potash fertilizers generate fewer emissions as they are produced through extractive activities.

Fertiliser use per hectare of cultivated land serves as an indicator of the level of intensification in agricultural systems. As shown in Figure 3, nitrogen fertiliser consumption per hectare is higher in Germany, France and the Netherlands than in Spain. This is largely due to the extensive area of rainfed farmland in Spain, where average fertiliser application rates are lower. Following a drop in consumption during the 2008–2009 economic crisis, fertiliser use in Spain rose until 2014. A slight downward trend has been observed since 2015. In 2022, a sharp decline in consumption was recorded, driven by the surge in fertiliser prices caused by the war in Ukraine, an effect that was further exacerbated in Spain by severe drought conditions.

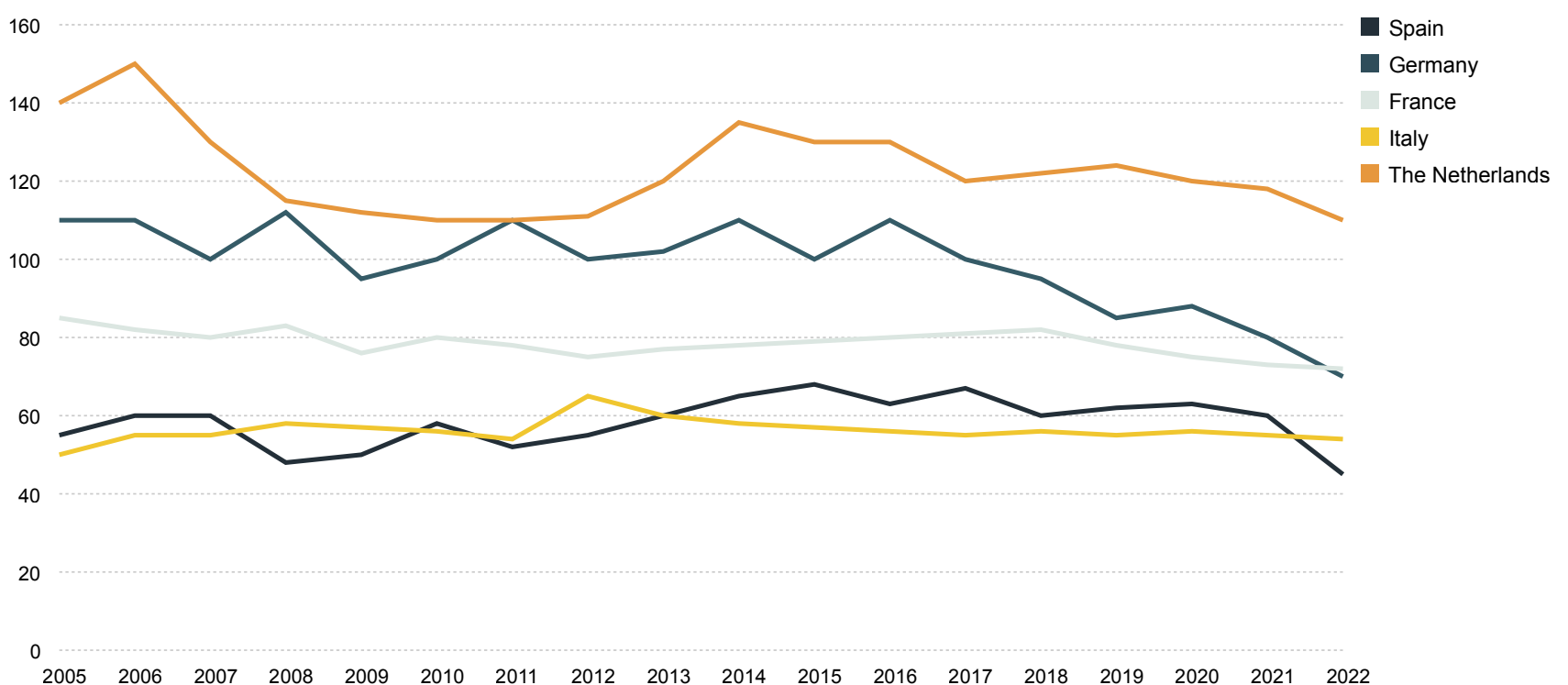


Figure 1 : Nitrogen fertilizer consumption in 5 eu-27 countries (2005 - 2022) in kg/ha/year.

Source: Cajamar, 2024b.



The chemical industry of phytosanitary products is also characterized by energy-intensive processes and dependence on fossil fuels. In general terms, the consumption of phytosanitary products per area in Spain is higher than the EU-27 average, with values close to 5 kg/ha compared to almost 3 kg/ha in the EU-27. The following graph shows the evolution of total sales and their breakdown by type of crop protection product.

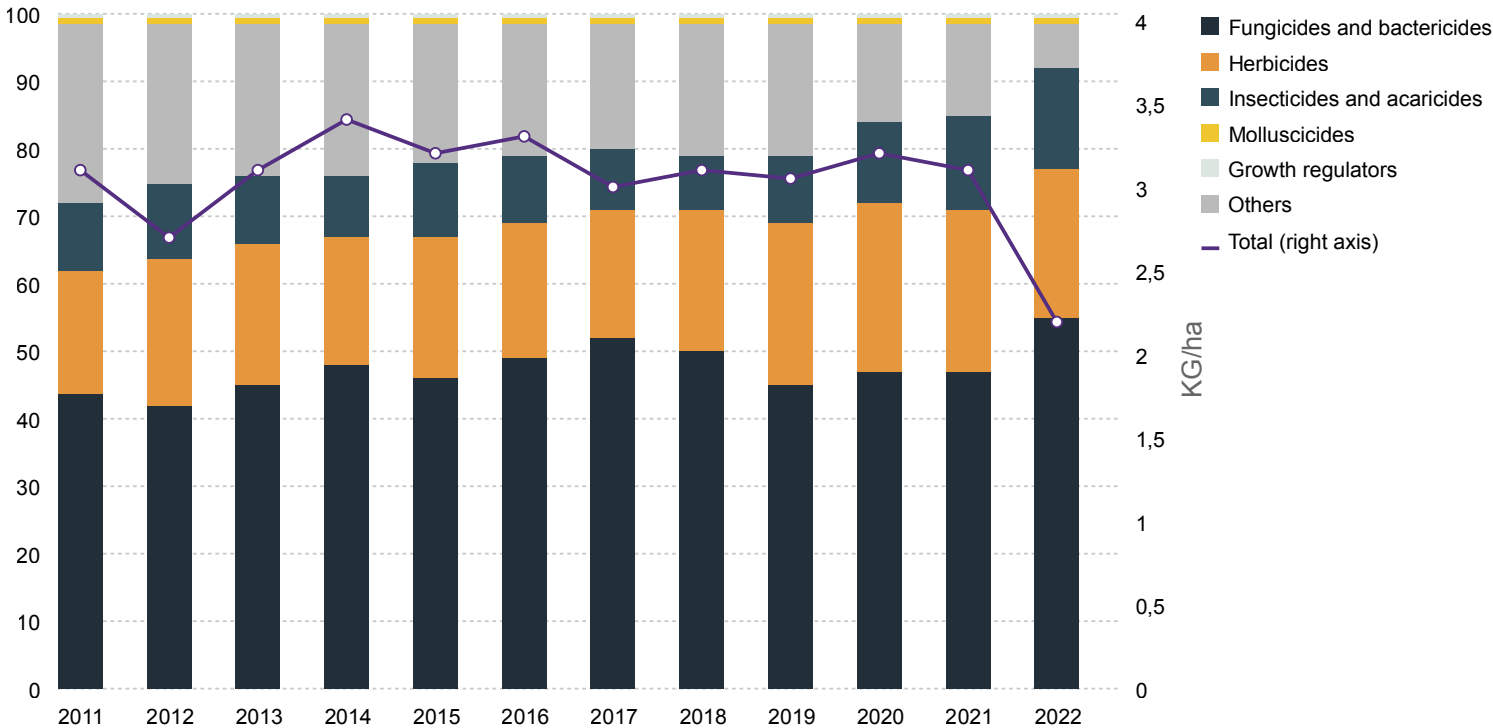


Figure 2 : Evolution of plant protection product sales distribution in Spain by percentage.
Source: Cajamar, 2024b

In preparing this report, we were unable to quantify the GHG emissions corresponding to the average annual consumption of fertilizers and plant protection products in Spain.

2. AGRICULTURE AND LIVESTOCK

Agricultural structure

Spain's agricultural sector is characterised by a high proportion of small-scale farms: over half operate on 5 hectares or less. The average annual output per farm is approximately €49,600, although 63% of farms generate less than €15,000 per year which is significantly below the levels observed in other major agricultural producers in the European Union, such as Germany, France and the Netherlands (Table 2). As discussed in the section on key challenges identified, there appears to be a correlation between farm size and economic indicators such as profitability and investment capacity, a link that is supported by some stakeholders in the sector (COAG, 2021).

Table 2 : Structural characteristics of farms by country, 2020.
Source: ENA (2025) with data from the statistical yearbook, MAPA.

Member State	No. of holdings	UAA (ha)	UAA/holding	Standard Output	SO(€)/holding	AWU	AWU/holding	AWU/ha
Germany	262.560	16.578.460	63,1	46.612	177.529	469.910	1,79	0,03
Spain	914.870	23.913.680	26,1	45.349	49.569	827.470	0,90	0,03
France	393.030	27.364.630	69,6	64.325	163.664	670.850	1,71	0,02
Italy	1.130.530	12.041.230	10,7	56.615	50.078	849.140	0,75	0,07
The Netherlands	52.640	1.817.900	34,5	24.874	472.530	151.210	2,87	0,08
EU	9.067.300	155.093.000	17,1	359.984	39.701	7.917.720	0,87	0,05

In terms of ownership, the vast majority of farms are held by individuals (94%), with the owner typically serving as the farm manager (81%). The profile of farm holders is predominantly male (71%) and ageing, with 41% over the age of 65. Moreover, generational renewal remains limited. In 2023, employment in agriculture, livestock, forestry and fisheries totalled 767,300 persons (3.6% of total employment), representing a 3.9% decrease compared to 2022 (ENA, 2025).



The sector is undergoing a process of structural transformation. The number of agricultural holdings in Spain has declined significantly over the past three decades from approximately 1.6 million in 1989 to 914,871 in 2020, a reduction of 42.6% (Álvarez, 2023). Despite this decline, the period between 1990 and 2020 saw robust growth in real agri-food production and export (exceeding 80%) while the utilised agricultural area (UAA) remained relatively stable at around 23 to 24 million hectares. This trend reflects substantial productivity gains achieved over the period.

Table 3 : Evolution of the main structural indicators of spanish agriculture.
Source: MAPA, 2023b.

	2009	2020	Var. %
Number of holdings	989.796	914.871	-7,6
Total Area	30.614.166	28.931.479	-5,5
Utilised Agricultural Area (UAA)	23.752.688	23.913.682	0,7
Organic UAA	525.914	1.871.529	255,9
Number of livestock holdings	242.630	169.576	-30,1
Total Livestock Units (TLU)	14.576.640	16.565.204	13,6
Standard Output (Eur '000) (TSO)	34.173.070	45.167.717	32
Annual-Working-Units (AWU)			
Total	922.026	851.574	-7,6
Holder	330.909	318.520	-3,7
Family member of the holder	232.774	116.828	-49,8
Non-family workforce	358.343	416.225	16,2
Structural Indicators			
Average TA per holding (ha)	31,5	31,6	0,4
Average UAA per holding (ha)	24,6	26,4	7,4
Average AWU per holding	0,9	0,9	-0,1
Average TLU per holding	14,7	18,1	22,9
Average TSO per holding	34.525	49.371	43

In the decade preceding the most recent Agricultural Census (2020), the number of agricultural holdings in Spain declined by 7.6% (MAPA. 2023b) while the average farm size increased by 7.4%, reaching 26.6 hectares per holding (Table 3). As shown in Figure 1, the number of farms decreased across all size categories except the smallest, while holdings larger than 100 hectares grew by 9% compared to the 2009 Census. Two key factors help explain this trend. First, the structure of CAP support which is largely based on eligible agricultural area, acts as an incentive to expand land holdings. Second, economies of scale play a role, as increasing farm size can enhance profitability and facilitate compliance with regulatory requirements, particularly those related to sectoral standards and food safety.

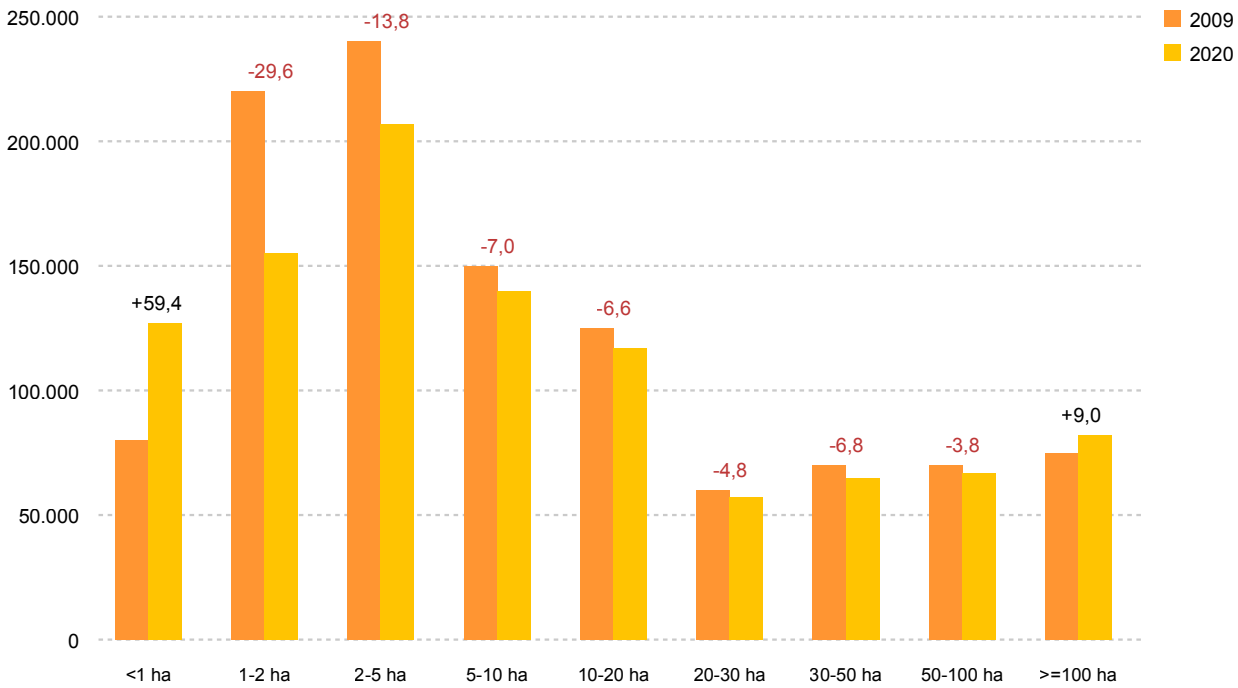


Figure 3 : Evolution of the number of farms by usable agricultural area, agricultural census comparison 2009 -2020.
Source: MAPA (2023b)

In terms of labour structure, relative weight of family farming in Spain has declined by 49.8% since 2009, together with a shift toward more commercially oriented farms that depend on salaried labour, which has increased by 16.2% (+16.2%) (Table3). Labour shortages are frequent and represent an additional challenge for certain regions and crop types.

Land use by production specialisation

Agricultural land occupies 52% of Spain’s total geographical area, underscoring the scale of the challenges the sector faces, particularly given that Spain is among the EU Member States most vulnerable to climate change, as noted in various assessments (EEA, 2024). Farmland accounts for 33% of the national territory, while permanent grasslands and pastures represent a further 19% (MAPA, 2023a).

Spanish agriculture features a combination of irrigated and rainfed cropping systems, with irrigated land covering 22% of the total agricultural area. However, irrigation intensity varies significantly by region and crop type. The main irrigated zones are concentrated in the Ebro Valley, the Valencian Community, Murcia, Andalusia, and parts of Castilla-La Mancha, many of which are affected by water stress (Pulido Velázquez et al., 2020). Key irrigated crops include vegetables, fruit trees, rice and citrus, while rainfed systems are more prominent in much of the interior and are characterised by cereals, vineyards and olive groves.

Figure 4 and Figure 5 provide an overview of Spanish agricultural holdings by their technical–economic orientation (TEO), based on data from the 2020 agricultural census. Crop-oriented farms clearly predominate in number (over 80% of total holdings), but they account for only about half of the utilised agricultural area (UAA) and generate lower average output (€30,128 per-holding). In contrast, livestock farms represent only 2 in 10 holdings but tend to be larger in both area and economic output, averaging €135,225 per-holding.

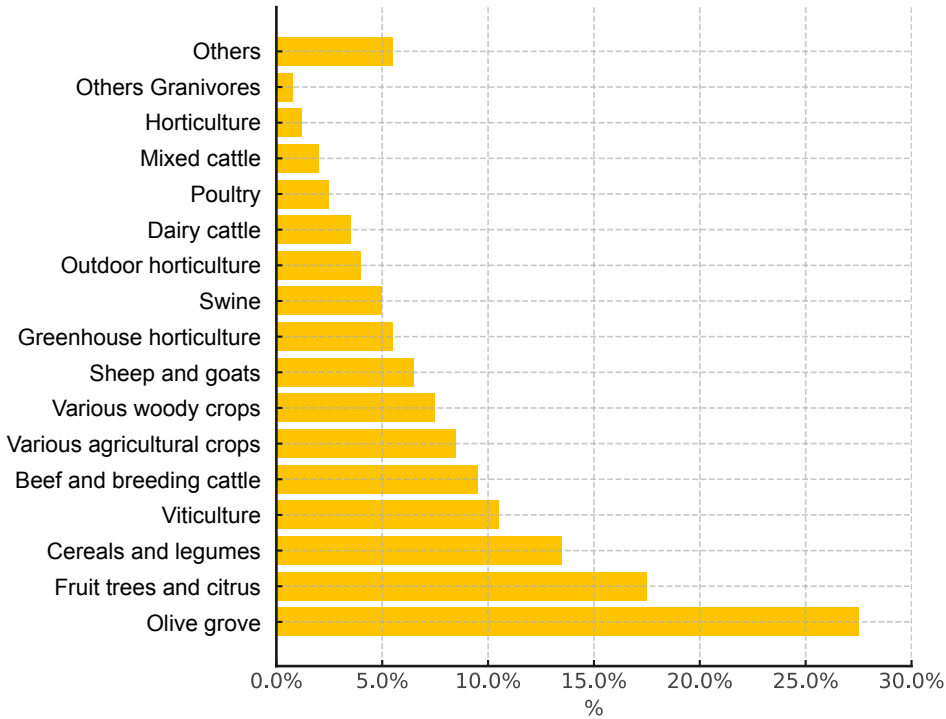


Figure 4 : Spanish farms according to technical-economic orientation. In percentage.
Source: Álvarez (2023), based on INE data (agrarian census 2020).

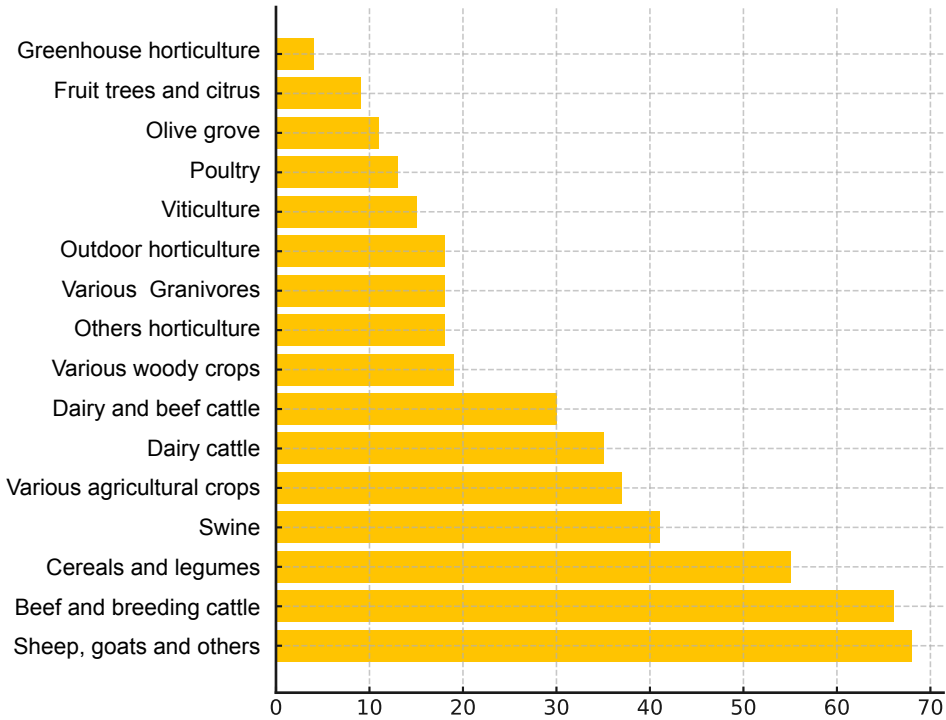


Figure 5 : Average useful agricultural area (uaa) according to the technical-economic orientation of spanish farms. In hectares.
Source: Álvarez (2023), based on INE data (agrarian census 2020).



By production sector, most Spanish agricultural holdings are dedicated to olive groves, fruit and citrus trees, and cereals and legumes, which together represent 63% of all farms. However, in terms of land use, sheep and goat farming, cattle farming, and the cultivation of cereals and legumes occupy the largest share of utilised agricultural area, collectively accounting for over half of the total (Álvarez, 2023). This uneven distribution of agricultural land is a key consideration when designing and implementing sector-specific climate adaptation strategies.

Greenhouse horticulture plays a particularly important role in Spanish agriculture, with production concentrated in Andalusia, the south-east of the peninsula, and the Canary Islands. Between the 2009 and 2020 agricultural censuses, the area under greenhouse crops increased by 42.1% (INE, 2022), likely driven by the high profitability associated with this specialised form of production (Álvarez, 2023).

In the livestock sector, the number of animals per holding has risen by 23%, a trend especially evident in larger operations such as pig farms, and in dairy and beef cattle production (MAPA, 2023b). This increase has occurred alongside a general decline in the total number of livestock facilities (Table 3).

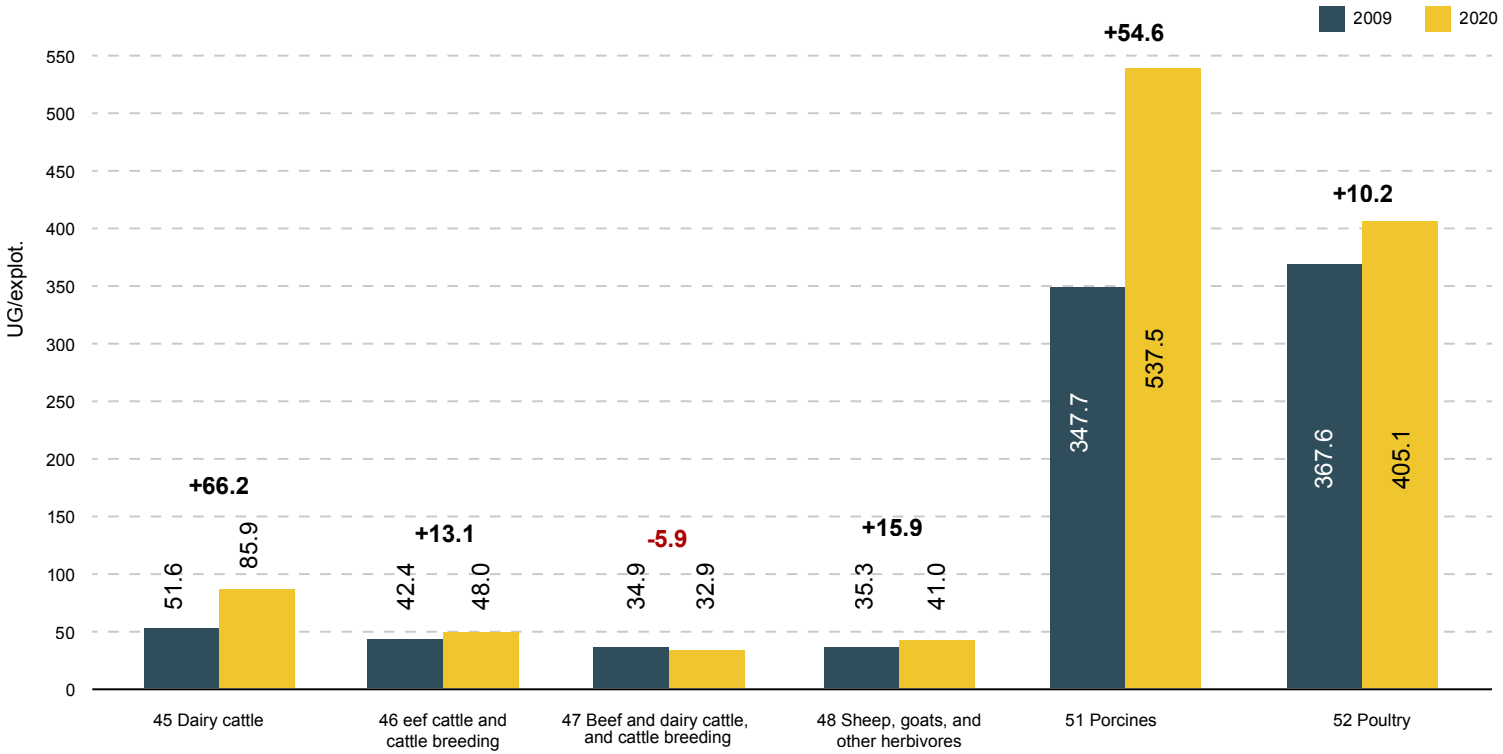


Figure 6 : Evolution of the average total livestock units (tlu) per farm, comparison of agricultural census 2009-2020.
Prepared by the author with data from MAPA (2023b)

Finally, when assessing the vulnerability of each production specialisation, it is important to consider that nationally significant sectors tend to be geographically concentrated. Olive holdings, for example, are heavily concentrated in Andalusia, which accounts for over 60% of all such farms in Spain. Fruit and citrus production are primarily located in the Valencian Community (45% of the total), while cereal and legume cultivation are concentrated in Castile and León and Castile-La Mancha, which together account for 62% of the national total. Livestock farms are more widely distributed but are particularly prominent in Catalonia, Galicia, Castile and León, and Andalusia (Álvarez, 2023).

While most regions exhibit a degree of sectoral diversity, certain areas are highly specialised in a single type of production. These include Andalusia (olive groves), Asturias and Cantabria (cattle), the Valencian Community and Murcia (fruit trees), and La Rioja (viticulture). Such regional specialisation may imply lower resilience to climate change impacts.

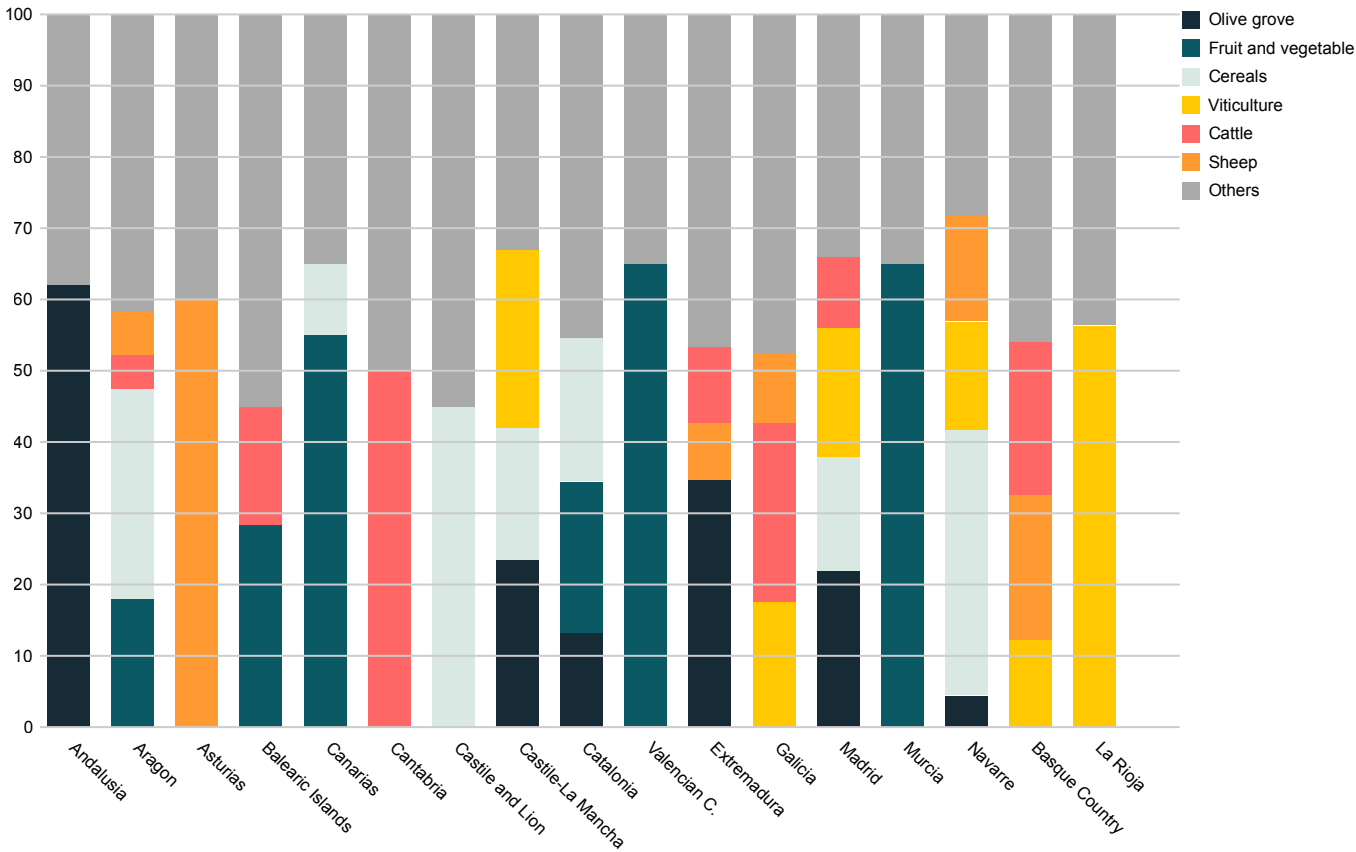


Figure 7 : Production specialisation of each autonomous community. % Of total farms in each region.
Source: Álvarez (2023)

GHG emissions

From the perspective of greenhouse gas (GHG) accounting, agriculture and livestock farming are classified as diffuse emission sectors. Emission estimates in these sectors are subject to significant methodological uncertainty, due both to the diversity of production systems and the complexity of accurately quantifying and monitoring their respective emission profiles. According to the National Emissions Inventory (MITECO, 2024a), agriculture and livestock together accounted for 11.9% of Spain’s total GHG emissions in 2022, equivalent to 34.8 million tonnes of CO₂-equivalent. The primary sources are enteric fermentation from livestock (49%, CH₄), manure management (31%, CH₄), and agricultural soil management, particularly the application of nitrogen-based fertilisers, which results in nitrous oxide (N₂O) emissions (MITECO, 2024a).

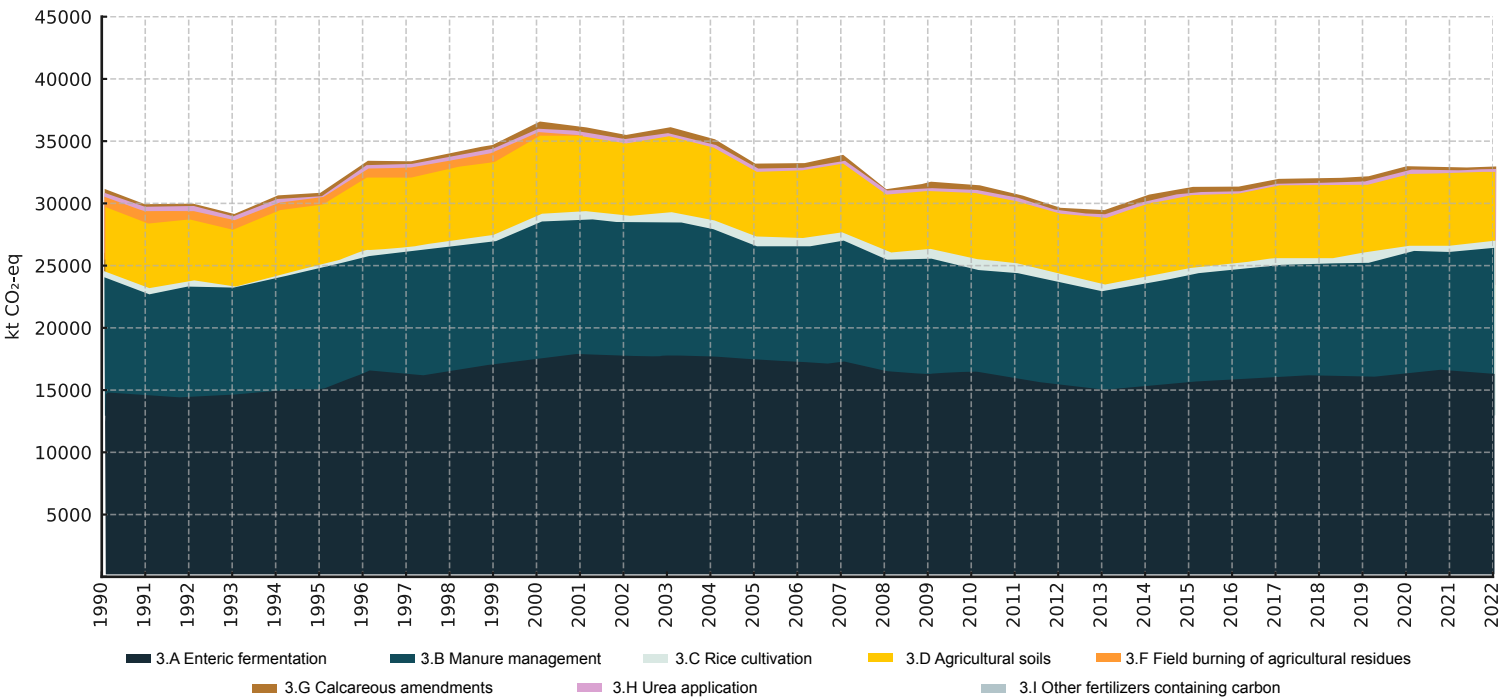


Figure 8 : Evolution of CO₂ equivalent emissions (t) from the agricultural sector (1990-2022).

Source: MITECO(2024a)

The National Integrated Energy and Climate Plan (PNIEC) classifies the agricultural sector as a “non-energy diffuse sector” and sets a target of reducing its greenhouse gas emissions by 18.6% compared to 2005 levels. However, an analysis of the trend reveals that emissions from the sector increased by 5.9% between 1990 and 2022 and decreased by only 0.2% between 2005 and 2022, thereby falling significantly short of the reduction target.

To address this gap, the PNIEC outlines a set of mitigation measures for the agriculture and livestock sector, including:

- Promoting crop rotation in rainfed systems, particularly the inclusion of legumes to replace cereal monocultures.
- Optimising nitrogen application in line with crop requirements
- Improving slurry management, including regular emptying in pig housing, covering of slurry storage ponds, separation of liquid and solid fractions, and composting of solids.
- Utilising pruning residues from woody crops as biomass.
- Enhancing energy efficiency on agricultural holdings, within irrigation communities, and in farm machinery
- Developing biogas and biomethane production.

LULUCF and sinks

Finally, emissions associated with land use, land use change and forestry (LULUCF) must also be considered, as they are reported separately in the National Emissions Inventory. When the net balance of greenhouse gas emissions and removals from these activities is negative, indicating that more carbon is sequestered than emitted, the sector functions as a carbon sink. This outcome reflects sustainable land management practices that enhance carbon sequestration, particularly in forests and croplands. In 2022, the LULUCF sector contributed a net sink of –47.4 million tonnes

of CO₂ equivalent (MITECO, 2024a). The PNIEC also includes a series of targeted measures for enhancing carbon sinks in both agriculture and forestry, many of which are closely tied to agricultural and livestock management practices.

Measures proposed in the PNIEC to preserve and enhance agricultural carbon sinks include:

- Promoting conservation agriculture (direct seeding).
- Maintaining ground cover and incorporating pruning residues in woody crop systems.

Several of these measures are also integrated into Spain’s CAP Strategic Plan (2023–2027) (MAPA, 2021) under the eco-scheme framework, particularly those grouped under the category of “low-carbon agriculture.” For example, direct seeding techniques are already applied on 89% of Spain’s cereal-growing area (MAPA, 2021). Regarding soil cover, 25% of woody crop areas currently use plant cover as a soil protection measure which is an increase of 14.7% over the past decade. The area under direct seeding has expanded by 65.4% since 2011, indicating that the sector is already taking action to implement both mitigation and adaptation measures.

Although the LULUCF sector currently functions as a net carbon sink in Spain, it could become a source of emissions in the future, as is already occurring in some other EU Member States. It is therefore essential to reinforce policies and practices that safeguard its sink capacity, particularly considering projected increases in extreme weather events, such as forest fires, which pose a growing threat to carbon sequestration potential (Figure 9)

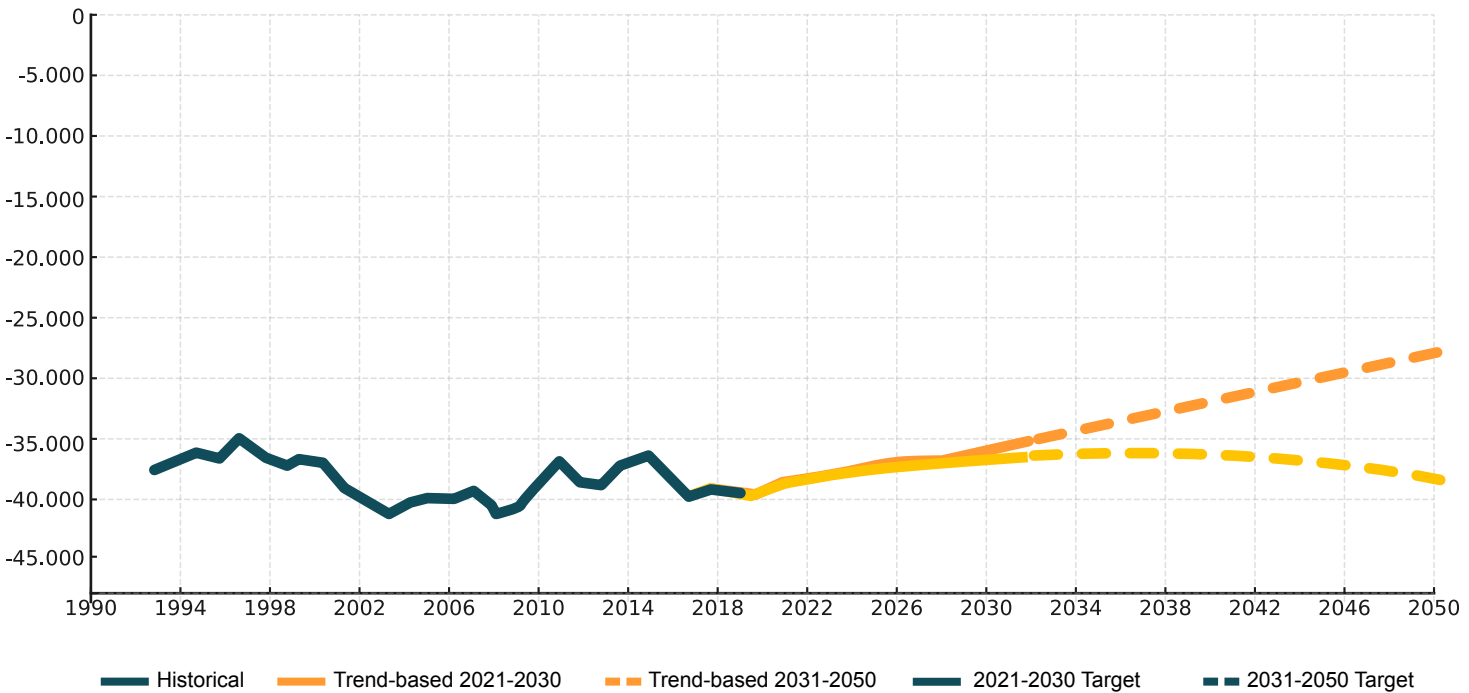


Figure 9: Evolution of equivalent CO₂ emissions/absorptions (kt) in the LULUCF sector. Historical and projections.
Source: MITECO (2020a)

In terms of climate change adaptation, alongside the objectives established for agriculture and livestock in the National Climate Change Adaptation Plan (PNACC, 2020b) and its associated work programme (2021–2025) (MITECO), it is also important to highlight the Platform on Adaptation to Climate Change (AdapteCCa), which provides a wide range of information, including specific measures and recommendations tailored to different sectors and regions.

3. THE AGRI-FOOD INDUSTRY

The Spanish food industry ranks fourth in the European Union in terms of turnover (11.4%), behind France (18.9%), Germany (16.5%) and Italy (12.8%) (ENA, 2025).

In Spain, the food and beverage industry is the leading manufacturing sector, with a turnover of €168,219.2 million (INE, 2022), representing 23.8% of the manufacturing sector, 23.3% of industrial employment and 18.2% of added value. It accounts for 2.3% of Spain's GDP in terms of gross value added (GVA), amounting to €25,741 million (+4.9%) (INE, 2021).

The number of enterprises in the food and beverage industry stands at 28,335 (INE, 2023), accounting for 17.9% of all manufacturing enterprises and 15.9% of the total industrial

sector. Of these, 96.1% are small enterprises with fewer than 50 employees (27,235), and 77.7% have fewer than 10 employees (22,029).

Within the food industry, the leading subsectors in terms of turnover are as follows: the meat industry (€38,290 million, 22.8%), beverage manufacturing (€24,421 million, 14.5%), animal feed production (€19,938 million, 11.9%), oils and fats (€16,306 million, 9.7%), and fruit and vegetable processing and preservation (€13,305 million, 7.9%) (ENA, 2025).

The number of people employed in the agri-food industry in 2023 totalled 562,500 (2.6% of total employment), representing a 3.5% increase compared to 2022 (ENA, 2025).
GHG emissions

Figure 10 presents greenhouse gas (GHG) emissions from the food industry, which in 2023 amounted to approximately 5 million tonnes of CO₂ equivalent. Emissions from the food industry are primarily the result of fossil fuel combustion for energy use, making CO₂ the dominant gas, accounting for over 80% of total emissions of the main GHGs. Methane (CH₄) represents most of the remaining share, with slightly over 15%, while nitrous oxide (N₂O) contributes less than 0.5% of total GHG emissions from the sector (Cajamar, 2024b).

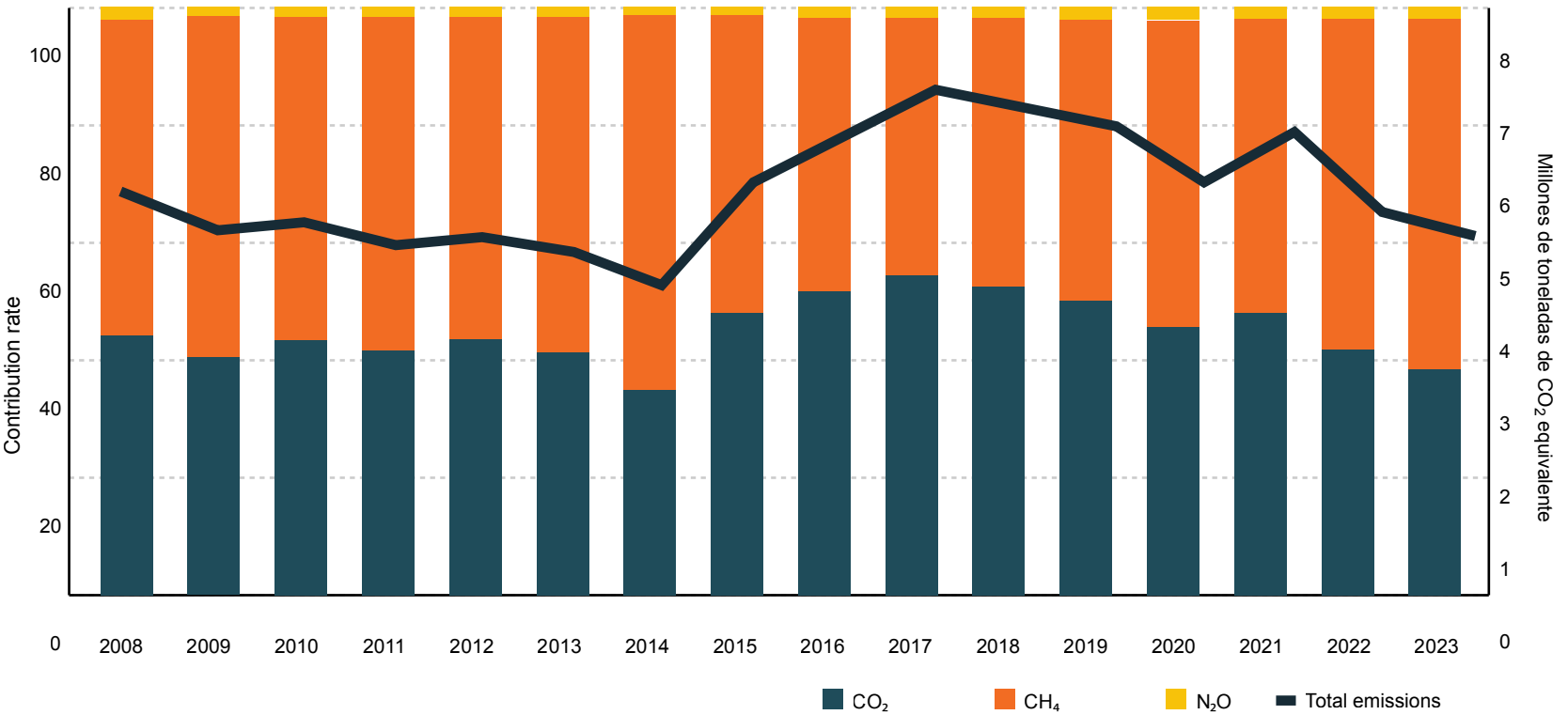


Figure10 : Distribution of ghg emissions by gas type in the spanish food industry in percentage (2008-2023).
Source: Cajamar (2024b).(2008-2023).

4. FOOD DISTRIBUTION

Distribution plays a key role in the food chain by ensuring the supply of and access to quality products for consumers, while also contributing to the promotion of responsible consumption.

In Spain, the sector includes over 180,000 active enterprises, both in wholesale and retail, accounting for 13% of national GDP and generating 17% of total employment. Wholesale trade is structured around the Public Wholesale Market Network, managed by MERCASA, which is the largest of its kind globally. It comprises 24 wholesale units that handle 8.9 million tonnes of fresh produce annually, representing 1.56% of GDP (ENA, 2025).

Self-service formats like hypermarkets and supermarkets, have increased their market share in recent years through growth in both the number of outlets and total sales area. In contrast, traditional shops, also referred to as the specialist or local retail channel, have experienced a decline in their market share. The image below illustrates the trend in market share among the main purchasing channels.

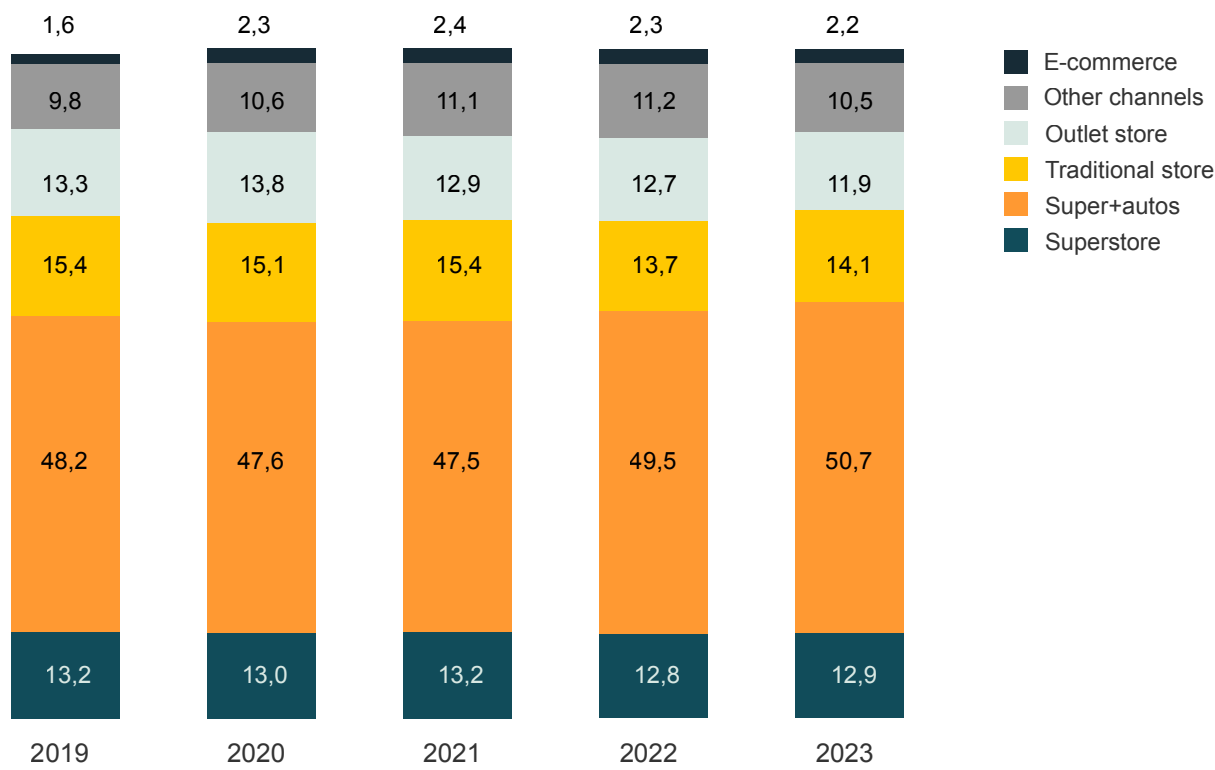


Figure11 : market share of purchasing channels.
Source: ena (2025) with data from the Annual Food Consumption report 2023.

GHG emissions

No disaggregated data is available on greenhouse gas (GHG) emissions specifically attributable to food distribution in Spain. However, reference studies provide indicative estimates for the contribution of distribution activities to overall food system emissions in industrialised countries. A study by the European Commission (Crippa et al., 2021) estimates that distribution (transport, packaging, and marketing) accounts for 27% of GHG emissions associated with the food system, which itself represents approximately 30% of total emissions in Europe.

It is estimated that most distribution-related emissions stem from local and regional road and rail transport, rather than aviation or maritime shipping. As such, urban planning and food logistics policies have the potential to significantly improve the energy efficiency of food systems. GHG emissions linked to transport are particularly high for heavy or perishable goods, with certain products such as bananas having transport-related emissions exceeding 40% of their total GHG footprint (Poore & Nemecek, 2018). In the marketing phase, cold chains and refrigeration are major contributors to emissions. Refrigeration alone accounts for 43% of GHG emissions from the supermarket sector globally (Behfar et al., 2018).

5. FOOD CONSUMPTION

This section highlights the climate dimension of food

consumption, focusing on two key variables: the quantity and origin of calorie and protein intake, and food waste in Spain. The Food and Agriculture Organization (FAO, 2010) defines a sustainable diet as one that has a low environmental impact and contributes to food and nutritional security and healthy lives for present and future generations.

Figure12 shows the daily per capita intake of calories and protein by origin for Spain and the EU-27. From a nutritional perspective, these intake levels significantly exceed the recommendations issued by the European Food Safety Authority (EFSA) for all age and gender groups. In the case of caloric intake, the average exceeds EFSA recommendations by approximately 27% for a 30–60-year-old male. Protein intake surpasses recommended levels by more than 100%

The average consumption of total protein per person per day in Spain exceeds the European average. In both cases, most of the protein is of animal origin. While caloric intake is mostly of vegetable origin.

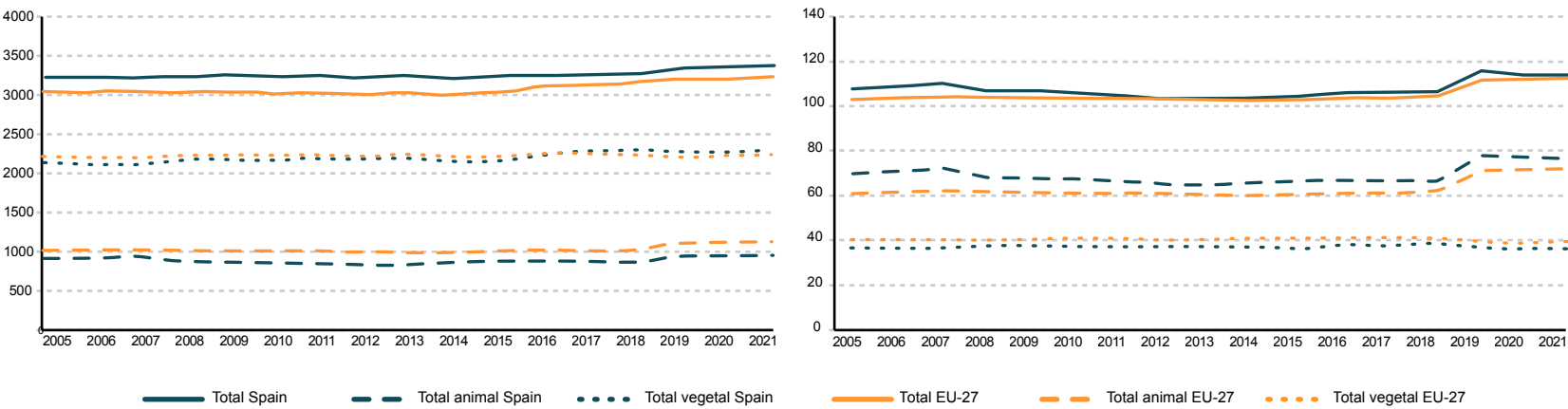


Figure 12: Caloric intake (left) in kcal per capita per day and protein intake (right) in g/ per capita per day by source for Spain and EU-27 (2005-2021). *Source: Cajamar (2024b)*

In 2020, total food waste in Spain amounted to 4.3 million tonnes, equivalent to 90 kilograms per person per year which is significantly below the European average of 127 kilograms per capita annually. The highest share of food losses occurs at the household level, followed by the processing industry, agriculture, retail, and food service sectors. (Figure13).

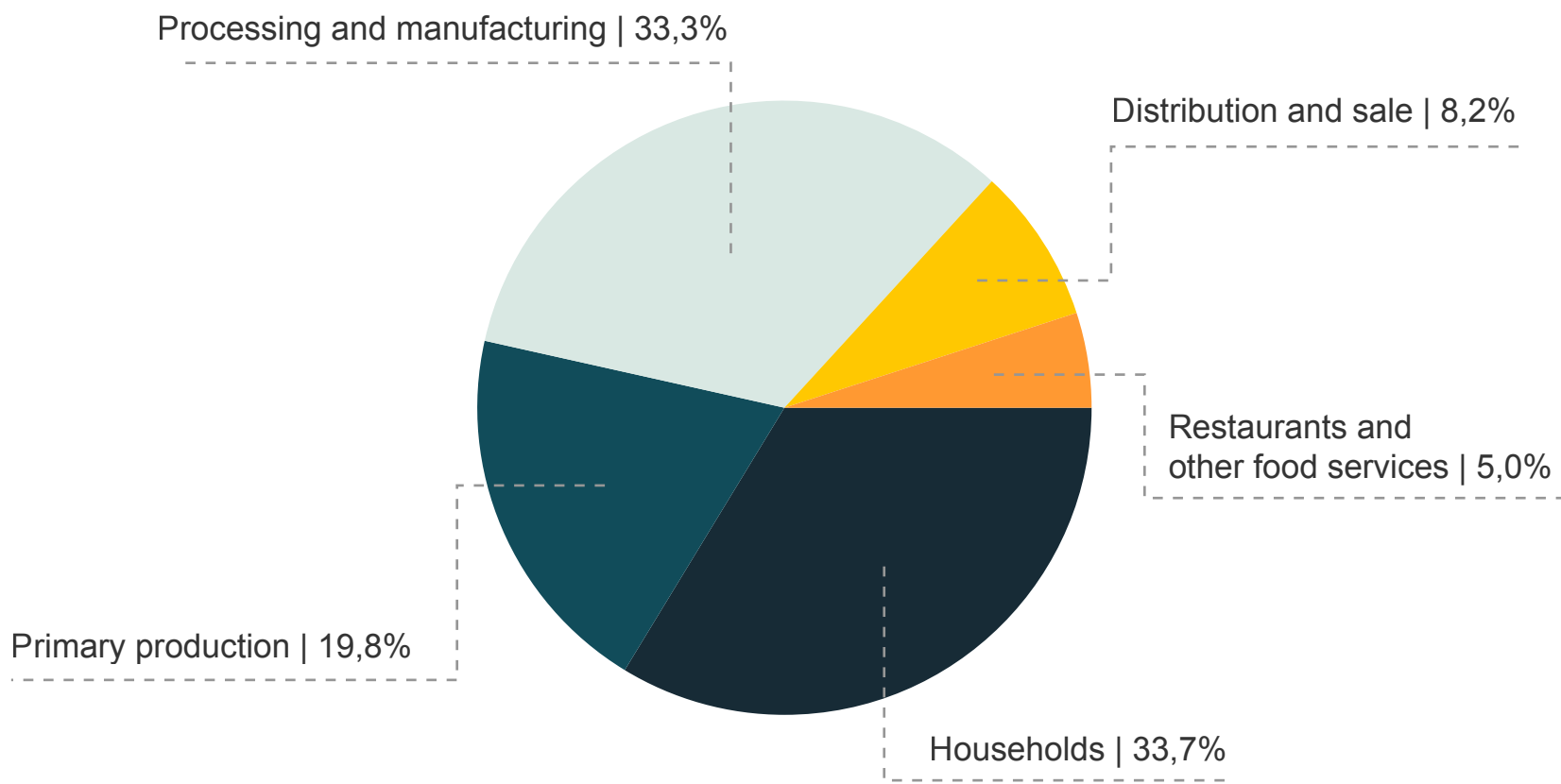
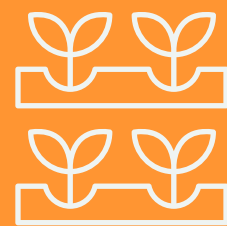


Figure 13 : Food losses and food waste in Spain (2020). In percentage. *Source: Cajamar (2024b) based on Eurostat data.*

GHG emissions

Food waste is estimated to contribute between 8% and 10% of total global greenhouse gas emissions (UNFCCC, 2024). In Spain, according to Aguilera et al. (2020), food waste accounts for one-quarter of total emissions from the agri-food system, which in absolute terms is equivalent to approximately one tonne of CO₂ per capita per year. Reducing food waste is therefore clearly linked to lowering GHG emissions, improving resource efficiency, and addressing food insecurity. Spain’s new Law 1/2025 on the prevention of food loss and waste aims to advance these objectives.



Key Challenges Identified

According to the methodology used by alinnea, a 'key challenge' is understood as any circumstance or barrier that hinders or limits the achievement of climate mitigation and adaptation objectives established for the agri-food sector. A total of eight key challenges were identified during the working group sessions and are outlined in the following sections. In the methodology carried out by alinnea, a "key challenge" is a circumstance or barrier that slows down or limits the achievement of the climate mitigation and adaptation objectives established for the agri-food sector. During the working group sessions, a total of 8 key challenges were identified, which are detailed in the following sections.

1. LACK OF DATA FOR THE SECTOR'S CLIMATE IMPACT

Unlike other sectors, where emissions are more concentrated and associated with specific processes or locations, emissions from agriculture and livestock are diffuse and difficult to monitor, not only due to logistical challenges, but also because of the economic and human resource requirements often involved.

A major barrier to advancing the measurement of climate outcomes along the food chain is the mismatch between evaluation timeframes and the medium- to long-term nature of climate impacts. The effects of many sustainability practices only become evident over extended periods, which reflect the gradual transformation of agricultural, industrial, or logistical systems in response to adaptation and mitigation measures. This hinders the ability to detect structural shifts, cumulative effects, or delayed benefits in terms of emission reductions or enhanced resilience.

In recent years, the sector has intensified its efforts to assess climate impacts, driven by regulatory obligations, certification schemes, and sustainability reporting requirements that

increasingly include climate-related criteria, as well as through voluntary initiatives. These diverse methodologies and reporting frameworks cover a broad array of sustainability dimensions, contributing to a fragmented climate action landscape that requires coordinated attention. This highlights the need to address existing knowledge gaps and misinformation, and to allocate greater resources to climate-related aspects of farm management.

At the international level, there are multiple production models such as conventional agriculture, integrated production, organic farming (with official certification), agroecology (as defined by 10 principles developed by a multi-stakeholder group coordinated by the FAO), regenerative agriculture, among others, which vary in their performance across different sustainability indicators. Despite the complexity involved, there is a clear need to develop a more detailed characterisation of the sector, incorporating environmental metrics alongside socioeconomic factors, given the diversity of production systems and the challenges they face.

At the European Union level, both the Strategic Dialogue on the Future EU Agriculture of agriculture in the EU and the EU⁷ Vision for Agriculture and Food reflect growing interest in establishing an EU-wide benchmarking system for agriculture and food systems, with the aim of harmonising on-farm sustainability assessment methodologies. The Strategic Dialogue explicitly includes climate among its sustainability priorities, whereas the Vision does not mention climate at all. The recent integration of sustainability indicators into the Farm Accountancy Data Network (FADN)⁸ is particularly noteworthy. For many years, FADN has served as the only source of microeconomic data based on harmonised accounting principles, offering essential information for assessing the impact of measures implemented under the Common Agricultural Policy (CAP). In early 2025, FADN was succeeded by the Farm Sustainability Data Network (FSDN)⁸. The FSDN will build on the legacy of the FADN,

7. References to the benchmarking system in both the Strategic Dialogue and the Vision are outlined below:

Strategic Dialogue (EC, 2024), "The system should facilitate comparisons between different sustainability objectives and ambitions (e.g. biodiversity conservation and restoration, reduction or sequestration of GHG emissions, pollution reduction, improvement of animal welfare, water quality, and working conditions) to promote a holistic approach to sustainability. It should allow for comparability across production models within specific sectors to effectively assess sustainability performance and could support public and private institutions in overcoming existing barriers to financing the transition and in generating tailored incentives."

The Vision for Agriculture and Food (EC, 2025a): "The Commission will also develop and gradually roll out a voluntary benchmarking system for on-farm sustainability assessments, thereby enabling simplification and benchmarking to proceed in parallel. Similar benchmarking approaches could be extended to the wider agri-food sector, including tools to support consumer choices."

"The sustainability compass should serve as a one-stop shop to streamline reporting and reduce the administrative burden for farmers by enabling them to monitor and record sustainability data only once. Secondly, it will support farmers in the progressive adoption of more sustainable practices and in attracting new sources of financing. It will allow them to better assess and compare their sustainability performance and to demonstrate their provision of ecosystem services through easier data sharing. Thirdly, improved measurement and reporting will contribute to the design of proportionate public policies. This voluntary system for on-farm sustainability assessment will be developed based on a bottom-up, participatory and user-centred approach."

8. Farm Sustainability Data Network FSDN - European Commission

expanding its scope to cover not only farm income and economic activities, but also indicators related to environmental and social sustainability performance.

2. LACK OF CHAIN APPROACH

The working group has consistently highlighted the structural fragmentation affecting the agri-food sector. This fragmentation poses a significant obstacle to advancing climate ambition, underscoring the need to foster constructive and inclusive dialogue. No single pathway exists for transforming the sector; instead, context-specific assessments are needed to support the development of multiple transition scenarios. This need is beginning to give rise to promising initiatives. For example, the National Food Strategy (ENA, 2025) was published in early 2025 as a result of a stakeholder dialogue process focused on the food chain.

The agri-food sector's climate transition is further complicated by a fragmented regulatory and economic approach. While certain areas, such as interbranch organisations, allow for more straightforward coordination, the current regulatory framework has only recently begun to address the agri-food sector as an integrated value chain. Until now, economic and environmental objectives have largely been addressed separately for each segment of the chain, including production, processing, distribution, and market placement.

This segmentation limits the potential to implement integrated strategies that take advantage of the interdependencies among different actors, thereby hindering a more efficient and equitable climate transition, both in terms of adaptation and mitigation, across the sector. Concrete examples could include:

- Integrated climate action plans (with cross-cutting objectives and joint targets)
- Circular economy plans for the reuse of agri-food by-products (in line with the draft law on food waste).
- Regulations for characterization and monitoring of the entire chain (benchmarking) together with expanded traceability and public access.
- Joint responsibility across the entire chain for reducing climate risk
- A climate architecture that makes the chain more resilient and generates financial incentives through various mechanisms.
- Other tax and financial incentives, etc.
- There are also differing views on how responsibility for climate action should be allocated across the agri-food value chain. Some argue that the responsibility should primarily lie with consumers.

Others believe that industry and the distribution sector should play a more proactive role, given their influence over food prices and the conditions they set for suppliers. Input providers, such as producers of fertilisers and plant protection products, are also considered potential key actors, particularly in relation to mitigation efforts. In this regard, the European Commission has at times referred to the possibility of introducing additional climate-related measures beyond those currently in place, which could have implications for these sectors.

Finally, agriculture and livestock farming, the economic activities with the highest GHG emissions within the food chain, are making progress in mitigation efforts, particularly through voluntary initiatives to quantify emissions and removals,

such as those promoted under the Carbon Removal Certification Framework (CRCF) Regulation. In addition, there are reporting obligations related to scope 3 emissions under the Corporate Sustainability Reporting Directive (CSRD) and the Corporate Sustainability Due Diligence Directive (CSDDD), both of which are currently under revision through the Omnibus Directive (EC, 2025b) with the aim of simplification. In Spain, the GHG emission reduction targets for the sector are established in the National Integrated Energy and Climate Plan (PNIEC).

3. TRAINING AND ADVISORY GAP

The lack of sufficient training, technical advice, and specialised support is a significant barrier to the climate transition of the agri-food sector in Spain. Strengthening the sector's capacity to adapt to climate change and reduce or sequester GHG emissions (mitigation) across the entire value chain requires new knowledge and skills.

At the production level, this gap includes limited training in areas such as soil regeneration, optimised fertiliser use, digitalisation (e.g. digital farm records), management of renewable energy systems, mixed farming (combining crop and livestock production), and the use of biodiversity to enhance productivity. In addition, there is a limited understanding of the economic and environmental benefits associated with these practices.

The lack of accessible advisory and support services particularly affects small and medium-sized producers, reducing their ability to plan and implement effective climate strategies. In the absence of clear, tailored guidance, many farmers and livestock producers feel uncertain or overwhelmed by the prospect of changing their practices

It is also important to consider the wide range of priorities and pressing challenges currently facing the agriculture and livestock sectors, of which climate change is only one. Some of these challenges include:

- The lack of generational renewal, driven by various factors such as the mismatch between labour demands in the sector, low-income levels and wages, and the economic and lifestyle expectations of today's society
- The need to achieve minimum profitability thresholds
- Administrative burdens and regulatory compliance
- Uncertainty linked to new trade agreements (e.g. EU-MERCOSUR) and the impact of the EU-Ukraine agreement on sectoral competitiveness
- Compliance with European environmental regulations
- The ongoing need for digitalisation
- Others

In the other links of the value chain, the training deficit includes limited knowledge of the climate and environmental impacts of supply chains, as well as of the tools needed to measure, monitor, and improve them over time. In the food industry, this lack of training is reflected in a poor understanding of the environmental footprint of production processes, the potential for decarbonisation in energy use and transport, and opportunities for innovation in product and packaging design based on circular economy principles. In the distribution sector, the training gap relates to efficient logistics management, food waste reduction, fleet electrification, and the integration of sustainability criteria into procurement and marketing decisions. In both cases, there is also a cross-cutting need for training on climate-related regulation,

green finance, and collaborative strategies across the value chain.

4. CONTRASTING NARRATIVES

There is significant ideological polarisation, marked by opposing narratives in Spain and across the European Union. This divide has deepened in recent years, particularly as EU sustainability policies such as the Farm to Fork Strategy, the Nature Restoration Law, and the new Common Agricultural Policy (CAP) which have all begun to influence practices within the sector. The agri-food sector itself is fragmented and polarised, and there are generally no shared spaces for dialogue. Two notable exceptions are the Strategic Dialogue on the Future of EU Agriculture launched by the European Commission (EC, 2024) and the recently introduced National Food Strategy by the Ministry of Agriculture, Fisheries and Food (MAPA) (ENA, 2025). In the public debate (especially on social media) the dominant framing is a division between perceived winners and losers of climate action measures, which makes it difficult to build consensus around developing effective policies and collaborative proposals.

On one side, some stakeholders advocate for maintaining existing production models and agricultural development pathways as a means of ensuring economic viability and employment in rural areas. They are generally reluctant to embrace the EU's sustainability requirements, viewing them as a threat to the competitiveness and profitability of their farms, and above all, as an added burden for which they receive insufficient support. On the other side, an increasing number of social and environmental organisations and movements, as well as segments of the business sector, support more ambitious ecological transition policies at the EU level, including stronger action to reduce greenhouse gas emissions and preserve biodiversity. Despite these differences, both perspectives recognize the urgent need to strengthen the sector's capacity to adapt to the growing impacts of climate change.

5. MULTIPLE OBJECTIVES IN THE CLIMATE FRAMEWORK

The current climate framework comprises a range of regulations and targets that apply to different actors within the agri-food sector.

At the production level, the CAP and the National Strategic Plan have introduced new environmental measures in cross-compliance (GAEC - Good Agricultural and Environmental Conditions) and eco-schemes, both linked to direct payments under Pillar I. Several of the eco-schemes in Spain's Strategic Plan are aligned with low-carbon agricultural practices.

Other regulations affect downstream segments of the agri-food sector. These include the new Emissions Trading System for buildings, road transport, and additional sectors (ETS2), which will enter into force in 2027 and is expected to impact both transport and the agri-food industry. Law 1/2025 on the prevention of food loss and waste also falls within this framework. Furthermore, the Corporate Sustainability Due Diligence Directive (CSDDD) and the Corporate Sustainability Reporting Directive (CSRD) introduce obligations to account for scope 3 emissions, encouraging companies in the agri-food industry and distribution to reduce emissions

across their supply chains, which, in the case of distribution, can represent a substantial share of total emissions (McKinsey & Company, 2024). However, the Omnibus Directive (EC, 2025b) on simplification scaled back some elements of climate ambition, including the removal of requirements such as the obligation to develop climate transition plans under the Global Compact.

6. PROFITABILITY AT RISK AND LACK OF ECONOMIC INCENTIVES

Small and medium-sized producers, defined as those with less than 20 hectares, make up 78% of all farms in Spain (MAPA, 2023b). The working group emphasised the difficulty many of these producers face in reaching minimum profitability thresholds. In addition to this financial vulnerability, the sector requires substantial investment to adopt the practices and technologies needed to transition towards a more climate-resilient and decarbonised agri-food system.

Economies of scale and integration into international markets were also identified as key factors contributing to reduced profitability for certain farm sizes and production models. This dynamic is one of the drivers of the sectoral transformation outlined in the contextual analysis. Moreover, compliance with common EU regulations, including those related to sustainability, the hygiene package and animal welfare often imposes considerable financial and administrative burdens on producers.

There is a clear need to establish mechanisms and incentives to finance this transition. The Strategic Dialogue on the Future of EU Agriculture (EC, 2024) proposes the creation of two new public funds, outside the scope of the CAP, to support investment over a sufficiently long period to facilitate the sector's rapid transition: the Agri-Food Just Transition Fund and the Nature Restoration Fund. The Dialogue notes that these funds should provide financial support (through loans or grants) to farmers and other actors in the food system during a critical window for structural change. It also calls for public-private partnerships to mobilise both public and private capital for investment. The recently published Vision for Agriculture and Food in the EU does not explicitly refer to either of these proposed funds.

Difficulty scaling up best practices

Many local initiatives serve as best-practice examples with notable environmental benefits; however, the uptake and scaling of these measures are hindered in a sector where price remains the dominant factor driving competitiveness.

7. RISK OF FALLING INTO THE "CARBON TUNNEL".

The concept of the "carbon tunnel" refers to an overly narrow focus on reducing GHG emissions, while overlooking other critical dimensions such as the adaptation and resilience of farms, biodiversity conservation, water use, and the broader ecological and social impacts of the agri-food sector.

The working group stressed the urgent need to prioritise adaptation measures, which remain underrepresented in climate-related decision-making across sector stakeholders. It is widely recognised that Spain is particularly vulnerable to the impacts of climate change. The financial costs associated with risk and crisis management, whether through insur-

ance mechanisms or public and private funds, are expected to continue rising. In this context, it is essential to support a transition strategy that places adaptation and resilience at its core.

8. UNCERTAINTY OF DEMAND AND RESPONSIBLE CONSUMPTION

While the consumption of low-environmental-impact foods is on the rise, uncertainty around pricing and market dynamics for products derived from low-carbon and climate-resilient practices remains a significant barrier. Producers are concerned that changes to their production systems may not translate into sufficient profitability, which slows the uptake of more sustainable practices.

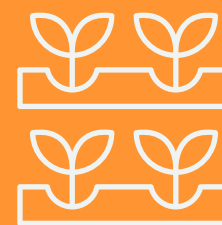
The “food choice environment” refers to the range of factors and conditions that influence consumers' food decisions, such as product availability and placement, price, labelling and packaging information, social norms, education levels, and emotional or behavioural drivers. The European Commission's Strategic Dialogue on the Future of Agriculture in Europe (EC, 2024) highlights the need to define public policies on consumption, although it does not yet provide specific details.

Traceability: necessity and challenges

There is a wide range of social and environmental sustainability indicators that could be collected across the food chain, such as biodiversity impact, GHG emissions, animal welfare, water quality, soil health, and working conditions. However, presenting this information through labels, standards, or certification schemes alongside nutritional data can overwhelm consumers, making it difficult for them to access clear, easily understandable information to guide their purchasing decisions.

Moreover, in order to trace and communicate the climate impact of food products, progress must be made in the characterisation systems as discussed elsewhere in this document as benchmarking ‘challenges’.

Traceability plays a critical role in advancing climate objectives, as it enables climate-related information to be passed along the value chain to the end users of that information. Yet implementing traceability for climate data is highly complex due to the lack of standardised methodologies for quantification and the structural challenges of a globalised food system, where long, multi-layered supply chains often mix products of diverse origins at each stage.



Proposals

The following proposals were developed based on the ideas collected and discussed within the working group. In certain cases, **alinnea** has further explored these ideas through bilateral interviews or literature review.

The proposed measures represent potential actions, primarily addressing areas that require multi-stakeholder dialogue. They are intended as invitations to reflect and collaborate.

Each specific measure is introduced with a reference to the corresponding segment of the food chain, indicated in square brackets: [production], [industry], [distribution], and [consumption]. When a measure is relevant to the entire chain, the term food chain is used.

1. DETERMINE TRANSITION NEEDS

Spain hosts a wide range of agricultural systems, with more extensive models in certain regions and more industrialised, export-oriented models in others. Beyond agriculture and livestock farming, the country also has a highly diverse industrial base in terms of energy use and business size, as well as a distribution sector composed of actors operating across local, national, and international sales channels. Transition recommendations must therefore be tailored to this diversity in order to be effective.

As a result, the food chain, and particularly the agriculture and livestock segments, constitutes the most vulnerable link. Spain's capacity to produce a wide variety of food products is largely due to its considerable climatic diversity, among other factors. However, the latest report from the European Environment Agency (EEA, 2024) identifies Spain as one of the EU Member States most likely to experience severe impacts from climate change, with water scarcity highlighted as a critical medium-term risk that could affect population supply and multiple economic sectors.

The degree of climate resilience will ultimately determine the viability of many existing production models in their current locations.

Objective:

- Plan agriculture and livestock farming development and investments based on climate forecasts and available water resources.

Measures:

- Characterise each territory according to its climate projections, saturation levels, and available water resources in order to identify the most economically viable and climate-resilient agricultural activities for that area. Based on current conditions, it is possible to estimate investment needs across different levels (technology, infrastructure, crop changes, agricultural practices, etc.). Identify the financial instruments required to

address the investment and other needs linked to the climate transition in each territory.

- Promote collaboration between actors in industry, distribution, and consumption with the local primary sector to assess detailed transition needs and associated costs.
- [Production]: Propose transformative adaptation measures specific to each region and crop, using the National Climate Change Adaptation Plan (PNACC) and the 20 CAP regional frameworks as reference points.
- Work in collaboration with the primary sector to expand knowledge, review plans, regulations and strategies and propose transformative measures for adaptation to increased climate risk for each territory and crop (in line with measures 6.1, 6.3 and 6.4 PNACC)

2. ANALYSIS OF PROPOSALS ON CLIMATE BENCHMARKING AT THE FARM LEVEL

In its Strategic Dialogue on the Future of Agriculture and Food in the EU (EC, 2024), the European Commission states its interest in developing an EU-wide reference system to harmonise sustainability assessment methodologies at the farm level, including both mitigation and adaptation indicators. The Dialogue states: "This system should be based on common objectives, principles, and criteria, and include monitoring and verification tools with common metrics and indicators. It should measure where each farm and sector stands, facilitate comparisons across diverse sustainability objectives and ambitions, and thus contribute to implementing the necessary steps to raise sustainability standards."

Objective

To understand the implications for Spain of a potential EU-wide reference system proposed by the European Commission to harmonise farm-level sustainability assessment methodologies, specifically with respect to mitigation and adaptation indicators.

Measures

- [Production]: Identify synergies with existing monitoring efforts under Spain's CAP Strategic Plan (PEPAC), including work carried out by CSIC, INIA, and others; the National Agricultural Accounting Network⁹ (RECAN) which compiles the new indicators introduced through the European Commission's Farm Sustainability Data Network¹⁰ (FSDN) and the Agri Sustainability Compass¹¹ launched by the Commission in 2024, which includes 20 climate-related indicators focused on emissions reduction. The international AgriBenchmark¹² network may also be relevant, given the Ministry of Agriculture, Fisheries and Food's (MAPA) involvement as a collaborating partner.
- [Production]: In the event that the Commission implements a harmonised benchmarking system, validate the

9. National Agrarian Accounting Network. National Agrarian Accounting Network (RECAN).

10. Farm Sustainability Data Network FSDN - European Commission

11. Agri Sustainability Compass. European Commission | Agri Sustainability Compass

12. Agribenchmark. Home - agri benchmark

proposed farm-level mitigation and adaptation indicators. Analyse variations by geographic region and production type and ensure the integration of local knowledge when assessing the relevance and appropriateness of the indicators.

- [Production]: Estimate the costs and identify potential financing mechanisms required to meet the monitoring and reporting objectives.

3. DIALOGUE WITH A CHAIN APPROACH

Inspired by the initiative undertaken by the European Commission through the Strategic Dialogue on the Future of Agriculture in the European Union (EC, 2024), we propose establishing a space for dialogue on climate action in the agri-food sector in Spain.

Objective

- To generate safe spaces for dialogue to align priorities, define trade-offs and responsibilities, identify specific challenges at the national, regional and sectoral level and develop viable and consensual solutions for the climate transition.

Measures

- [Food chain]: Establish a space for dialogue involving key actors ensuring a value chain approach and focus on the climate agenda.
- [Distribution]: Pay particular attention to the logistics sector and wholesale suppliers of fresh produce.
- [Food chain]: Replicate this dialogue at the level of autonomous communities or highly productive provinces, as well as at the sectoral level (value chains), identifying those sectors facing the greatest challenges in advancing mitigation and adaptation objectives.
- [Food chain]: Create or adapt an advisory council on climate action and the food chain similar to the Agricultural Council or the State Agri-Food Council, therein bringing together representatives from MITECO-OECC, autonomous communities, the scientific community specialising in the food-climate nexus, relevant think tanks, academic experts with experience in the climate-agriculture agenda, trade unions and professional agricultural organisations, and private sector representatives¹³.

4. TRAINING, SUPPORT AND SCALABILITY

A large part of climate-friendly and economically viable practices require training, support, and investment of both time and money. Meeting these needs is significantly more challenging for small and medium-sized farms than for larger ones. Economies of scale are relevant not regarding economics, but also in terms of access to technology and training.

Objective:

- Empower actors in the agri-food sector, particularly in agriculture and livestock farming as they are the primary sources of GHG emissions, by equipping them with tools and practical knowledge in areas such as technology, digitalisation (e.g. farm record-keeping), and innovative

practices to integrate climate action into their production models

- Increase the scalability and profitability of solutions with strong environmental benefits by leveraging scientific knowledge and guided implementation pathways.
- Address the challenge of generational renewal in the sector.

Measures

- [Food chain]: Identify training and support needs for the climate transition, assess associated costs, and map the available public and private funding to address them. A key focus should be the adoption and effective use of digital farm records, which can improve transparency and data availability, thereby enabling more informed strategic decision-making at the sectoral and territorial levels.
- [Production]: Assess to what extent cooperatives or producer associations at the territorial level are engaging with climate challenges, whether they have access to sufficient information, and if they offer advisory services to their members. Identify their specific needs in this regard.
- [Production]: Reinforce workspaces, institutions, and organisations capable of providing advisory services on climate action so they can become key actors in the climate transition process.
- Identify valuable environmental practices that show potential for scalability, especially those related to climate mitigation and adaptation. If the European Commission proposes a benchmarking indicator system, use it as a reference. Carry out a detailed analysis of the current barriers preventing these practices from scaling and propose priority measures to overcome them.
- [Production]: Develop mentored pre-entrepreneurship roadmaps to support the deployment of scalable practices with strong environmental benefits (e.g. CROPS4LIFE¹⁴).
- [Industry & Distribution]: Generate guidelines for industry and distribution with best practices linked to their upstream suppliers (scope 3 emissions) and contribute to achieving the mitigation targets of the PNIEC and the adaptation objectives of the PNACC. If the Commission proposes a benchmarking indicator system, align with relevant indicators.

5. NEW "WIN-WIN "NARRATIVE: COMPETITIVENESS AND CLIMATE ACTION

Society's prevailing narrative on the production sector is ambivalent, oscillating between a critical view and a more optimistic appreciation of the various actors in the sector's value chain. While some focus on high dependence on subsidies, low profitability, growing vulnerability to the impacts of climate change, and competition from foreign products, others focus on recognizing the strategic role of the sector, Spain's relevance in international markets, and the many synergies with other areas such as biodiversity, land stewardship, and the consolidation of employment in rural areas.

Objective:

- Identify factors that reinforce the link between incorporating climate measures and improving the sector's com-

13. Representatives of fertiliser and pesticide suppliers, representatives of agricultural cooperatives, representatives of interprofessional agri-food organisations, representatives of the food industry (employer organisations and sectoral associations), major national and regional food retailers (hypermarkets, supermarkets, wholesale markets, etc.), and representatives of the distribution sector (employer organisations and associations).

14. <https://cea.vitoria-gasteiz.org/portal/es/w/crops4life-proyecto-reduccion-huella-ambiental-del-sistema-agroalimentario>

petitiveness.

- Explore untapped opportunities to communicate this relationship.
- Reinforce value chain narratives that position climate action as a driver for enhancing the sector’s competitiveness.

Measures

- [Production]: Highlight the role of agriculture and livestock farming as part of the solution to climate change, through research and evidence-based analysis. In collaboration with the academic sector and the scientific community.
- [Food chain]: Identify and give visibility to practices with significant environmental returns, along with success stories. In collaboration with primary sector stakeholders. Potential partners: farmers’ organisations (“OPA”), inter-branch organisations, Rural Action Forum, etc.
- [Food chain]: Promote positive narratives around the economic benefits of transitioning to environmentally valuable practices, using concrete examples and testimonials from actors in the sector, focusing on climate-related aspects. Emphasise digital and multimedia communication with engaging content in collaboration with the communication sector (press, local radio, television, social media).
- [Production]: Conduct sector-specific surveys to examine the various links between the climate transition and the sector’s competitiveness, aiming to identify drivers for change and win-win solutions across economic, social, and environmental dimensions.
- [Production]: Promote and showcase synergies with sectors such as renewable energy and the circular economy at the territorial level. Develop targeted incentives to support this objective.
- [Food chain]: Develop territorialised narratives around win-win solutions, strengthening the links between actors that still operate with territorial logic (e.g. bioregions).

6. EFFECTIVE REGULATIONS FOR INCREASED COMPETITIVENESS BY ACHIEVING CLIMATE OBJECTIVES

Identify synergies and opportunities provided by national and European public policies to create incentives that support the climate transition across the entire chain.

Target

- Identify synergies and opportunities within national public policies (ENA, PNIEC, PNACC) and European climate regulations that can be leveraged to generate incentives for facilitating the climate transition of the agri-food chain.
- Identify regulations with the potential to accelerate progress on climate action.

Measures

- [Production]: Develop concrete proposals through dialogue for the reform of CAP 2027–2034:
 - Propose potential criteria for the allocation of CAP funds with a strong focus on climate action, addressing both mitigation and adaptation. Analyse the implications at multiple levels, including impacts on climate resilience, emission reductions, fund distribu-

tion, and improvements in sectoral competitiveness.

- Within this framework, examine future scenarios linked to a potential reduction in the CAP budget. Identify possible response strategies and assess their respective impacts on the level of climate ambition.
- Analyse possible opportunities within the CAP to accelerate and reinforce climate adaptation measures.
- [Production]: Explore the feasibility of establishing territorial livestock load thresholds. Link this approach with the Nitrates Directive and the Royal Decree on the sustainable nutrition of agricultural soils (e.g. through enhanced traceability) and develop a proposal for a just transition for the sector, aiming to avoid job losses and harm to the local agri food sector/supply chain that could result from such a system.
- [Consumption]: Assess the feasibility of creating a specific multi-stakeholder framework to support the production and consumption of locally sourced food.
- [Food chain]: In collaboration with relevant actors across the food chain subject to regulatory compliance, identify the synergies and implications of new European Commission strategies or legislative initiatives, such as:
 - The Clean Industrial Deal and its application to the agri-food industry. Identify potential incentives for reducing GHG emissions in the industrial sector.
 - Analyse the impact of the CRCF¹⁵ Regulation (Carbon Removal Certification Framework) on the sector. To this end, identify specific examples of how this regulation is being applied to various agricultural activities in Spain and assess the resulting implications, (economic impact, associated costs, training needs, and other relevant factors).
 - Amendments to the Green Taxonomy, CSDDD and CSRD regulations through the Omnibus Directive (EC, 2025b):
 - EU 2022/2464¹⁶ Corporate Sustainability Reporting Directive (CSRD), which in its pre-Omnibus version required scope 3 greenhouse gas emissions measurement and reporting, among other obligations. This directive is currently pending transposition.
 - EU 2024/1760¹⁷ Corporate Sustainability Due Diligence Directive (CSDDD), which in its pre-Omnibus version required the inclusion of mitigation plans addressing scope 3 emissions, among other obligations. This requirement has been removed in the revised version. The directive is also pending transposition.

7. FINANCING THE TRANSITION

Ensuring access to financing is essential to enable the agri-food sector in Spain and across Europe to carry out a successful climate transition. Agri-food stakeholders have expressed an urgent need for funding to support investments in agricultural and business practices that deliver significant environmental benefits, as well as in innovative technological solutions aimed at improving the sector’s climate and socioeconomic performance (such as reducing greenhouse gas emissions and enhancing resilience to the impacts of climate change, etc). These investments would also generate co-benefits for other local environmental challenges, including soil and water pollution, water use efficiency, and biodiversity protection.

15. This regulation is a key EU legislative proposal to establish a common certification framework for carbon farming and carbon removal. Once certified under this framework, carbon removals can be traded in voluntary carbon markets.

16. The CSRD will apply to companies with more than 250 employees, and/or €40 million in turnover, and/or €20 million in total assets.

17. The CSDDD will apply to large companies with more than 1,000 employees and more than €450 million in annual turnover and it will be phased in gradually.

Objective

- Assess and propose changes to the current financial architecture associated with the agri-food sector, exploring new opportunities to mobilize private capital and enhance its complementarity with public funding, in order to facilitate the achievement of climate mitigation and adaptation objectives across the food chain.

Measures

- [Food chain]: Assess financing needs at both sectoral and regional levels within the primary production sector (linked to recommendation 1). Estimating the level of investment required to develop climate-resilient and climate-neutral production systems would support the design of appropriate financing instruments and the development of targeted financial incentives for the sector.
- Analyse the main financing channels currently used by the sector to implement climate action measure, both in adaptation and mitigation. This analysis could include:
 - Explore barriers and opportunities for mobilizing private capital through financial instruments included under the European Agricultural Fund for Rural Development (EAFRD), within Pillar II of CAP.
 - Analyse financing mechanisms derived from the CRCF¹⁸ Regulation on carbon farming. Generate a report with concrete examples of this regulation’s application for different agricultural activities in Spain, including analyses of results obtained (economic impact, costs, training requirements and others).
 - [Food chain]: Establish a working group, including actors the private, public, social and environmental sectors, to deepen the level of understanding of the implications of a potential emissions trading scheme applied to the agri-food sector (AgETS).
 - [Food chain]: Propose mechanisms for collaboration and cross-financing¹⁹ by renewable energy facilities (e.g. photovoltaic) operating in the territory. For example, collaboration processes with local producers and the agri-food industry could be promoted to facilitate and accelerate the transition towards climate-positive production models in the territory.
 - [Industry]: Identify financial incentives under the Clean Industrial Deal that could support GHG emissions reductions in the agri-food industry.
 - [Food chain]: Identify incentives introduced by European regulations targeting the industrial and distribution sectors that could be leveraged to develop private funding schemes and financing instruments aimed at supporting investment in mitigation and adaptation measures within the primary production sector.

8. CLIMATE RISK MANAGEMENT AND RESILIENCE

Policies for risk reduction and climate crisis management are urgently needed. Among the most urgent measures are protection against extreme weather events, drought management, sustainable water resource management, soil protection and regeneration, and crop diversification across territories.

Target

Reinforce adaptation and risk reduction policies tailored to each territory and each crop.

Measures

- [Production]: Identify the barriers and limitations of the current Spanish agricultural insurance system. Conduct this analysis jointly with the insurance and financial sectors, mutual guarantee societies, etc., and propose priority measures to strengthen its connection to climate risk.
- [Production]: Examine the role of insurers in advancing adaptation to reduce risks (e.g., premium discounts, prerequisites, training, territorial risk assessments, prioritisation of measures).
- [Production]: Develop double materiality analyses to assess both internal impacts (financial materiality: examining how climate change and regulation may affect operating costs, income, or financial risks) and external impacts (impact materiality: evaluating how banking activity affects the production sector).
- [Food chain]: Assess the current level of development of climate and environmental impact assessments required by the ECB from financial institutions. Identify potential barriers to more effective implementation and explore opportunities for alignment with public policies (e.g., CAP).
- [Food chain]: Increase private sector investment through risk reduction instruments. The InvestEU programme is an example of an initiative that expands risk-sharing tools and mobilises public banks (primarily the EIB and EIF).
- [Industry and Distribution]: Survey the industry and distribution sectors to assess the extent to which adaptation measures affect competitiveness.

9. CONSUMPTION POLICIES

Reducing the carbon footprint of the agri-food sector in Spain requires consumption policies that promote climate-aligned consumption patterns, support shifts in purchasing behaviour, and reduce food waste.

Objective

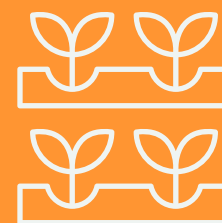
To promote progress toward climate objectives across different stages of the value chain through informed and responsible consumption.

Measures:

- [Food chain]: Develop public policies to provide information on the relationship between climate and food choices. Collaborate with distributors to identify barriers and priority actions for measuring, monitoring, and making available information on mitigation and adaptation at the farm level.
- [Food chain]: Addressing the spread of misinformation related to climate criteria.
- [Consumption]: Design public procurement and institutional catering policies that serve as levers for market transformation by encouraging the adoption of more ambitious environmental standards across the value chain and fostering consumption patterns aligned with climate goals.
- [Distribution]: Gather and assess proposals from the distribution sector on how to address consumption policies (food waste, diets, “food decision-making environment”, etc)
- [Industry]: Gather and assess proposals from the industrial sector on how to approach consumption policies in relation to the climate agenda.

18. This regulation is a key legislative initiative of the European Union aimed at establishing a common framework for the certification of carbon farming practices and carbon removals. Once certified, these removals can be traded on voluntary carbon markets.

19. Cross-financing is a mechanism in which revenue generated from one activity, sector, or group of users is used to support the financing of another activity, sector, or group.



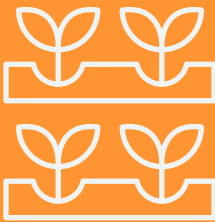
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Annex:

Regulatory Framework for the Agri-Food Sector in the Context of Climate Change



The regulatory framework governing emissions reduction and/or carbon sink enhancement in the agri-food sector is not defined by a single policy or legal instrument.

Historically, many environmental measures have been promoted through the Common Agricultural Policy (CAP), particularly via the evolution of its financial instruments. Since the adoption of the European Green Deal in 2020, the European Commission has introduced a series of directives and regulations that affect one or more stages of the food chain, with the objective of advancing its decarbonisation. The table below outlines key legislative milestones related to the decarbonisation of the food chain.

Table 4 : List of climate regulations affecting the food chain.

Original Legislative Document	Transposition in Spain (if applicable)	Target link in the Food Chain	Quantitative Objectives	Qualitative Objectives
Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading (ETS1 and ETS2)	Law 1/2005 regulating the greenhouse gas emission allowances trading scheme -	From 2027: Transport and food and beverage processing industries (ETS2)		Incentivise emission reductions through market mechanisms
Regulation (EU) 2018/842 on Effort Sharing (ESR)		Agriculture, transportation and consumption	0–40% emissions reduction target by 2030. Spain: –37.5% compared to 2005	Share responsibility among Member States for sectors not covered by the ETS
Regulation (EU) 2018/841 LULUCF	Integrated into Law 7/2021 on Climate Change and Energy Transition	Integrated into Law 7/2021 on Climate Change and Energy Transition	Integrated into Law 7/2021 on Climate Change and Energy Transition	Integrated into Law 7/2021 on Climate Change and Energy Transition
EU Methane Strategy (2020) (non-binding)	No specific transposition; linked to livestock policies	Livestock and waste management	No binding targets: voluntary sectoral targets are encouraged.	Promote methane emissions reduction in agriculture through improved practices
EU Soil Protection Strategy 2030 (2020)	No transposition	Primary sector	310 Mt CO ₂ -equivalent net removals by 2030 at EU level	Preserve and restore soil health to support carbon sequestration.
Regulation (EU) 2020/852. on establishing a framework to facilitate sustainable investments		Investments across the food chain	No direct mitigation and adaptation objectives.	Define which activities contribute to mitigation and adaptation
Original Legislative Document	Transposition in Spain (if applicable)	Target link in the Food Chain	Quantitative Objectives	Qualitative Objectives
Regulation (EU) 2021/1119 Framework for achieving climate neutrality	Law 7/2021 on Climate Change and Energy Transition; National Integrated Energy and Climate Plan (PNIEC) National Plan for Adaptation to Climate Change (PNACC)	Entire food chain	Reduce net GHG emissions by at least 55% by 2030 (compared to 1990); climate neutrality by 2050.	Establish a legally binding framework for climate neutrality; align all EU policies with climate targets
Common Agricultural Policy (CAP) Regulations: Regulation (EU) 2021/2115 Regulation (EU) 2021/2116 Regulation (EU) 2021/2117	Regulatory package accompanying the Plan Strategic CAP Plan	Agriculture and livestock	There is no specific mitigation target; financing is linked to eco-schemes and practices that promote low-carbon agriculture.	Promote sustainable farming practices, carbon sequestration and emissions reduction through subsidies and incentives.

Original Legislative Document	Transposition in Spain (if applicable)	Target link in the Food Chain	Quantitative Objectives	Qualitative Objectives
Directive (EU) 2022/2464 on corporate sustainability reporting (CSRD).	In the process of transposition.	Entire food chain: producers, processors, distributors, and retailers	1) Report on carbon footprint and GHG emissions, both direct (scope 1) and indirect (scopes 2 and 3). 2) Set GHG reduction targets in line with the Paris Agreement.	1) Integrate climate change adaptation strategies into sustainability reports. 2) Identify and manage climate risks in operations and value chains.
Regulation (EU) 2023/956 establishing a Carbon Border Adjustment Mechanism (CBAM)		Imports of primary sector raw materials and food products	Introducir un precio al carbono para productos importados a partir de 2026.	Prevenir la fuga de carbono e incentivar la reducción global de emisiones en las cadenas de suministro. 2024 obligación reportar 2026 obligación cumplimiento
Directive (EU) 2023/1791 on energy efficiency	In the process of transposition.	Food chain	Each Member State shall set a national indicative energy efficiency contribution based on final energy consumption in order to collectively meet the Union's binding final energy consumption target (763 Mtoe).	Improving energy efficiency in industrial and food processing sectors.
Regulation (EU) 2023/1115 on the marketing of raw materials and products associated with deforestation and forest degradation		Agri-food cooperatives, industry and distribution sector. From 2025	No quantitative mitigation or adaptation targets.	Strengthen transparency and traceability in food supply chains.
Regulation (EU) 2024/3012 on certification of permanent carbon removals, carbon farming, and carbon storage in products (CRCF)	Expected integration into Law 7/2021 and updating of the PNIEC. Certification methodologies pending.	Primary sector	Certify and quantify carbon removals using robust methodologies.	Establish transparency, integrity and trust in voluntary carbon removal projects.
Corporate Sustainability Due Diligence Directive (EU) 2024/1760 (CSDDD)	Pending adoption and legislative development in Spain.	Mainly large companies and their global supply chains.	1) Require companies to develop transition plans aligned with climate neutrality by 2050. 2) Identify and mitigate negative environmental impacts related to climate change.	1) Promote decarbonisation of global supply chains. 2) Support measures to mitigate climate impacts on affected communities.
	Law 1/2025 on the prevention of food loss and food waste		No specific quantitative mitigation or adaptation targets.	Prevent and reduce food loss and waste by all actors across the food chain.
COM/2025/75 The vision for agriculture and food	No transposition	Food chain	Achieving climate neutrality by 2050.	
	National Food Strategy (2025)	Food chain	No specific quantitative mitigation and adaptation targets.	