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RECEIVED 06 January 2025

ACCEPTED 10 June 2025

PUBLISHED 07 July 2025

CITATION

Santiago-Freijanes JJ, Rodríguez-Rigueiro FJ,
Ferreiro-Domínguez N, López-Díaz M¹L,
Rigueiro-Rodríguez A, Castro M,
González-Hernández MP,
Fernández-Lorenzo JL, Romero-Franco R,
García-Berrios JJ, Hallez T, Anzilotti S,
Giannetti F, Pantera A, Aldrey-Vázquez JA,
Couso-Viana A, Hosseini-Yekani SA,
Porto-Serantes N and
Mosquera-Losada MR (2025) Common
agricultural policy support to silvopasture in
the European Atlantic region.
Front. For. Glob. Change 8:1556380.
doi: 10.3389/ffgc.2025.1556380

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Romero-Franco, García-Berrios, Hallez,
Anzilotti, Giannetti, Pantera, Aldrey-Vázquez,
Couso-Viana, Hosseini-Yekani, Porto-Serantes
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Common agricultural policy support to silvopasture in the European Atlantic region

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Agroforestry practices are sustainable forms of land management recognized by the Food and Agriculture Organization (FAO) and the European Commission (EC). These organizations have established mechanisms to promote agroforestry globally. However, the policies they create often lack monitoring and thorough impact evaluation. To effectively analyze how policies promote agroforestry, it is crucial to consider the scale and context in which these practices are implemented. Policies should be tailored to specific socioeconomic and environmental contexts to ensure their relevance and effectiveness. The best practices that emerge can be applied to similar situations. The objective of this study was to analyze the current state of silvopasture in the Atlantic region of Europe and the Common Agricultural Policy (CAP) measures associated with the Rural Development Programs (RDPS). The goals are to enhance our understanding of how sustainable land use systems are promoted and to provide insights that can foster agroforestry across Europe. The Atlantic region is characterized by a significant intensification of agricultural activities, with a very low proportion of silvopasture, mostly in the Northern Atlantic regions. Agroforestry is recognized for its ability to provide ecosystem services that sequester carbon and enhance biodiversity and productivity in the Central Atlantic Region of Europe by promoting hedgerows or reducing forest fires in the Southern Atlantic regions. The CAP promotes agroforestry in some of these areas, primarily through agri-environmental measures. Political measures should prioritize the management, conservation, and implementation of silvopasture to increase sustainability across the European Union (EU). Efforts to promote

silvopasture should be encouraged through both agroforestry eco-schemes and CAP Pillar II interventions.

KEYWORDS

agroforestry, rural development programs, land use, permanent crops, arable crops, permanent grasslands, forestlands, CAP

1 Introduction

The Atlantic biogeographic region of Europe has the highest proportion of permanent grasslands and meadows (44%) compared to the Continental (28%), northern (18%), and southern (35%) regions of Europe (Agriadapt, 2017). These permanent grasslands are primarily associated with livestock production, which reflects the percentage of livestock units in these regions (43% in the Atlantic region, 31% in the Continental region, 3% in the northern region, and 23% in the southern region), with cattle being the primary focus in the Atlantic region of Europe. However, the extent of permanent grasslands has been decreased by 30% between 1967 and 2007 (Huyghe et al., 2014). These grasslands provide the highest level of ecosystem services compared to arable crops or temporary grasslands. In addition, these permanent grasslands have been protected through successive initiatives of the Common Agricultural Policy (CAP) (Schils et al., 2022). The relevance of the permanent grasslands has been highlighted in the last CAPs (greening, Green Deal) by protecting the land area of these grasslands and providing direct payments to farmers. However, there has been a decrease in these land areas due to the removal of trees, which resulted from successive tree density limits (100 and 50 trees per hectare in the CAP 2007–2013 and 2014–2020, respectively). This approach has led to loss of millions of trees across Europe as a requirement for farmers to receive direct payments. The elimination of trees in grasslands, as well as the adoption of silvopasture practices, reduces carbon sequestration, limits animal welfare, increases water contamination, and increases economic and environmental vulnerability in systems, among other negative productive and ecological aspects.

Agroforestry practices, such as silvopasture, are sustainable land management techniques that are closely linked to agroecology. These practices help to achieve sustainable development goals by addressing and adapting to climate change (Santiago-Freijanes et al., 2018a; Mosquera-Losada et al., 2018b). Additionally, they enhance biodiversity and the provision of ecosystem services (Mosquera-Losada et al., 2023) while also providing enlarged economic returns linked to multiple products (Kay et al., 2019; Moreno et al., 2018).

As a key factor in European agriculture, the European Union's (EU's) CAP, is promoting agroforestry across member states in Pillar I (Mosquera-Losada et al., 2018a) and Pillar II (Santiago-Freijanes et al., 2018b) from the CAP 2007–2013 to 2014–2020. The CAP 2023–2027 also acknowledges the need to implement sustainable practices that are locally adapted. It advocates for the replacement of general EU rules governing land use to enable farmers to qualify for direct payments by aligning with the nine main CAP objectives and various EU strategies (such as the Bioeconomy strategy, Farm to Fork strategy, and European Green Deal). Member States should demonstrate measurable results from these practices, with a focus on key actions, such as biodiversity conservation, nutrient efficiency, and climate mitigation. The promotion of agroforestry through various types of

policies should consider both the type of land use where it can be implemented and the social and natural environmental context in which agroforestry is to be fostered. The development of CAP Strategic Plans by the member states meant a massive change in the form of developing the CAP from a more top-down approach toward a more bottom-up approach, where member states have to fulfill environmental, productive and social objectives through the implementation of the different types of interventions linked to the local environments. This new framework requires a deep understanding of the types of measures from the former CAPs that can inform specific interventions in the 2023–2027 and 2028–2033 CAPs. The general intervention framework linked to the 2023–2027 CAP approved at the end of 2023 is currently being developed into specific interventions tailored to Member States' specific socioeconomic and environmental conditions. A similar CAP analysis was conducted in Mediterranean areas, where agroforestry practices, such as silvopasture or silvoarable, are more extensive compared to other European regions (Rodríguez-Rigueiro et al., 2021). In the Mediterranean region, either land abandonment or intensification is the primary force currently reducing the implementation of agroforestry. Adequate measures are proposed to overcome the reduction in agroforestry extent in the Mediterranean areas, taking into account their specificities (supporting regeneration in the Spanish–Portuguese Dehesa–Montado or promoting the establishment of agroforestry in abandoned lands in Italy and France). The socioeconomic and environmental context in the Atlantic region of Europe faces additional challenges, primarily intensification in higher productive lands, compared to the Mediterranean area already analyzed by Rodríguez-Rigueiro et al. (2021). The objective of this study is to analyze the current situation of silvopasture in the Atlantic region of Europe and the CAP measures associated with the Rural Development Programs (RDPs) to understand better how sustainable land use systems are promoted and provide insights to foster agroforestry across Europe.

2 Materials and methods

This study focuses on the Atlantic European regions in which the second pillar of the CAP and the Regional Development Plans (RDPs) are applied (Pillar I) following Rodríguez-Rigueiro et al. (2021) methodology. The RDPs are linked to different types of territories, as shown in Figure 1. Most of the Atlantic Member States implemented a single Regional Development Plan (RDP) covering the entire country. At the same time, larger states and those with significant regional differences opted for regional RDPs (i.e., Spain, France, and Germany). We selected each RDP region without considering its administrative status, and the regions that have a majority of their land within the Atlantic bioclimatic region, as defined by the European Economic Area (EEA, 2024) and the European Commission (EC,

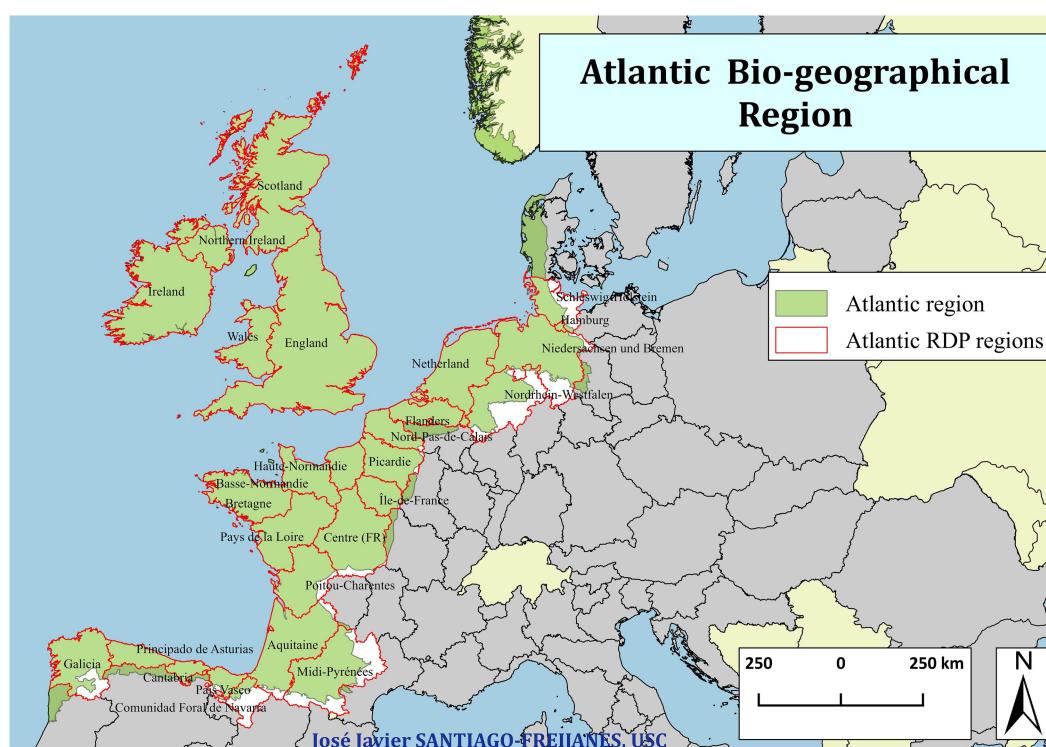


FIGURE 1
Atlantic RDP regions.

2024). The targeted regions are Scotland, Asturias, England, Wales, Navarra, Euskadi, Niedersachsen + Bremen, Northern Ireland, Galicia, and Cantabria. The selection includes regions such as Navarra (Spain), which participates in three bioclimates (Atlantic in the north, Alpine in the east, and Mediterranean in the south), given that there is more territory with the Atlantic bioclimate. However, the selection omitted the analysis of areas such as Denmark or Portugal, which have some lands in the Atlantic bioclimatic region. Still, most of their territory falls within the continental or Mediterranean bioclimate region (Figure 1), respectively.

Social, geographic, and biological factors that may influence grassland productivity and the implementation of policies have been taken into consideration. The social “land ownership” factor (Pulla et al., 2013) is regarded as a social indicator to evaluate long-term practices and as a restriction on receiving CAP payments, as the public ownership may not directly receive CAP direct payments. Geographic factors such as altitude (higher altitudes impact temperature and growing season, thereby influencing crop viability) from EEA (2017) and weather (total summer rainfall affecting soil moisture and crop water availability) were considered as indicators of environmental constraints on grassland production in the Atlantic biogeographic region of Europe. The vegetation and the agroforestry practices European extent distribution were studied as part of the biological factors.

To evaluate the extent of agroforestry, data from the Land Use/Cover Area Frame Statistical Survey (LUCAS) 2018 (Eurostat, 2024) on land cover and land use were used, as LUCAS did not survey the UK after Brexit. As in previous works, LUCAS data were used to determine the extent of silvopasture practice in Europe

(Mosquera-Losada et al., 2018b; Rodríguez-Rigueiro et al., 2021; Mosquera-Losada et al., 2022). Woody strata were identified in the primary land cover (LC1) data field, while grassland was considered a secondary land cover (LC2) data field. Additionally, signs of grazing marked as 1 in the land management data field were searched. Therefore, data from LUCAS were beneficial for mapping complex cover types, such as those typical of agroforestry practices, as it provides information about both vegetation strata and their use (Table 1).

Finally, policy agroforestry promotion was evaluated by understanding the rural development policies of the aforementioned Atlantic regions. These indicators can be related to the promotion of farming systems to fulfill the main pillars of the CAP: social, economic, and environmental aspects.

Mapping data were created with Open Source Geospatial Foundation (OSGeo) and subsequent updates.

3 Results

3.1 Ownership

In the different Atlantic regions, the ownership structure of forestry property (Figure 2) varies depending on the member state. Forests in the French and western Spanish regions are predominantly private. In contrast, those in the north-central regions of Spain, as well as in the UK, Belgium, and Germany, are mostly under public ownership. Galicia (Northwest Spain) presents a large proportion of private forest property, including a regime of

TABLE 1 LUCAS criteria used to identify silvopasture practices.

LUCAS field				LC2			Land management
Land cover / variable				Any other LC2 cover	Grassland		
Code		LUCAS class	E10		E20	E30	1
			Grassland with a sparse tree cover		Grassland without tree/shrub cover	Spontaneously re-vegetated surfaces	Signs of grazing
LC1	Permanent crops: fruit trees	B71	Apple	No silvopastoralism cover	Grazed under permanent crops		
		B72	Pear				
		B73	Cherry				
		B74	Nut trees				
		B75	Other fruit trees and berries				
		B76	Oranges				
		B77	Other citrus fruit				
	Other Permanent crops	B81	Olive groves		Pasture under woodland		
		B82	Vineyards				
	Permanent industrial crops	B84k	Mulberries and carob				
		B84m	Willow				
	Woodland	C10	Broadleaved woodland				
		C21	Spruce dominated woodland				
		C22	Pine dominated woodland				
		C23	Other coniferous woodland				
		C31	Spruce dominated mixed woodland				
		C32	Pine dominated mixed woodland				
		C33	Other mixed woodland				
	Shrubland	D10	Shrubland with sparse tree cover		Pasture under shrubland		
		D20	Shrubland without tree cover				
	Grassland	E10	Grassland with a sparse tree cover		Silvopastoralism on Grassland		
LC1 = Primary land cover, LC2 = Secondary land cover							

communal forests. Meanwhile, Scotland stands out for a low percentage of unqualified ownership based on the forestry inventory.

3.2 Topography

Regarding the altitude of the Atlantic region (Figure 3), the maximum altitude is generally below 250 m. However, this altitude increases in the regions of the Iberian Peninsula due to the proximity

of the Cantabrian Mountains, which significantly influence the topography. The altitude range spans from sea level to over 3,247 m in Aquitania, corresponding to the presence of the Pyrenean lands. As a coastal region, the average altitude is generally low, with an overall altitude usually below 500 m. However, in the mountains of northern Spain, this means altitude increases up to 627 m. The minimum altitude level is at sea level. However, there are also inland regions with a very low altitude. The highest values of minimal altitude were found in Aquitaine, where the mean altitude is less than 50 m above sea level.

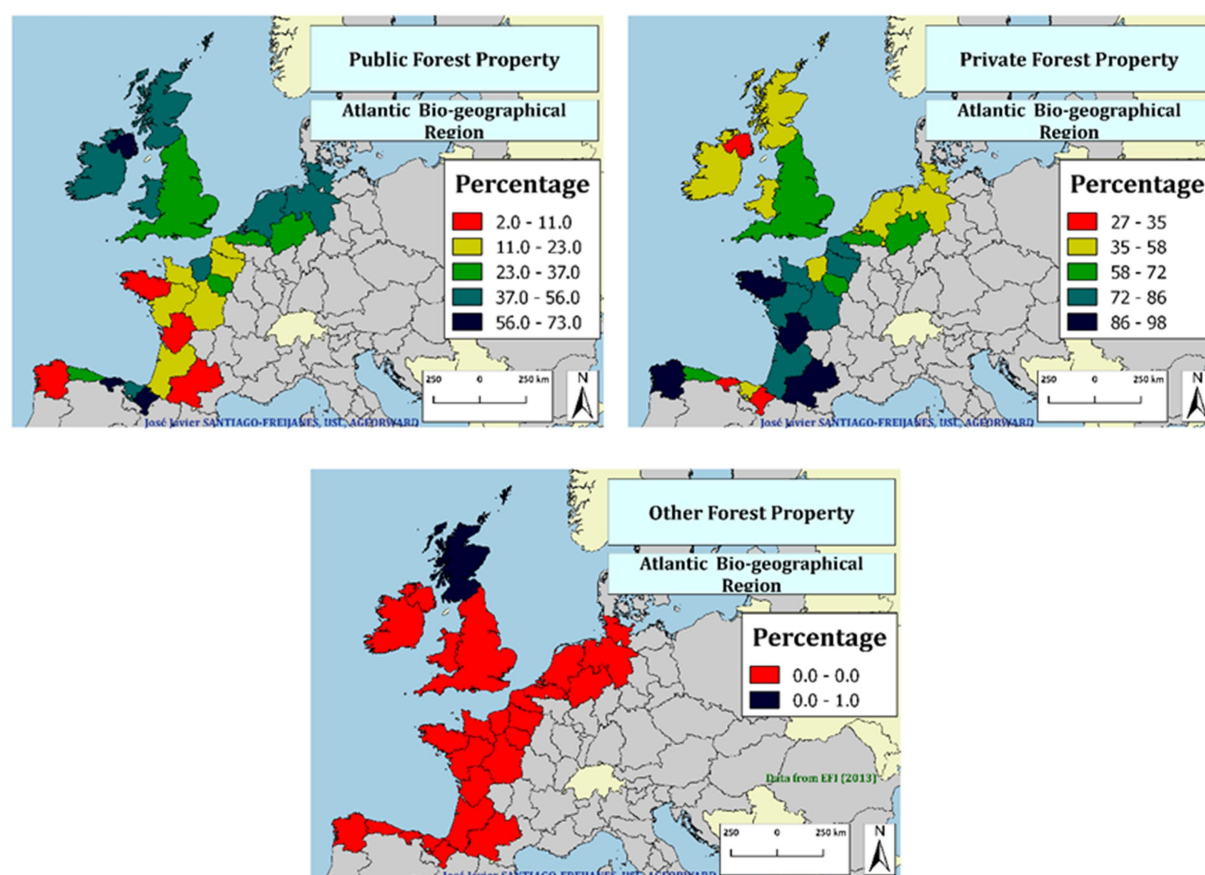


FIGURE 2
Forestry property maps.

3.3 Climate

The climate is temperate and highly influenced by the Gulf Stream, bringing humidity and warmth to the region. The majority of the days in a year are characterized by westerly winds. The temperature differences between winter and summer are reduced, with the eastern limit roughly aligning with the line where the annual average temperature is 16°C. Given that the region spans from 41°N to 60°N, there is a significant variation in sunlight distribution (Condé et al., 2008). There is also a notable difference in the timing of agricultural production. In the Northern Atlantic regions, the peak of production occurs during the summer months. Conversely, the Southern Atlantic areas often experience intense droughts during this period, which significantly limit grassland production.

3.4 Land use

Considering the dominant vegetation (Figure 4), most of the Atlantic area is characterized by the presence of meadows and broadleaf forests. However, there is a land cover gradient from the North to the South Atlantic regions of Europe, with France considered a transitional area. Northern Atlantic regions have a reduced forest cover, while the southern regions are dominated by forestlands (Figure 4). The Atlantic forestland analysis reveals that broadleaved

trees are the predominant type of forest cover (Figure 4). Regarding croplands, only some French regions (Nord-Pas-de-Calais, Picardie, Haute-Normandie, and Île-de-France), where wheat is the dominant crop, do not feature grasslands without trees or shrubs as the main crop.

3.5 Silvopasture

The distribution of silvopasture as the dominant agroforestry practice in agricultural and forest lands is illustrated in Figure 5. Silvopasture is predominantly found in Southern Atlantic regions of Europe (Spain and France), followed by the Comunidad Foral de Navarra (Spain), Scotland and Wales (UK), Basse-Normandie, Nord-Pas-de-Calais, Pays de la Loire and Poitou-Charentes (France), and Belgium. Silvopasture was not detected in Hamburg, Schleswig-Holstein, Niedersachsen + Bremen in Germany.

Silvopasture management was also analyzed across different types of CAP-eligible lands: permanent crops and permanent grasslands. Silvopasture covers over 10% of the land in permanent crops and permanent grasslands (agricultural lands). In agricultural lands, silvopasture is widespread across most Atlantic regions, being less prominent in Brittany and Centre—Val de Loire in France, Comunidad Foral de Navarra in Spain, Schleswig-Holstein in Germany, Ireland, England, and the Netherlands. No silvopasture in agricultural lands is

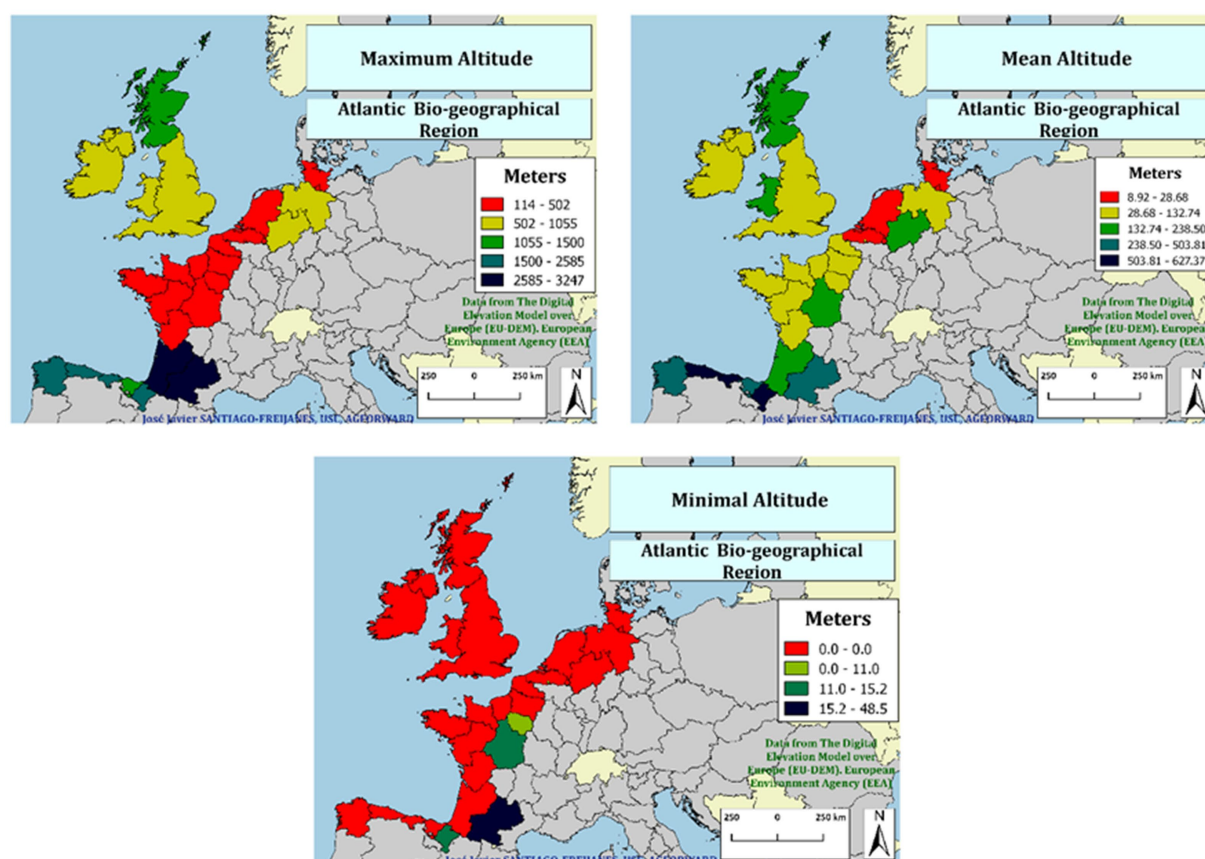


FIGURE 3
Altitudes (maximum, minimum, and average).

found in Wales and Scotland in the UK, Picardy (France), Niedersachsen, + Bremen (Germany). Silvopasture linked only to permanent crops represents 1.28% of the permanent crops in the Atlantic regions of Europe. It is a dominant practice in the western regions of France, Germany, and Belgium. In the case of permanent grasslands, silvopasture covers over 11% of the land, being less represented in the UK, Ireland, and the regions of Bretagne and Centre—Val de Loire in France, as well as Nordrhein—Westfalen in Germany. Silvopasture linked to permanent grasslands was not detected in France (Picardie), the Netherlands, and Germany (Hamburg and Schleswig—Holstein).

Silvopasture associated with forestlands is illustrated in Figure 6, showing its distribution across both woodlands and shrublands. In the Atlantic regions, silvopasture maximum cover is similar under woodlands and shrublands (approximately 4.5%). Silvopasture under woodlands is primarily found in the southern Atlantic regions, as well as in Wales and Pays de la Loire in the UK and France, respectively. However, its presence diminishes along the Atlantic coast of northern France, Belgium, and Germany. Silvopasture under shrublands is mainly found in Spain, the UK, and the regions of Basse-Normandie and Midi-Pyrénées in France.

3.6 Silvopasture and CAP

Within the forestry measures of the RDPs, the implementation of silvopasture is well developed in the UK (Scotland with six measures,

Northern Ireland, and Wales with three measures, and England with two measures) and Spanish (with two measures in Asturias and Navarra and one measure in Galicia, Cantabria, and Navarra) RDPs (Figure 7). Very few measures to promote forest understory grazing as a form of silvopasture were identified, as this practice was only documented in Scotland (six measures), Northern Ireland (two measures), and England (one measure) in the UK as well as Navarra, Asturias, and Galicia with one measure in Spain.

Table 2 shows the target of the measures linked to the Atlantic regions of Europe. The majority of the RDP regions include silvopasture as an activity to be promoted under the agro-environmental measure M10.1, except for Galicia and Cantabria. Forest damage prevention was another activity implemented in four RDP-regions (Galicia, Scotland, Asturias, and Navarra), with Galicia specifically addressing wildfire damage. Additionally, in Galicia, Scotland, Asturias, and Navarra, non-productive investments from measure M04 were primarily implemented, linked to the development of new agroforestry-based products.

4 Discussion

The Atlantic region of Europe is clearly and positively influenced by the Gulf Stream, which creates distinct weather patterns from north to south in Europe. While the abundant summer rainfall in Northern Europe allows for the production forage from temporary and

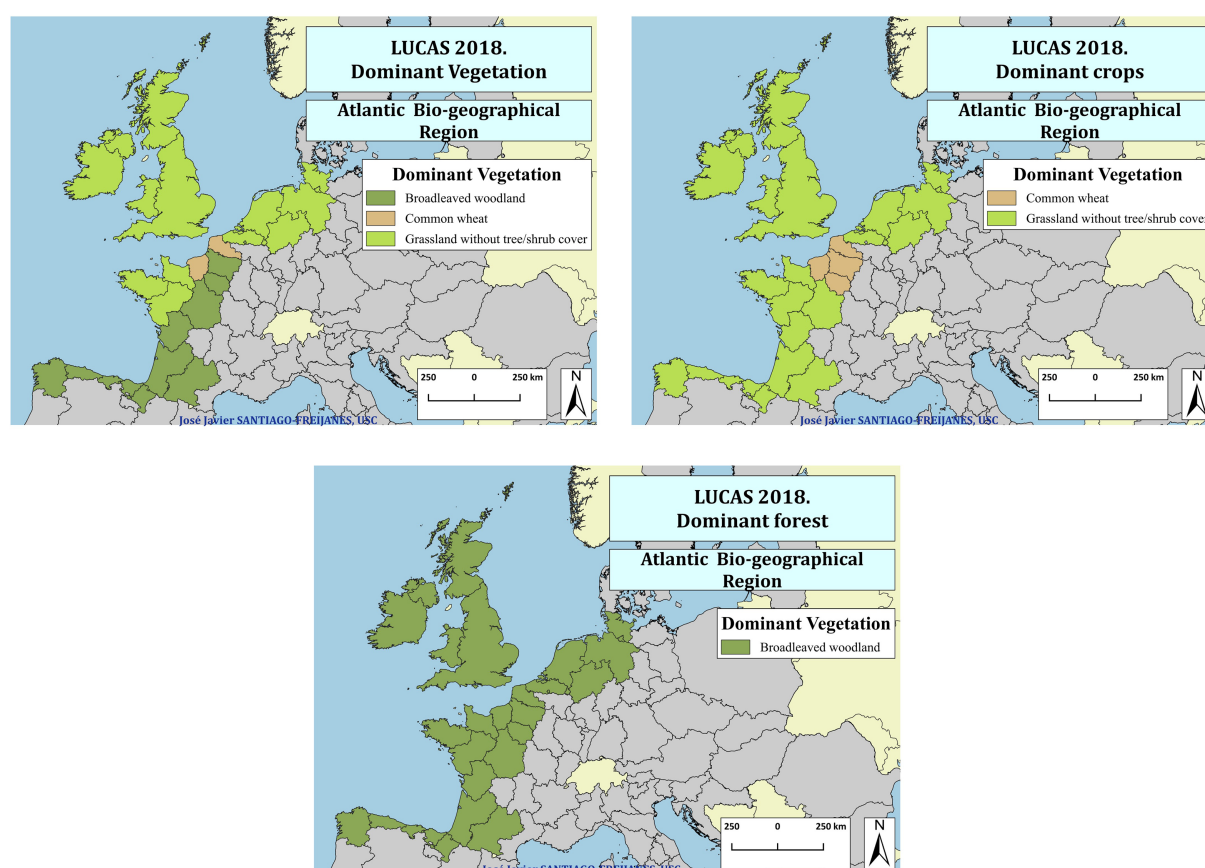


FIGURE 4
Dominant land cover.

permanent grasslands, the summer drought in Southern Europe makes woody perennials more likely to thrive. This is due to the deeper roots of woody perennials, which can access water from deeper soil layers compared to herbaceous vegetation. Water availability during the summer time in northern altitudes makes grass from different types of grasslands (temporary and permanent) available for livestock breeding. This fact enables a higher degree of intensification in the Northern areas that face significant challenges from water contamination (Kay et al., 2019), due to activities such as fertilization. It also justifies the lower proportion of forestlands, shrublands, and woodlands (Schils et al., 2022). The lower proportion of silvopasture in northern areas of Europe compared with the south is associated with the lower proportion of forestlands, woodlands, and shrublands in the Atlantic Northern Regions of Europe. The type of agroforestry linked to these areas is mainly associated with the use of hedgerows such as those found in Ireland (Ireland Government, 2025), the UK (UK Government, 2025) and the bocage in Western France (Normandie Government, 2023) usually used to reduce the negative effect of strong winds linked to the vegetation desiccation or soil erosion (Santiago-Freijanes et al., 2018c). This justifies the abundance of silvopasture associated with permanent grasslands, but not with shrublands or forestlands, in the northern regions of Europe. Hedgerows are one of the most significant types of activity financed by agri-environmental measures in the CAP, aiming to reduce soil erosion, provide a suitable environment (through negative wind

reduction effects), and enhance water quality, among other ecosystem services (Kratschmer et al., 2024).

The southern part of Europe is dominated by forestlands, shrublands, and woodlands as the primary type of land use, which makes it possible to introduce livestock as a form of silvopasture (Balaguer et al., 2017). Traditionally, forests and shrublands have been integrated into mixed farming systems as a way to overcome the summer drought period in the southern latitudes of the Atlantic biogeographic region of Europe, as observed in the Mediterranean region (Papanastasis et al., 2009). As mentioned before, the deep roots of the woody perennials (trees and/or shrubs) make this type of vegetation more prone to provide forage during the forage shortage periods of summer. Silvopasture was deployed in different forms in these areas by (i) performing transhumance or trastermitance allowing livestock to use the woody perennials (Ruiz and Ruiz, 1986), (ii) implementing forest grazing in the nearby forestlands (Humphrey et al., 1998), (iii) pruning trees during the summer to provide high forage quality from small tree branches and leaves for livestock (Kotwoski et al., 2023), and (iv) by using livestock rustic breeds, smaller than in Northern Atlantic regions with a lower maintenance energy requirements to allow them to survive during those shortage periods (Celaya et al., 2022). Still, these practices are currently being developed in the northern part of Spain, primarily in restricted areas.

Moreover, the fact that the southern areas of the Atlantic region of Europe experience summer droughts makes this area particularly

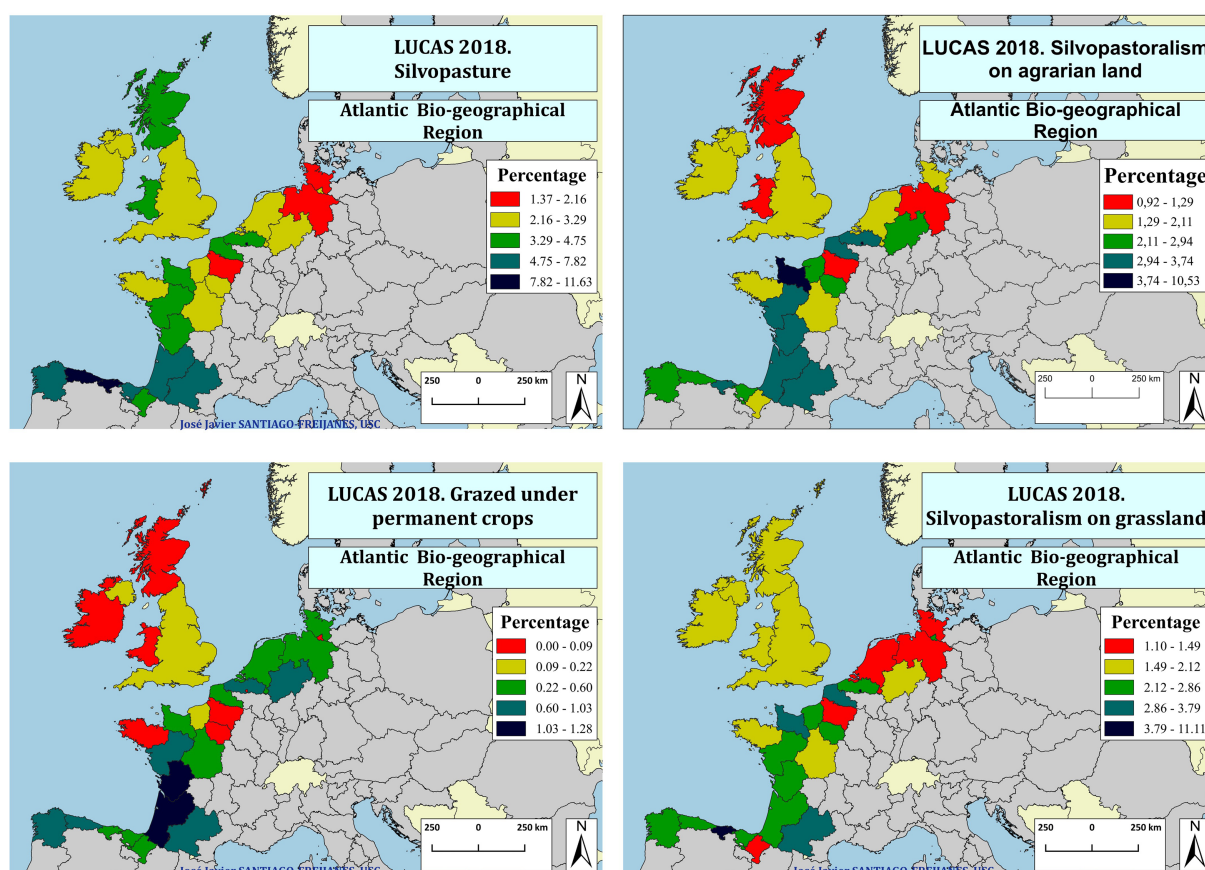


FIGURE 5

Silvopastoralism on total land (agricultural and forest lands), agricultural land (permanent crops and permanent grasslands), and separately on permanent crops and permanent grasslands.

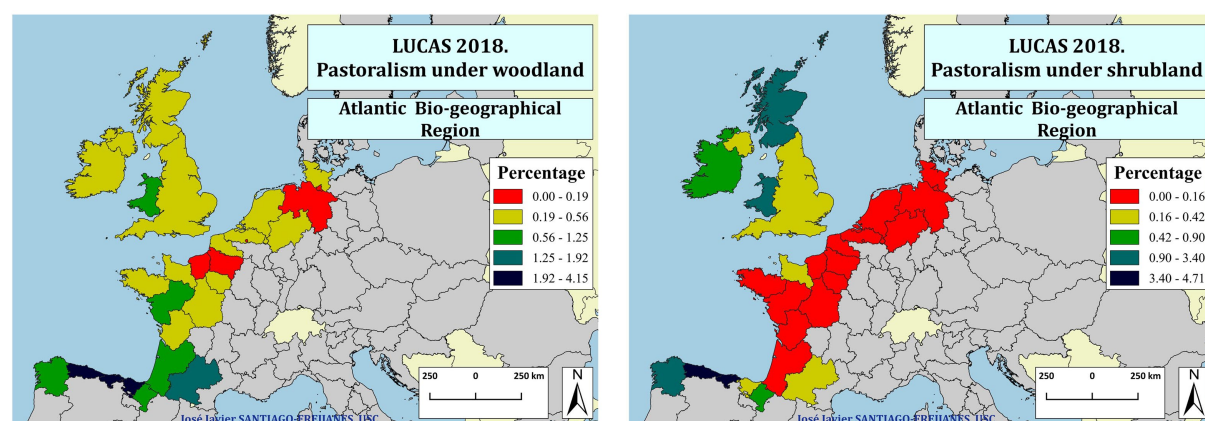


FIGURE 6

Silvopastoralism under woodland and shrubland.

susceptible to fires. The North of Spain is one of the most fertile areas in Europe, primarily due to the abandonment of silvopasture land management, especially in Galicia with lower altitudes (San-Miguel-Ayán et al., 2024). Cantabria, the Basque Country, Asturias, and Navarra typically have large forage availability linked to woody perennials, thanks to the higher altitudes of these regions compared

to Galicia. The recovery of silvopasture practices is carried out thanks to funds focused on the agrifood systems. While Galicia is more focused on forest fire prevention, regions such as Asturias and Navarra are more associated with damage prevention linked to livestock use. In contrast, areas such as Navarra and Cantabria have adopted an approach to enhance the business environment associated

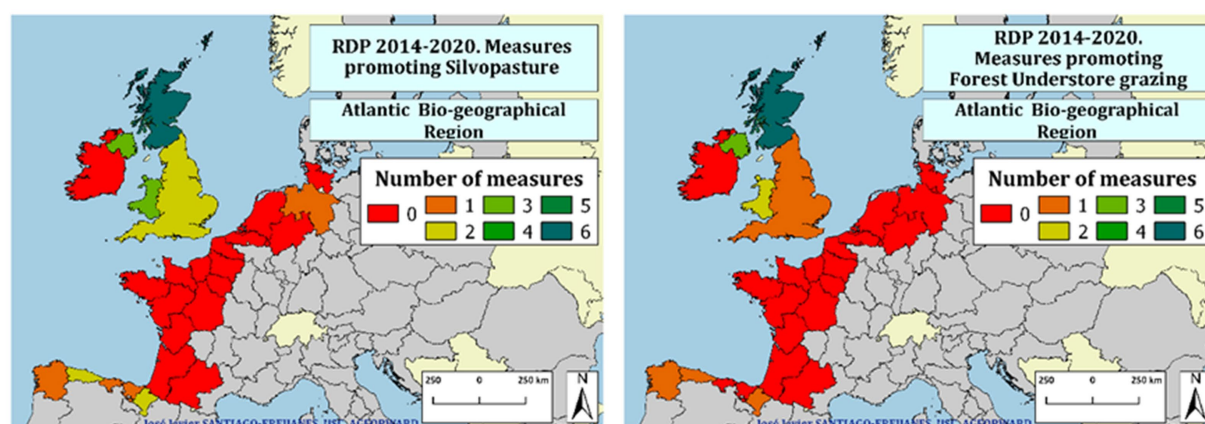


FIGURE 7
Measures promoting silvopasture.

TABLE 2 Measures promoting silvopasture (code of measure of the Rural Development Program [RDP]; number of activities promoting agroforestry).

RDP-region	Measure target		
Scotland	Damage prevention and restoration (M08; 1)	Improve forest resilience (M08;1)	Agro-environment (M10.1; 4)
Asturias	Damage prevention (M08; 1)	Agro-environmental (M10.1; 1)	
England	Non-productive investments (M04; 1)	Agro-environmental (M10.1; 1)	
Wales	Non-productive investments (M04; 1)	Agro-environmental (M10.1; 2)	
Navarra	Damage prevention	Non-productive investments (M04; 1)	
Euskadi	Agro-environmental (M10.1; 1)		
Niedersachsen + Bremen	Agro-environmental (M10.1; 1)		
Northern Ireland	Agro-environmental (M10.1; 3)		
Galicia	Fire prevention (M08; 1)		
Cantabria	Non-productive investments (M04; 1)		

with the value chains of products sustainably produced under silvopasture.

Surprisingly, the silvopasture extent linked to orchards is barely present in the Biogeographic region of Europe, where silvopasture represents 2% of the total land use (Agriadapt, 2017), first because the permanent crops are not a type of dominant vegetation in Europe (6%) despite being eligible for the Pillar I payments. The intensification of orchards and livestock systems is also facilitated by the fact that CAP payments are provided either to permanent crops or grasslands, based on the farmer's choice. Some stakeholders, primarily farmers, propose enhancing silvopasture in orchards by allocating 20% more funds when permanent crops are combined with livestock. Moreover, orchard silvopasture helps adapt the system to climate change. When fruit prices, such as those for apples, are low and forage is expensive, using apples as forage reduces the production costs of livestock rearing.

Silvopasture is mainly promoted by measures not linked to the agroforestry (measure 8.2) or forest (measure 8.1) measures during the implementation of the CAP 2014–2020 as happened in the former CAP 2007–2013 (measures 222 and 221, respectively) but linked to the agri-environment measure (measures 214 and 10.1 for the CAP 2007–2013 and 2014–2020, respectively) as agroforestry is perceived as a type of land management able to enhance the

ecosystem services provision. The agroforestry measures were not successful because they competed with forestry measures that were more beneficial to farmers who implemented them (Santiago-Freijanes et al., 2018b). Some measures target “non-productive measures” linked to value chain promotion as a way to link the agrifood system to farming system sustainability, which will be fostered in the post-2028 EU period, as highlighted by the EU Regulation, 2023/2674. The transition of CAP development from the EC headquarters toward the Member States makes it necessary to analyze sustainable practices such as agroforestry in the specific Member States' CAP strategic plans.

5 Conclusion

The Atlantic region is characterized by a significant intensification of agricultural activities, with a very low proportion of silvopasture, primarily found in the Northern Atlantic regions. Agroforestry is perceived as a provider of ecosystem services, sequestering carbon and enhancing biodiversity and productivity in the central Atlantic region of Europe through the promotion of hedgerows or the reduction of forest fires in the Southern Atlantic regions. CAP promotes

agroforestry in some of these areas, primarily linked to the agri-environment measures. Political actions should prioritize management, conservation, and the establishment of silvopasture to increase sustainability across the EU. Silvopasture promotion should be fostered in both the agroforestry eco-schemes and CAP Pillar II interventions.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors without undue reservation.

Author contributions

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Funding

The author(s) declare that financial support was received for the research and/or publication of this article. This work was supported by the European Union's Horizon Europe research and innovation program (AF4EU with grant agreement number, 101086563, and FOREST4EU with grant agreement number, 101086216). Nuria Ferreiro-Domínguez was funded by the Pilot Program of the University of Santiago de Compostela (USC) for the hiring of distinguished research staff—call 2021—funded by a collaboration agreement between USC and Banco Santander for the period of

2021–2024. Francisco Javier Rodríguez-Rigueiro was supported by the Spanish Ministry of Universities through the “Convocatoria de Recualificación del Sistema Universitario Español” on its “Margarita Salas” modality; the Ministry of Universities' Recovery Transformation and Resilience Plan (funded by the European Union through the NextGenerationEU).

Acknowledgments

The authors would like to thank Divina Vázquez-Varela, Pablo Fernández-Paradela, Teresa Piñeiro-López, and Manuel Cotado-Rodríguez for their help with data management.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

The author(s) declared that they were an editorial board member of *Frontiers*, at the time of submission. This had no impact on the peer review process and the final decision.

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